VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY
(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005)
Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand

SYLLABUS

Approved in 13th Meeting of Executive Council held on 27th March 2023 subsequent to the 14th Meeting of Academic Council held on 20th March 2023

(For admission in 2022-23 and onwards)

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005) Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand

SYLLABUS

For

B.TECH

(Computer Science and Engineering)

4th Year

Effective From – Session 2025-26

SEMESTER-VII													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-015 /AHT-016	HSC	Rural Development Administration and Planning/ Project Management and Entrepreneurship	3	1	0	30	20	50	100		150	3
2	CST-0XX	DE	DepartmentalElective-4	3	0	0	30	20	50	100		150	3
3	CST-0XX	DE	DepartmentalElective-5	3	0	0	30	20	50	100		150	3
4	CSO-0XX	OE	Open Elective-2	3	0	0	30	20	50	100		150	3
5	CSP-017	DLC	Machine Learning Lab	0	0	2		25	25		25	50	1
6	CSP-018	DLC	Project Seminar	0	0	2			50			50	1
7	CSP-019	DLC	Design Project	0	0	4			100			100	2
8	CSP-020	DLC	Mini Project-III or Internship-III*	0	0	2			50			50	1
9	AHT-017	MC	Disaster Management	2	0	0		50	50		50	100	2
10	AHT-018	NC	Innovations and Problem Solving	2	1	0	15	10	25	50			
11	GP-007	NC	General Proficiency						50				
			Total	12	1	12						900	19
12			Minor Course (Optional)**	3	1	0	30	20	50	100			4
	*The Internship-III (4-6weeks) will be conducted during summer break after the VI semester and will be assessed during VII semester.												
	MOOCs course												

DepartmentalElective-5		
S. No.	Subject Code	Subject Name
1	CST-034	Data Science
2	CST-035	Cryptography & Network Security
3	CST-036	DevOps
4	CST-037	Cloud Computing
5	CST-038	Natural Language Processing

Departmental Elective–4		
S. No.	Subject Code	Subject Name
1	CST-029	Ad-hoc & Sensor Networks
2	CST-030	Machine Learning
3	CST-031	Mobile Computing
4	CST-032	Data Mining
5	CST-033	Block Chain

Open Elective -2 (This course can be taken only by the students of branches other than CSE and specialized branches of CSE in VIIth semester. Students of CSE and specialized branches of CSE shall opt open electives floated by other departments)

OpenElective-2		
S. No.	Subject Code	Subject Name
1	CSO-051	Computer Network

Abbreviations: **L**-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance, **PS**-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks, PE-Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	**1 Hr Tutorial**	**2 or 3 Hr Practical**
1 Credit	**1 Credit**	**1 Credit**

SEMESTER-VIII													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-015 / AHT-016	HSC	Rural Development Administration and Planning/ Project Management and Entrepreneurship	3	0	0	30	20	50	100		150	3
2	CST-0XX	DE	DepartmentalElective-6	3	0	0	30	20	50	100		150	3
3	CSO-0XX	OE	OpenElective-3	3	0	0	30	20	50	100		150	3
4	CSO-0XX	OE	OpenElective-4	3	0	0	30	20	50	100		150	3
5	CSP-021	DLC	Project	0	0	12			100		200	300	6
6	GP-008	NC	General Proficiency						50				
			Total	12	0	12						900	18
7			Minor Course (Optional)**	3	1	0	30	20	50	100			4
	MOOCs course												

DepartmentalElective-6		
S. No.	Subject Code	Subject Name
1	CST-039	Soft Computing
2	CST-040	Software Project Management
3	CST-041	Cyber and Digital Forensics
4	CST-042	Digital Image Processing
5	CST-043	Big Data Analytics

Open Elective-3 and **Open Elective-4** (This course can be taken only by the students of branches other than CSE and specialized branches of CSE in VIII th semester. Students of CSE and specialized branches of CSE shall opt open electives floated by other departments)

Open Elective-3		
S. No.	Subject Code	Subject Name
1	CSO-052	Software Engineering

OpenElective-4		
S. No.	Subject Code	Subject Name
1	CSO-053	Object Oriented Programming

Abbreviations: **L**-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance, **PS**-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks, PE-Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	**1 Hr Tutorial**	**2 or 3 Hr Practical**
1 Credit	**1 Credit**	**1 Credit**

(AHT-015)

L:T:P:: 3:1:0 **Credits-03**

Course Objectives

This course enables the students to:

1. Gain knowledge on the concepts related to administration, its importance and various approaches of Development Administration.
2. Gain skills on New Public Management, Public Grievances and Redressal Mechanisms, Accountability and Transparency in Administration and e-governance in the rural development sector.
3. Develop their competency on the role of Bureaucracy in Rural Development.

Course Outcomes

After completion of the course student will be able to:

1. Students can understand the definitions, concepts and components of Rural Development.
2. Students will know the importance, structure, significance, resources of Indian rural economy.
3. Students will have a clear idea about the area development programmes and its impact.
4. Students will be able to acquire knowledge about rural entrepreneurship.
5. Students will be able to understand about the using of different methods for human resource planning.

Course Contents

UNIT-I: **(8 hours)**

Rural Planning & Development: Concepts of Rural Development, Basic elements of rural Development, and Importance of Rural Development for creation of Sustainable Livelihoods, An overview of Policies and Programmes for Rural Development- Programmes in the agricultural sector, Programmes in the Social Security, Programmes in area of Social Sector.

UNIT-II: **(8 hours)**

Rural Development Programmes: Sriniketan experiment, Gurgaon experiment, Marthandam experiment, Baroda experiment, Firkha development scheme, Etawapilot project, Nilokheri experiment, approaches to rural community development: Tagore, Gandhi etc.

UNIT-III: **(8 hours)**

Panchayati Raj & Rural Administration: Administrative Structure: bureaucracy, structure of administration; Panchayati Raj Institutions Emergence and Growth of Panchayati Raj Institutions in India; People and Panchayati Raj; Financial Organizations in Panchayati Raj Institutions, Structure of rural finance, Government & Non-Government Organizations / Community Based Organizations, Concept of Self help group.

UNIT-IV: **(8 hours)**

Human Resource Development in Rural Sector: Need for Human Resource Development,

Elements of Human Resource Development in Rural Sector Dimensions of HRD for rural development-Health, Education, Energy, Skill Development, Training, Nutritional Status access to basic amenities – Population composition.

UNIT-V: **(8 hours)**

Rural Industrialization and Entrepreneurship: Concept of Rural Industrialization, Gandhian approach to Rural Industrialization, Appropriate Technology for Rural Industries, Entrepreneurship and Rural Industrialization- Problems and diagnosis of Rural Entrepreneurship in India, with special reference to Women Entrepreneurship; Development of Small Entrepreneurs in India, need for and scope of entrepreneurship in Rural area.

Text Books/References:

1. Corporate Social Responsibility: An Ethical Approach - Mark S. Schwartz.
2. Katar Singh: Rural Development in India – Theory History and Policy.
3. Todaro M.P. Economic Development in III World war.
4. Arora R.C – Integrated Rural Development in India.
5. Dhandekar V.M and Rath N poverty in India.
6. A.N.Agarwal and Kundana Lal: Rural Economy of India
7. B.K.Prasad: Rural Development-Sarup& Son's Publications.

PROJECT MANAGEMENT & ENTREPRENEURSHIP (AHT-016)

L:T:P:: 3:1:0 **Credits-03**

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the concepts of Project Management for planning to execution of projects.
2. Understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. Be capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.
4. Understand the concepts of Entrepreneurship, role of entrepreneur in economic development, steps for establishing an enterprise.

COURSE OUTCOMES:

After completion of the course student will be able to:

1. Understand project characteristics and various stages of a project.
2. Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic.
3. Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
4. Describe Entrepreneurship, Examine role of entrepreneur in economic development.
5. Describe the steps to establish an enterprise.

UNIT-I: **(8 hours)**

Entrepreneurship: Entrepreneurship: need, scope , Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (Mc Clellend's Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes.

UNIT-II **(8 hours)**

Entrepreneurial Idea and Innovation: Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness.

UNIT-III: **(8 hours)**

Project Management: Project management: meaning, scope & importance, role of project manager; project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal, Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.

UNIT-IV **(8 hours)**

Project Financing: Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.

UNIT-V: **(8 hours)**

Social Entrepreneurship: Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.

Case study and presentations: Case study of successful and failed entrepreneurs. Power point presentation on current business opportunities..

Text Book:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harperand Row.
2. Business, Entrepreneurship and Management: Rao, V.S.P.;Vikas
3. Entrepreneurship: Roy Rajeev.
4. TextBookofProjectManagement:Gopalkrishnan,P.andRamamoorthy,V.E.;McMill.
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.;PHI.
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.;MGH.

ADHOC AND SENSOR NETWORK (CST-029)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Learn Ad hoc network and Sensor Network fundamentals.
2. Understand the different routing protocols
3. Have an in-depth knowledge on sensor network architecture and design issues
4. Understand the transport layer and security issues possible in Ad hoc and Sensor networks

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Impart the trends in emerging field of wireless ad hoc and sensor networking.
2. Focus on layered communication modeling, such as the media access control and network layer.
3. Understand the basic concept of QoS and Multicast routing protocol.
4. Address quality of service issues and network reliability for transmission of real-time information.
5. Learn the various routing protocols of ad hoc and sensor networks

Unit 1- ADHOC NETWORKS INTRODUCTION: Introduction to Wireless Communication Technology, Characteristics of the Wireless Channel, IEEE 802.11a/b Standard, Origin of Ad-hoc Packet Radio Networks, Architecture of PRNETS, Introduction to Ad-hoc Wireless Networks, Heterogeneity in Mobile Devices.

Unit 2- ADHOC NETWORK ROUTING PROTOCOLS: Introduction -to designing a Routing Protocol, Classifications of Routing Protocols, Destination Sequenced Distance Vector (DSDV), Dynamic Source Routing (DSR), Zone Routing Protocol (ZRP), Wireless Routing Protocol (WRP), Source—Initiated On— Demand Approaches, Ad hoc On-Demand Distance Vector Routing , AODV.

Unit 3- QoS AND Multicast Routing Protocol in MANET: Issues and challenges in providing QoS in Adhoc Wiress Networks, Introduction to QoS in Ad hoc Wireless Networks, Classifications of QoS Solutions, Introduction to Multicast Routing Protocol, Classifications of Multicast Routing Protocols.

Unit 4- WSN INTRODUCTION: Characteristic requirements, Challenges of sensor networks Emerging technologies for wireless sensor networks, Advantages of sensor networks, Sensor network applications.

Unit 5- WSN PROTOCOLS: Communication protocols, MAC protocaols, Namlng and Addressing-Routing protocols, Energy efficient routing.

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, ―Ad Hoc Wireless Networks Architectures and Protocols, Prentice Hall, PTR, 2004.
2. Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks, John wiley publication, Jan 2006.

REFERENCE BOOKS:

1. Feng Zhao, Leonidas Guibas, ―Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.
2. Charles E. Perkins, ―Ad Hoc Networking, Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, ―Wireless sensor networks: a survey, computer networks, Elsevier, 2002, 394 - 422.

MACHINE LEARNING (CST-030)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Understand the need for machine learning for various problem solving.
2. Study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.
3. Learn and design the appropriate machine learning algorithms for problem solving.

COURSE OUTCOME: On successful completion of this course, the students will be able to

1. Learn the basics of learning problems with hypothesis and version spaces.
2. Understand the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning.
3. Analyze the concept of neural networks for learning linear and non-linear activation functions.
4. Learn the concepts in tree, probability and graphical based models and methods.
5. Understand the fundamental concepts of Genetic Algorithm and Analyze and design the genetic algorithms for optimization engineering problems.

Unit 1- INTRODUCTION: Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

Unit 2- LINEAR MODELS: Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

Unit 3- TREE AND PROBABILISTIC MODELS: Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

Unit 4- DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS: Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary

Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

Unit 5- GRAPHICAL MODELS: Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

TEXT BOOK:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.

REFERENCE BOOKS:

1. EthemAlpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series) Third Edition, MIT Press, 2014
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

COURSE OBJECTIVES: The objectives of the course are to

1. Understand the basic concepts of mobile computing and basics of mobile telecommunication system.
2. Become familiar with the network layer protocols and Ad-Hoc networks.
3. Know the basis of transport and application layer protocols.
4. Gain the knowledge about different mobile platforms and application development

COURSE OUTCOME: On successful completion of this course, the students will be able to

1. Impart knowledge of mobile and wireless computing systems and techniques.
2. Understand the knowledge of wireless network
3. Understand the concepts of security and failure detection and recovery strategies.
4. Understand the concepts routing protocols.
5. Understand the working of mobile tracking in wireless network

Unit 1- Introduction: Issues, Challenges, and benefits of Mobile Computing, IEEE 802.11 & Bluetooth, Wireless Multiple access protocols, spread spectrum, cellular wireless networks.

Unit 2- Data Management Issues: Wireless computing, nomadic computing, ubiquitous computing and tunneling, data replication for mobile computers, adaptive Clustering for Mobile Wireless networks, LEACH and TORA, mobile TCP (M-TCP) Spooning TCP, Frequency for radio transmission.

Unit 3- Distributed location Management: pointer forwarding strategies, Process communication techniques, Socket Programming, RPC, RMI, Mobile IP, TCP Over wireless. Hidden and exposed terminal problems.

Unit 4- Routing Protocols: Routing Protocol, Dynamic State Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), and Destination Sequenced Distance – Vector Routing (DSDV), Cluster Based Routing Protocol (CBRP).

Unit 5- Fault tolerance and security: Security and fault tolerance, transaction processing in Mobile computing environment. Mobile Agent Systems: Aglets, PMADE, Case Studies, agent failure scenarios, node failure detection and recovery.

TEXT BOOKS:

1. Jochen Schiller, ―Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing, PHI Learning Pvt. Ltd, New Delhi – 2012.

REFERENCE BOOKS:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems, Thomson

Asia Pvt Ltd, 2005.

2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ―Principles of Mobile Computing, Springer, 2003.
3. William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition,TataMcGraw Hill Edition ,2006.
4. C.K.Toh, ―AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002.

DATA MINING (CST-032)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Present methods for mining frequent patterns, associations, and correlations.
2. Describes methods for data classification and prediction, and data–clustering approaches.
3. Covers mining various types of data stores such as spatial, textual, multimedia, streams.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Interpret the contribution of data warehousing and data mining to the decision-support level of organizations
2. Evaluate different models used for OLAP and data preprocessing
3. Categorize and carefully differentiate between situations for applying different data-mining techniques: frequent pattern mining, association, correlation, classification, prediction, and cluster and outlier analysis
4. Design, implement and evaluate the performance of different data-mining algorithms
5. Propose data-mining solutions for different applications

Unit 1- DATA WAREHOUSE: Data Warehousing - Operational Database Systems vs Data Warehouses - Multidimensional Data Model - Schemas for Multidimensional Databases – OLAP operations – Data Warehouse Architecture – Indexing – OLAP queries & Tools.

Unit 2- DATA MINING & DATA PREPROCESSING: Introduction to KDD process – Knowledge Discovery from Databases - Need for Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

Unit 3- ASSOCIATION RULE MINING: Introduction - Data Mining Functionalities - Association Rule Mining - Mining Frequent Item sets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint – Based Association Mining.

Unit 4- CLASSIFICATION & PREDICTION: Classification vs Prediction – Data preparation for Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Unit 5- CLUSTERING: Cluster Analysis - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based.

Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

Data Visualization: Principles, Parallel Coordinates, Visualization Neural Networks, Visualization of trees.

TEXTBOOKS:

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining, pang-ning tan and Michael steinbach, second edition, Pearson Education.
3. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.
4. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.

REFERENCE BOOKS:

1. K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
2. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition.

BLOCKCHAIN (CST-033)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Study the concepts of blockchain technologies.
2. Cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus.
3. Familiarize potential applications for Bit coin-like crypto currencies.
4. Learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Understand Blockchain technology.
2. Develop Blockchain based solutions and write smart contract using Hyperledger Fabric and Ethereum frameworks.
3. Build and deploy Blockchain application for on premise and cloud-based architecture.
4. Develop the concepts for safe use of crypto currency
5. Integrate ideas from various domains and implement them using Blockchain technology

Unit 1-Introduction: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency toBlockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain. Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

Unit 2-Understanding Blockchain with Crypto currency: Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashcashPoW, BitcoinPoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Unit 3-Understanding Blockchain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned Blockchain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Unit 4-Enterprise application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Blockchain.

Unit 5-Blockchain application development: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Ritesh Modi, "Solidity Programming Essentials: A Beginner"s Guide to Build Sma Ethereum and Block Chain", Packt Publishing.
2. Antony Lewis, "The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Crypto Trading, Digital Assets)", Mango Publications.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.

DATA SCIENCE (CST-034)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVE: The objectives of the course are to

1. Learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration.
2. Understand the basic types of data and basic statistics.
3. Identify the importance of data reduction and data visualization techniques

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Demonstrate the mathematical foundations needed for data science.
2. Collect, explore, clean and manipulate data.
3. Demonstrate the basic concepts of machine learning.
4. Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering.
5. Build data science applications using Python based toolkits.

Unit 1-Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting

Unit 2-Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK Visualizing Data: Bar Charts, Line Charts, Scatterplots Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning , Manipulating Data, Rescaling, Dimensionality Reduction

Unit 3-Mathematical Foundations: Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution

Unit 4-Machine Learning: Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks- Learning and Generalization, Overview of Deep Learning.

Unit 5-Case Studies of Data Science Application: Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.
2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
2. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
3. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
4. Paul Teetor, "R Cookbook", O'Reilly, 2011.

CRYPTOGRAPHY & NETWORK SECURITY (CST-035)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Explain the importance and application of each of confidentiality, integrity, authentication and availability.
2. Understand various cryptographic algorithms and basic categories of threats to computers and networks.
3. Describe the enhancements made to IPv4 by IPSec.
4. Understand Intrusions, intrusion detection, Web security and Firewalls.

COURSE OUTCOMES: On Successful completion of this course, the students will be able to

1. Identify the various attacks and its issues.
2. Learn usage of cryptographic algorithms for avoiding basic level threats.
3. Comprehend the issues involved in Integrity, Authentication and Key Management techniques.
4. Realize the importance of user authentication and Kerberos concepts.
5. Acquire the knowledge of network and system security domain.

Unit 1- Introduction of Cryptography: Introduction To security: Attacks, Services and Mechanisms, Conventional Encryption: Conventional Encryption Model, Steganography, Block Cipher Principles, DES Standard, DES Strength, Differential and Linear Cryptanalysis, Block Cipher Modes of Operations.Double DES, Triples DES, Blowfish, International Data Encryption Algorithm,Placement of Encryption Function, Key Distribution, Random Number Generation and Traffic confidentiality

Unit 2- Number Theory and Public Key Encryption: Fermat's and Euler's Theorem, Primality Testing, Chinese Remainder Theorem , Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm.

Unit 3- Key Management: Key Management scenario in secret key and public key cryptography, Diffie Hellman Key Exchange algorithm, OAKLEY and ISAKMP key management protocol, Elliptic Curve Cryptography

Unit 4-Hash Functions: Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function and MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures, Digital Signature Standard (DSS).

Unit 5- Network and System Security: Authentication Applications: Kerberos, X.509, Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine Security: Architecture, Authentication Header, Encapsulating

Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction (SET), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

DEVOPS (CST-036)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. Implement automated system update and DevOps lifecycle.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tool.
4. Investigate different DevOps Software development models.
5. Assess, collaborate, and adopt Devops in real-time projects

Unit 1-Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

Unit 2-Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.

DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

Unit 3-Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

Unit 4-Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

Unit 5-Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development

Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

TEXTBOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN10: 1788392574.
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOK:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.

CLOUD COMPUTING (CST-037)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Provides an insight into cloud computing.
2. Enable students to deliver an application built in the cloud with the concept of application-based building blocks for processing of data.
3. Appreciate the emergence of cloud as the next generation computing paradigm.

COURSE OUTCOMES: Upon completion of this course, the students will be able to

1. Impart the knowledge of cloud computing and technologies, issues in cloud computing etc.
2. Design and develop cloud and implement various services on cloud.
3. To develop an understating of virtualization technology and its different dimensions.
4. Investigate the issues and challenges in implementing cloud security.
5. Compare and contrast various open and proprietary cloud platforms

Unit 1- Introduction to Cloud Computing: Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud.

Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

Unit 2- Introduction to Cloud Technologies: Study of Hypervisors, Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services.

Virtualization Technology: Virtual machine technology, Virtual Machine migration, virtualization applications in enterprises, Pitfalls of virtualization.

Multitenant software: Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores, Data access control for enterprise applications,

Unit 3- Data and Security in the cloud: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, Map-Reduce model, Enterprise batch processing using Map-Reduce.

Cloud computing security challenges: Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit 4- Service Management and Monitoring in Cloud: Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud.

Monitoring in cloud: Implementing real time application over cloud platform, Cloud Federation, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Cloud Middleware, load balancing, resource optimization, resource dynamic reconfiguration,

Unit 5- Cloud computing platforms: Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, T-Platform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform

TEXT BOOK:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCE BOOK:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
3. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010.
4. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance", O'Reilly, 2009.

NATURAL LANGUAGE PROCESSING (CST-038)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Understand natural language processing and learn how to apply basic algorithms in this field.
2. Acquire the basic concepts and algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.
3. Design and implement applications based on natural language processing.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Have a broad understanding of the capabilities and limitations of current natural language technologies.
2. Able to model linguistic phenomena with formal grammars.
3. Be able to Design, implement and test algorithms for NLP problems.
4. Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP.
5. Able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.

UNIT - I

Introduction: History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP ,Applications of NLP**.**

UNIT - II

Word Level Analysis: Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.

UNIT - III

Syntax Analysis: Part-Of-Speech tagging (POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF).

UNIT - IV

Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy,

Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD), Dictionary based approach.

Pragmatics: Discourse reference resolution, reference phenomenon, syntactic & semantic constraints on co reference

UNIT – V

Applications (preferably for Indian regional languages): Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition.

TEXTBOOKS:

1. Daniel Jurafsky, James H. Martin ―Speech and Language Processing‖ Second Edition, Prentice Hall, 2008.
2. Christopher D.Manning and Hinrich Schutze, ― Foundations of Statistical Natural Language Processing ―, MIT Press, 1999.

REFERENCE BOOKS:

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Daniel M Bikel and Imed Zitouni ― Multilingual natural language processing applications Pearson, 2013.
3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) ― The Handbook of Computational Linguistics and Natural Language Processing ― ISBN: 978-1-118-.
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O ‘Reilly.
5. Brian Neil Levine, An Introduction to R Programming.
6. Niel J le Roux, Sugnet Lubbe, A step by step tutorial: An introduction into R application and programming

COMPUTER NETWORKS (CST-021/CSO-051)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the protocol layering and physical level communication.
2. Analyze the performance of a network .and understand the various components required to build different networks.
3. Learn the functions of network layer and the various routing protocols.
4. Familiarize the functions and protocols of the Transport layer.

COURSE OUTCOMES: On completion of the course, the students will be able to

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of local area networks (LANs, wide-area networks (WANs) and Wireless LANs (WLANs).
3. Address the issues related to network layer and various routing protocols.
4. Configure DNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP.
5. Configure Bluetooth, Firewalls using open source available software and tools.

Unit 1- Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit 2- Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols- Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, high level data link control(HDLC), Point To Point protocol (PPP).

Unit 3- Network Layer: Repeater, Hub, Switches, Bridges, Gateways, Switching, Logical addressing – IPV4, IPV6, Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Unit 4- Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit 5- Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography , Digital Signature.

TEXTBOOK:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

REFERENCE BOOKS:

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013

MACHINE LEARNING LAB (CSP-017)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of the course are to

1. Effective use of the various machine learning tools.
2. Understand the Selection of data, learning model, model complexity and identify the trends.
3. Understand and implement a range of machine learning algorithms along with their strengths and weaknesses.

COURSE OUTCOME: On successful completion of this course, the students shall be able to

1. Make use of Data sets in implementing the machine learning algorithms.
2. Understand the implementation procedures for the machine learning algorithms.
3. Design Java/Python programs for various Learning algorithms.
4. Apply appropriate data sets to the Machine Learning algorithms.
5. Identify and apply Machine Learning algorithms to solve real world problems.

Lab Experiments:

1. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

PROJECT SEMINAR (CSP-018)

L:T:P:: 0:0:2 **Credits-01**

THE OVERVIEW OF PROJECT SEMINAR

The course is accompanied by seminars that introduce new approaches to understand and further elaborate different facets of innovation thinking and to provide participants with practical training as well as ready to use state of the art knowledge. Besides, students will present on a regular basis the development of their business plans of practical oriented innovation projects. At last, students will be asked to defend their developed business plans of projects with consideration of discussed aspects. The aim of this course is to consolidate, expand and exercise theoretical and practical skills for successful implementation of projects from start to finish by developing business plans of innovative projects.

COURSE OUTCOME: On successful completion of this course, the students shall be able to

1. Prepare and develop practically applicable business plan for an innovative project with consideration of addressed issues.
2. Develop the sub-skills required for business plans of innovation projects presentation and group discussions.
3. Acquire the soft skills and interpersonal skills which will help them in their workplace needed for these functions.
4. Develop planning skills of the innovative projects and business ideas in order to improve professional competencies.
5. Make presentation on the topic, answer the queries/questions that come forward, clarify, and supplement if necessary, and submit a report.

The Project Seminar consists of four major topics:

1. Project introduction
2. Project environment
3. Project assessment
4. Project presentation

Project introduction includes an introductory session where students will understand how to apply specific tools and models in innovation project management, as well as how to manage teamwork. Also, during this topic, the ideas of projects will be introduced with taking into account appropriate cases of specific projects across different industries. The session ends with the choice of core stream for which students will be asked to prepare a project.

Project environment allows students to learn market analysis, including identification of current trends in the industry by using suitable strategic planning tools, and evaluating external/internal risk factors. In addition, the competition analysis and the estimation of risks in innovative projects will be introduced.

Project assessment provides understanding and practical knowledge of assessment and forecasting of potential markets by using various approaches within the innovation project management, as well as cost analysis and assessment of the impact of innovation on the cost structure.

Project presentation assumes that students will apply learned knowledge and skills by developing business plans of innovation projects, its discussions, and presentations. An oral defense will be held at the last class (final colloquium), in which students present the developed business plan of the innovation project with consideration of addressed issues.

The assessment of the Project Seminar

The activities on the Project Seminar classes and developed projects are assessed separately. Students form groups of 3-5 members to develop business plan of practical innovative project plan i.e., project. The final grade will be calculated in accordance with the syllabus of this course. Students are expected to develop and gradually improve their business plans of innovation projects with regular presentations of interim results. Apart from that, by the end of the course students are supposed to submit their final version of business plans of projects as an essay. The oral defense of group project will be held on the final colloquium.

DESIGN PROJECT (CSP-019)

L:T:P:: 0:0:4 **Credits-02**

COURSE OBJECTIVES: The objectives of the course are to

1. Develop skills in doing literature survey, technical presentation, and report preparation.
2. Enable project identification and execution of preliminary works on final semester project.

COURSE OUTCOMES: On successful completion of this course, the students shall be able to

1. Discover potential research areas in the field of information technology.
2. Create very precise specifications of the IT solution to be designed.
3. Have introduction to the vast array of literature available about the various research challenges in the field of IT.
4. Use all concepts of IT in creating a solution for a problem.
5. Have a glimpse of real world problems and challenges that need IT-based solutions.

Internship-III/Mini Project-III – (CSP-020)

L:T:P:: 0:0:2 **Credits-01**

ABOUT INTERNSHIP/MINI PROJECT

It is an organized method or activity of enhancing and improving engineering students' skill sets and knowledge, which boosts their performance and consequently helps them meet their career objectives. Internship/Mini Project is essential in developing the practical and professional skills required for an Engineer and an aid to prospective employment.

OBJECTIVES OF INTERNSHIP/MINI PROJECT:

1. The main objective of Internship/Mini Project is to expose the students to the actual working environment and enhance their knowledge and skill from what they have learned in college.
2. Another purpose of this program is to enhance the good qualities of integrity, responsibility, and self-confidence. Students must follow all ethical values and good working practices.
3. It is also to help the students with the safety practices and regulations inside the industry and to instils the spirit of teamwork and good relationship between students and employees.

COURSE OUTCOMES: At the end of Industrial Training, the students will be able to

1. Understand organizational issues and their impact on the organization and employees.
2. Identify industrial problems and suggest possible solutions.
3. Relate, apply, and adapt relevant knowledge, concepts and theories within an industrial organization, practice and ethics.
4. Apply technical knowledge in an industry to solve real world problems.
5. Demonstrate effective group communication, presentation, self-management, and report writing skills.

DISASTER MANAGEMENT (AHT-017)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES:

The course should enable the students:

1. To introduce the students to various types of natural and manmade disasters.
2. To understand causes and impact of disasters.
3. To understand approaches of Disaster Management.
4. To build skills to respond to disaster.

COURSE OUTCOMES:

At the end of the course, Student will be able:

1. To provide students an exposure to disasters, their significance and types.
2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
3. To understand approaches of Disaster Management.
4. To build skills to respond to disaster.

Unit-1 Introduction to Disasters

Concepts, and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks). Disaster Types, Trends, Causes, Consequences and Control of Disasters, Geological Disasters; Hydro-Meteorological, Biological, Technological and Manmade Disasters.

Unit-2 Disasters: Classification, Causes, Impacts

(Including social, economic, political, environmental, health, psychosocial, etc.)
Differential impacts-in terms of caste, class, gender, age, location, disability. Global trends in disasters urban disasters, pandemics, complex emergencies, Climate change.

Unit-3 Approaches to Disaster Risk Reduction:

Disaster cycle- its analysis, Phases, Culture of safety, prevention, mitigation and preparedness, community based DRR, Structural- nonstructural measures, roles and responsibilities of community, Panchayati Raj Institutions/ Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders.

Unit-4 Inter-relationship between Disasters & Development

Factors affecting Vulnerabilities, differential impacts, Impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources

Unit-5 Disaster Risk Management in India:

Hazard and Vulnerability profile of India. Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation)

Text/Reference Books:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.

3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

INNOVATIONS AND PROBLEM SOLVING(AHT-18)

L:T:P:: 2:1:0 **Credits-0**

PREREQUISITE:
Basic Engineering Aptitude

COURSE OBJECTIVES:
This subject aims to inculcate critical thinking abilities and application of knowledge for problem solving. It will expose the students with various simple methods and practices that are essential to development of new systems, problem formulation and problem solving in technical and non-technical fields. This course will stimulate the work environment of the modern day engineers and technologists by familiarizing them with the state-of-the art results, design and analysis tools in various disciplines, the ability to extract relevant information to formulate and solve problems arising in practice.

COURSE OUTCOMES:
The course will enable students to,

1. Identify the market and value proposition
2. Carry out rigorous and accessible formulation to problems
3. Solutions via reducing the search space
4. Eliminating tradeoffs to reduce dimension of optimization problems
5. Execution through developing strategies for experiment, construction and monetization.
6. Simulate the work environment of the modern engineer or knowledge worker in general.

Unit – I **8 Hrs**
Introduction to Critical Design Thinking

- Understanding critical thinking, creative thinking, and problem solving through examples.
- New ways to solve problems.

Unit – II **8 Hrs**
Theory of Inventive Problem Solving

- Examples of inventive problem solving,
- Era of technical systems,
- Science of inventing,
- Art of inventing,
- Amazing world of tasks

Unit – III **8 Hrs**
Logic and Tools for Creativity and Clarity of Thought

- TRIZ tools for creativity and solutions,
- World's known solutions,
- Fundamentals of Problem solving,
- Thinking in Time and Scale,
- Uncovering and solving contradictions,

- Fast Thinking with ideal outcome.

Unit – IV **8 Hrs**

Modeling for Problem Solving

- Moving from problem to ideal final result,
- Tradeoffs and inherent contradictions,
- Invisible reserves,
- Law of increasing ideality,
- Evaluation of solutions,
- Enriching models for problem solving.

Unit – V **8 Hrs**

Principles for Innovation

- General review,
- Segmentation, Separation,
- Local quality, symmetry change, merging and multifunctionality,
- Nested doll and weight compensation,
- Preliminary counteraction, preliminary action, and beforehand compensation,
- Equipotentiality, the other way around and curvature increase,
- Dynamic parts, partial or excessive actions, dimensionality change, mechanical vibration
- Periodic action, continuity of useful action, and hurrying,
- Blessing in disguise, feedback, and intermediary,
- Self service, copying, cheap disposables, and mechanical interaction substitution
- Pneumatics and hydraulics, flexible shells and thin films, and porous materials,
- Optical property changes, homogeneous, and discarding and recovering,
- Parameter changes, phase transitions, and thermal expansion,
- Strong oxidants, inert atmosphere, and composite materials,
- How to select most suitable principle out of 40 ways to create good solutions

References

1. ABC-TRIZ Introduction to Creative Design Thinking with Modern TRIZ Modeling by Michael A. Orloff
2. TRIZ And Suddenly the Inventor Appeared TRIZ, the Theory of Inventive Problem Solving by GenrichAltshuller
3. TRIZ for Engineers Enabling Inventive Problem Solving by Karen Gadd
4. Simplified TRIZ New Problem Solving Applications for Engineers and Manufacturing Professionals by Rantanen K., Domb E.

SOFT COMPUTING (CST-039)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Familiarize with soft computing concepts.
2. Introduce and use the idea of Neural networks, fuzzy logic and use of heuristics based on human experience
3. Introduce and use the concepts of Genetic algorithm and its applications to soft computing using some applications.

COURSE OUTCOMES: On completion of this course, the students will be able to

1. Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions
2. Recognize the feasibility of applying a soft computing methodology for a particular problem.
3. Design the methodology to solve problem and decision making using fuzzy logic, genetic algorithms and neural networks.
4. Mining the bulk of data present in the warehouse.
5. Effectively use existing software tools to solve real problems using a soft computing approach.

Unit 1- Introduction to Genetic Algorithm: Introduction to soft computing, soft computing vs hard computing, Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues, challenges and applications of G.A.

Unit 2- Artificial Neural Networks & Learning : Introduction to Learning concept: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Neural Model and Network Architectures, Model of Artificial Neuron, Different Activation Functions, Perceptron network, Perceptron Learning, Supervised Hebbian Learning, Adaptive Linear Neuron, Backpropagation network, Backpropogation learning, Fundamentals of Associative Memory, Associative memory models, Auto associative memory, Bi-directional hetero associative memory.

Unit 3- Competitive Networks: Introduction to Competitive Nerual Networks, Principles of Competitive Learning, Hopfield Network, Computing with Neural Nets and applications of Neural Network.

Unit 4- Introduction to Fuzzy Sets: Introduction to fuzzy sets, difference between fuzzy sets and crisp sets theory, Operations on Fuzzy sets, Fuzzy properties, Fuzzy Relations, Fuzzy Measures, Applications of Fuzzy Set Theory to different branches of Science and Engineering.

Unit 5- Knowledge discovery in databases: KDD process, star schema, snowflack schema, Data mining and web mining using soft computing techniques. new datawarehouse architecture, database vs datawarehouse bioinformatics, amazon redshift, google big query, panoply.

TEXT BOOKS:

1. E – Neuro Fuzzy and Soft computing – Jang J.S.R., Sun C.T and Mizutami, Prentice hall New Jersey, 1998
2. Fuzzy Logic Engineering Applications – Timothy J.Ross, McGraw Hill, NewYork, 1997.
3. Fundamentals of Neural Networks – Laurene Fauseett, Prentice Hall India, New Delhi, 1994.

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence – E Charniak and D McDermott, Pearson Education
2. Artificial Intelligence and Expert Systems – Dan W. Patterson, Prentice Hall of India.

SOFTWARE PROJECT MANAGEMENT (CST-040)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Introduce the primary important concepts of project management related to managing software development projects.
2. Become familiar with the different activities involved in Software Project Management
3. Know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.

COURSE OUTCOMES: Upon completion of this course, the students will be able to

1. Identify the different project contexts and suggest an appropriate management strategy.
2. Practice the role of professional ethics in successful software development.
3. Identify and describe the key phases of project management.
4. Determine an appropriate project management approach through an evaluation of the business context and scope of the project
5. Manage the people and control the defects.

Unit 1- Basic Concepts: Product, Process and Project, Definition, Components of Software Project Management(SPM), Challenges and Opportunities, Tools and Techniques, Managing Human Resource and Technical Resource, Costing and pricing of projects, Training and development, Project management technique, Product Life Cycle , Project Life Cycle Models.

Unit 2- Format Process Models and Their Use: Definition and Format Model for a Process, ISO 9001 and CMM Models and their relevance to Project Management, Other Emerging Models like People CMM

Unit 3- Umbrella Activities In Projects: Metrics, Methods and Tools for Metrics, Issues of Metrics in multiple Projects, Configuration Management, Software Quality Assurance, Quality Standards and Certifications, Process and Issues in obtaining Certifications, Risk issues in Software Development and Implementation, Identification of Risks , Resolving and Avoiding risks, Tools and Methods for Identifying Risk Management.

Unit 4- Instream Activities In Project: Project Initiation, Project Planning, Execution and Tracking, Project Wind Unit 4- Instream Activities In Project: Project Initiation, Project Planning, Execution and Tracking, Project Wind up, Concept of Process, Project Database.

Unit 5- Engineering And Issues In Project Management: Requirements, Design, Development, Testing, Maintenance, Deployment, Engineering Activities and Management Issues in Each Phase, Special Considerations in Project Management for India and Geographical Distribution Issues.

TEXT BOOK(S)

1. Royce and Walker, “Software Project Management”, 2nd Edition, Pearson Education, 2002.

REFERENCES

1. Bob Hughes and Mike Cotterell, “Software Project Management”, 5th Edition, Tata McGrawHill, 2011.
2. Kelker, S. A, “Software Project Management”, 2nd Edition, Prentice Hall, 2003.
3. Gopalaswamy Ramesh, "Managing Global Projects", 1st Reprint Edition, Tata McGraw Hill,2006.
4. Robert K. Wysocki, “Executive's Guide to Project Management”, 2nd Edition, John Wiley &Sons, 2011.
5. Teresa and luckey, Joseph Phillips, “Software project Management for dummies”, 3rdEdition, Wiley publishing Inc., 2006.

CYBER AND DIGITAL FORENSICS (CST-041)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVE: The objectives of the course are to

1. Understand the basics of the cyber forensics.
2. Introduce the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Digital Forensics

COURSE OUTCOMES: Upon completion of this course, the students will be able to

1. Understand the concept of cybercrime and emerging crime threats and attacks in cyberspace.
2. Demonstrate the various types of cyber laws and their applicability.
3. Apply the forensic science techniques to data acquisition and evidence collection
4. Get the practical exposure to forensic tools from the scenarios of passive and active attacks.
5. Demonstrate the use of anti-malware tools for enhancing system network protection.

Unit 1: Introduction to IT laws & Cyber Crimes: Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security.

Legal and Ethical Principles: Introduction to Forensics – The Investigative Process – Code of Ethics, Ethics of Investigations, Evidence Management – Collection, Transport, Storage, access control, disposition

Unit 2- Forensic Science: Principles and Methods –Scientific approach to Forensics, Identification and Classification of Evidence, Location of Evidence, Recovering Data, Media File Forensic Steps, Forensic Analysis – Planning, Case Notes and Reports, Quality Control .

Unit 3- Digital Forensics: Hardware Forensics – Hidden File and Anti- forensics - Network Forensics – Virtual Systems - Mobile Forensics Digital Watermarking Protocols: A Buyer-Seller Watermarking Protocol, an Efficient and Anonymous Buyer-Seller Watermarking Protocol, Extensions of Watermarking Protocols, Protocols for Secure Computation

Unit 4- Application Forensics, Tools and Report Writing – Application Forensics, Email and Social Media Investigations, Cloud Forensics, Current Digital Forensic Tools, Report Writing for Investigations.

Unit 5- Counter Measures: Defensive Strategies for Governments and Industry Groups, Tactics of the Military, Tactics of Private Companies, Information Warfare Arsenal of the future, and Surveillance Tools for Information Warfare of the Future.

TEXT BOOKS:

1. Bill Nelson, Christopher Steuart, Amelia Philips, “Computer Forensics and Investigations”, Delmar

Cengage Learning; 5th edition January 2015.

2. Chuck Eastom, "Certified Cyber Forensics Professional Certification", McGraw Hill, July 2017.
3. Nilakshi Jain, Dhananjay Kalbande, "Digital Forensic: The fascinating world of Digital Evidence" Wiley India Pvt Ltd 2017.
4. John R.Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, 2015.

REFERENCE BOOKS:

1. MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.
2. Clint P Garrison "Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data , Syngress Publishing, Inc. 2010.

DIGITAL IMAGE PROCESSING (CST-042)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Understand the image fundamentals and mathematical transforms necessary for image processing.
2. Expose students to current applications in the field of digital image processing.

COURSE OUTCOMES: On completion of this course, the students will be able to

1. Learn the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. To learn and understand various image compression and Segmentation techniques used in digital image processing.
5. Understand the various image representation techniques and perform feature and object detection techniques.

Unit 1-Introduction: Digital Image Processing, The origins of Digital Image Processing, Examples of Digital Image Processing application, Fundamental steps in Digital Image processing, Components of Image Processing system Fundamentals: Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels, Linear and Nonlinear Operations, An introduction to mathematical tool used in digital image processing.

Unit 2-Image Enhancement in the spatial domain: Background, some basic gray level transformation, Introduction of Histogram processing, Enhancement using Arithmetic/Logic operations, Basics of spatial filtering, smoothing spatial filters, Sharpening spatial filters, Concept of Sampling.

Unit 3-Image Restoration: Model of the Image Degradation/Restoration process, Noise Models, Restoration in the presence of noise only spatial filtering, Inverse filtering, Minimum Mean Square Error (Wiener) filtering, Geometric mean filter.

Unit 4-Image Compression: Fundamentals, Lossy Compression, Lossless Compression, Image Compression models, Error-free Compression: Variable length coding, LZW coding, Bit plane coding, Run length coding, Introduction to JPEG, introduction to color image processing, color fundamentals, color models, Pseudo color image processing.

Unit 5-Morphology and Segmentation: Erosion, Dilation, Duality, Opening and Closing, Hit-and Miss transform, Morphological

Algorithms: Boundary Extraction, Hole filling, Extraction of connected components, Convex Hull, Concept of Thinning and Thickening.

Image Segmentation: Definition, characteristics of segmentation Detection of Discontinuities, Thresholding, Region based segmentation. Introduction Object Recognition, pattern and Pattern classes.

TEXT BOOK:

1. Rafael C. Gonzalez, Richard E. Woods, _Digital Image Processing‘, Pearson, Third Edition, 2010.
2. Anil K. Jain, _Fundamentals of Digital Image Processing‘, Pearson, 2002.

REFERENCE BOOKS:

1. Kenneth R. Castleman, _Digital Image Processing‘, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, _Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, _Multidimensional Digital Signal Processing‘, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, _Digital Image Processing‘, John Wiley, New York, 2002
5. Milan Sonka et al _Image processing, analysis and machine vision‘, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

BIG DATA ANALYTICS (CST-043)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Make students comfortable with tools and techniques required in handling large amounts of datasets.
2. Uncover various terminologies and techniques used in Big Data.
3. Use several tools publicly available to illustrate the application of these techniques.
4. Know about the research that requires the integration of large amounts of data.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Identify and distinguish big data analytics applications.
2. Design efficient algorithms for mining the data from large volumes.
3. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
4. Understand the fundamentals of various big data analytics techniques.
5. Present cases involving big data analytics in solving practical problems.

UNIT – I

Introduction to big data: Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

UNIT – II

Mining data streams: 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 ina Window – Decaying Window - Real time Analytics Platform(RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

UNIT – III

Hadoop: History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job Run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features-Hadoop environment.

UNIT – IV

Frameworks: Applications on Big Data Using Pig and Hive – Data processing operatorsin Pig – Hive services – **Frameworks:** Applications on Big Data Using Pig and Hive – Data processing operatorsin Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zookeeper - IBM Infosphere Big Insights and Streams.

UNIT – V

Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

TEXTBOOKS:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.

REFERENCE BOOKS:

1. Michael Minelli, Michele Chambers, and Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley,2013.
2. Frank J. Ohlhorst, Big Data Analytics: Turning Big Data into Big Money, Wiley, 2012.
3. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, MC Press, 2012.
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
6. Jeffrey Aven, Hadoop in 24 hours, person education 2018.
7. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, Reprinted 2008.
8. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007.
9. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
10. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands- On Approach ",VPT, 2016
11. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014.

SOFTWARE ENGINEERING (CST-015/CSO-052)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Learn and understand the principles of Software Engineering.
2. Learn methods of capturing, specifying, visualizing, and analyzing software requirements.
3. Apply Design and Testing principles to S/W project development.
4. Understand project management through life cycle of the project.

COURSE OUTCOMES: On successful completion of the course, the student will be able to

1. Identify appropriate software design model based on requirement analysis.
2. Formulate Software Requirements Specification (SRS) reports for the real world application.
3. Translate a specification into a design and identify the components to build the architecture.
4. Plan a software engineering process to account for quality issues and non-functional requirements.
5. Estimate the work to be done, resources required and the schedule for a software project plan.

Unit 1- : **Introduction to Software Engineering**: Introduction, software applications, importance of software evolution of software, Software Components, Software Characteristics, Software Crisis & myths. Software Engineering paradigms: introduction, principles & Processes, Software Quality Attributes. Comparison between software engineering & computer science, & software engineering & Engineering. Some terminologies: product & process, deliverables and milestones, measures, metrics& indicators. Programs & software products. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, RAD model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

Unit 2- Software Requirement Analysis: Structured analysis, object-oriented analysis, software requirement specification, and validation.

Unit 3- Design and Implementation of Software: software design fundamentals, design methodology (structured design and object-oriented design), design verification, monitoring and control coding.

Unit 4- Testing: Testing fundamentals, white box and black box testing, software testing strategies: unit testing, integration testing, validation testing, system testing, debugging.

Unit 5- Software Reliability: Metric and specification, fault avoidance and tolerance, exception handling, defensive **Unit 5- Software Reliability:** Metric and specification, fault avoidance and tolerance, exception handling, defensive programming.Software Maintenance – maintenance characteristics, maintainability, maintenance tasks, maintenance side effects. CASE tools, software certification- requirement, types of

certifications, third part certification. Software Re-Engineering, reverse software Engineering. Software Configuration Management

Activities, Change Control Process, Software Version Control, CASE: introduction, levels of case, architecture, case building blocks, objectives, case repository, characteristics of case tools, categories, Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

TEXTBOOKS:

1. Roger Pressman, ―Software Engineering: A Practitioner ‘s Approach, McGraw Hill, ISBN 007– 337597–7.
2. Ian Sommerville, ―Software Engineering, Addison and Wesley, ISBN 0-13-703515-2.

REFERENCE BOOKS:

1. Carlo Ghezzi, ―Fundamentals of Software Engineering, Prentice Hall India, ISBN-10: 0133056996.
2. Rajib Mall, ―Fundamentals of Software Engineering, Prentice Hall India, ISBN-13: 9788120348981.
3. Pankaj Jalote, ―An Integrated Approach to Software Engineering, Springer, ISBN 13: 9788173192715.
4. S K Chang, ―Handbook of Software Engineering and Knowledge Engineering, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1.
5. Tom Halt, ―Handbook of Software Engineering, ClanyeInternational ISBN- 10: 1632402939

OBJECT ORIENTED PROGRAMMING (CST-004/CSO-053)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to:

1. Provide flexible and powerful abstraction.
2. Allow programmers to think the problem in terms of the structure rather than in terms of structure of the computer.
3. Decompose the problem into a set of objects.
4. Objects interact with each other to solve the problem.
5. Create new type of objects to model elements from the problem space

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
2. Apply some common object-oriented design patterns.
3. Specify simple abstract data types and design implementations using abstraction functions to document them.
4. Design a convenient way for the handling problems using templates and use simple try-catch blocks for Exception Handling.
5. Manage I/O streams and File I/O oriented interactions.

Unit 1- Object Oriented Programming Concepts: Classes and Objects, Methods and Messages, Abstraction and Encapsulation, Inheritance, Abstract Classes, Polymorphism. Introduction to C++: Classes and Objects, Structures and Classes, Unions and Classes, Friend Functions, Friend Classes, Inline Functions, Static Class Members, Scope Resolution Operator, Nested Classes, Local Classes, Passing Objects to Functions, Returning objects, object assignment. Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, Type Checking, this Pointer, Pointers to Derived Types, Pointers to Class Members, References, Dynamic Allocation Operators.

Unit 2- Function Overloading and Constructors: Function Overloading, Constructors, parameterized constructors, Copy Constructors, Overloading Constructors, Finding the Address of an Overloaded Function, Default Function Arguments, Function Overloading and Ambiguity. Operator overloading: Creating member Operator Function, Operator Overloading Using Friend Function, Overloading New and Delete, Overloading Special Operators, Overloading Comma Operator.

Unit 3- Inheritance and Polymorphism: Inheritance: Base-Class Access Control, Inheritance and Protected

Unit 3- Inheritance and Polymorphism: Inheritance: Base-Class Access Control, Inheritance and Protected
Members, Inheriting Muitiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes. Polymorphism: Virtual Functions, Virtual Attribute and Inheritance, Virtual Functions and

Hierarchy, Pure Virtual Functions, Early vs. Late Binding, Run-Time Type ID and Casting Operators: RTTI, Casting Operators, Dynamic Cast.

Unit 4- Templates and Exception Handling: Templates: Generic Functions, Applying Generic Functions, Generic Classes, The type name and export Keywords, Power of Templates, Exception Handling: Fundamentals, Handling Derived Class Exceptions, Exception Handling Options, Understanding terminate() and unexpected(), uncaught_exception () Function, exception and bad_exception Classes, Applying Exception Handling.

Unit 5- I/O System Basics: Streams and Formatted 1/O. File I/O: File Classes, File Operations. Namespaces: Namespaces, std Namespace. Standard Template Library: Overview, Container Classes, General Theory of Operation, Lists, string Class, Final Thoughts on STL.

TEXTBOOKS:

1. Object Oriented Programming with C++ by E. Balagurusamy, McGraw-Hill Education (India).
2. ANSI and Turbo C++ by Ashoke N. Kamthane, Pearson Education

REFERENCE BOOKS:

1. Big C++ - Wiley India.
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India).
3. C++ and Object Oriented Programming – Jana, PHI Learning.
4. Object Oriented Programming with C++ - Rajiv Sahay, Oxford.
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)

PROJECT (CSP-021)

L:T:P:: 0:0:12 **Credits-06**

COURSE OBJECTIVE:

The objective of Project is to enable the student to extend further the investigative study taken up under project either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.

COURSE OUTCOME: On successful completion of this course, the students shall be able to

1. Review and finalize the approach to the problem relating to the assigned topic and prepare an action plan for preparing conducting the investigation and assign responsibilities for teamwork
2. Conduct detailed analysis, modeling, simulation, design, problem solving, or experiment as needed on the assigned topic
3. Develop product/process, test, draw results and conclusions, and give direction for future research and prepare a paper for conference presentation/publication in journals, if possible
4. Prepare a project report in the standard format for being evaluated by the Department and make final presentation on the project before a Departmental Committee.