CSE(BC) Semester:Vi	Code Subject BC – 601 Cloud Computing	L T P C 3 1 0 4
Prerequisite: Knowledge of Computer network, Internet Technology and ACA		
CO1	Explain the core concepts of the cloud computing paradigm:, characteristics, advantages and challenges brought about by the various models and services in cloud computing.	Level 2: Understand
CO2	Describe importance of virtualization along with their technologies and compare various load balancing algorithms.	Level 2: Understand
CO3	Describe and analyze the key components of Google and Amazon web service and apply them to solve problems on the cloud.	Level 3: Analyze
CO4	Describe the key components of Microsoft azure platform and cloud management on azure.	Level 3: Apply
CO5	Explain major security and privacy problems in the cloud and how they are addressed with the security mechanisms	Level 3: Apply
UNITs	**Descriptions**	**Hrs.**
Unit-I	Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing Architecture ,Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept .	6 Hrs.
Unit-II	Unit –II : Concepts of Abstraction and Virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization ,Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF).Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS.	7 Hrs.

Unit-III	Application frameworks Use of Google Web Services ,Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, Google Toolkit (including introduction of Google APIs), major features of Google App Engine service. Use of Amazon Web Services Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store.	8 Hrs.
Unit-IV	Windows Azure platform: Microsoft's approach, architecture, and main elements, Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services, Types of services required in implementation – Consulting, Configuration, Customization and Support Cloud Management. An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle).	7 Hrs.
Unit -V	Cloud security concerns, Security boundary, Security service boundary Security of data, Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management.Service Oriented Architecture,message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs, Cloud storage definition – Manned and Unmanned ,Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services.	7 Hrs.
Text Books		
• Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India		
Reference Books		
• Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013 • Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill • Education (India) Private Limited, 2013 • Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill • Cloud Computing, Miller, Pearson • Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson.		
CO – PO – PSO Mappings		

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 1	PO 11	PO 12	PSO 1	PSO 2
CO-1	2	2							1			2	2	2
CO-2	2	2		1								1	1	2
CO-3	2	3		1	2							2	2	3
CO-4	2	3		1	2							2	2	3
CO-5	1	1						2				1	2	

CSE(BC) Semester:VI	Code BC – 602	Subject Introduction to Smart Contract	L T P C 3 0 0 3
Prerequisite: Basic concepts in networking in Blockchain			
CO1	To understand the working and importance of smart contracts and Ethereum.		
CO2	To learn the Issues in Application of Smart Contract		
CO3	To understand and build the working of Solidity		
CO4	To Analyze the Truffle Framework & Ganache		
CO5	Analyze the results of the algorithm and convert to appropriate information as per the requirement.		
UNITs	**Descriptions**		**Hrs.**
Unit - I	Smart Contracts: Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum , Ethereum Virtual Machine(EVM), Sample examples of working Ethereum Smart Contract		6 Hrs.
Unit - II	Issues in Application of Smart Contract: Market Impact and Scientific innovation, Trust, Future resistance features, Security Merkle's Tree, Notable Smart Contract related Hacks & Scandals, Workflow of developing a Smart Contract		7 Hrs.
Unit - III	Introduction to Solidity: Contracts, Constructors & Functions, Variables, Getters &Setters, Arrays, Memory vs Storage, Mappings in Solidity Advanced Solidity: Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, Abstract Contracts, Inheritance, And Interfaces, Events		7 Hrs.
Unit - IV	Truffle Framework & Ganache: Environment Setup for Truffle & Ganache, Truffle Project Creation, Truffle Compile, Migrate and Create Commands.		7 Hrs.
Unit - V	Decentralized App Creation: Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.		8 Hrs.
Text Books			
1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons. 2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.			
Reference Books			
1. Building Blockchain Projects, Narayan Prusty, Packt Publishing. 2. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas			
Corresponding Online Resources:			

1. https://www.coursera.org/learn/smarter-contracts
2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-inethereum- blockchain/
3. Introduction to Blockchain Technology and Applications,

CO – PO – PSO Mappings

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	2	2							1			2	2	2
CO-2	2	2		1								1	1	2
CO-3	2	3		1	2							2	2	3
CO-4	2	3		1	2							2	2	3
CO-5	1	1						2				1	2	

CSE(BC) Semester:VI	Code Subject BC – 603(A) Project Management	L T P C 3 0 0 3
Prerequisite: Software Engineering		
CO1	Discuss complete structure of project management and analyze the scope of project planning.	Level 2: Understand
CO2	Identify different project selection method	Level 3: Understand
CO3	Explain the importance of procurement and its techniques.	Level 3: Apply
CO4	Interpret the concept of agile software engineering and its advantages in software development	Level 3: Apply
CO5	Make use of various tools available to agile teams to facilitate the project.	Level 3: Apply
UNITs	**Descriptions**	**Hrs.**
Unit - I	**Concepts of project management:** Meaning, definition and characteristics of a project, project life cycle phases, project planning and graphic presentation; Customer needs, Stake holder concept, project concept, feasibility study and report, baseline plan, SWOT analysis	6 Hrs.
Unit - II	**NW analysis:** PERT network; mean time and variances; probability to complete PERT project in specified time; CPM network; Event Occurrence Time (EOT); activity start/ finish times; forward and reverse path calculations, concept and calculation of floats; resource allocation and critical-chain;	7 Hrs.
Unit - III	**Project Monitoring and Control:** Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI)	8 Hrs.
Unit - IV	**Introduction to Agile PM:** The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools	7 Hrs.
Unit - V	**Agile Scrum Framework:** Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.	7 Hrs.

Text Books

1. Software Project Management, Bob Hughes and Mike Cotterell, McGraw Hill

Reference Books

1. Prasana Chandra: Projects: planning Implementation control; TMH.
2. Gray Clifford F And Larson EW; Project The managerial Process; TMH
3. Panneerselven and Serthil kumar; Project management, PHI
4. Burke ; Project Management-Planning and control technics; Wiley Indi
5. Kamaraju R; Essentials of Project Management; PHI Learning
6. Jack R. Meredith, Project Management: a managerial approach, Wiley.
7. Choudhary ;Project Management; TMH
8. Srinath LS; PERT And CPM Principles and Appl; East West Press
9. Richman L; Project Management: Step By Step; PHI Learning
10. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", International Edition, Pearson.
11. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", First International Edition, Prentice Hall.

CO – PO – PSO Mappings

COs	**Programme Outcomes (POs)**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	2	1								
CO2	3	3	3	2	2	1								
CO3	3	3	3	2	2	1								
CO4	3	3	3	2	2	1						1		
CO5	3	3	3	2	2	1						1		2

CSE(BC) **Semester: VI**	**Code Subject** **BC-603(B) – Advanced Web Technologies**	**LTP C** **3 0 0 3**
Prerequisite: Discrete mathematics, Basic probability theory and Data Structure		
CO1	Apply Object Oriented concepts in developing PHP applications	Level 3: Apply
CO2	Use various third party APIs and advance concepts of PHP to develop Applications	Level 3: Apply
CO3	Create and deploy scalable web based system using Laravel.	Level 6: Create

CO4	Develop server-side web applications using Node.js (Create)	Level 6: Create
CO5	Understanding and applying the concept of react.js	Level 3: Apply
UNITs	**Descriptions**	**Hrs.**
Unit - I	Object Oriented PHP: Object Oriented Programming with PHP – Classes, Properties, Methods, Magic Methods: Constructor, Destructor, Getter and Setter, Encapsulation, Inheritance, Data Abstraction, Polymorphism..	6 Hrs.
Unit - II	Advance PHP: Web Scraping using cURL, Regular Expression, Mail function, Web Services & APIs	6 Hrs.
Unit - III	PHP MVC Framework - Laravel: Introduction to Laravel and MVC, Environment Setup, Routes, Namespaces, Controllers, Views, Request Response, Redirections, Forms, Session, Cookie, Database Connectivity and CRUD operations	8 Hrs.
Unit - IV	Node.js Introduction to Node.js, Node Package Manager, REPL Terminal, Node.js Webserver – Server and Clients, creating a simple server, Rendering HTML, Rendering JSON Data, Routing	8 Hrs.
Unit - V	Introduction to React Overview of React and its benefits, Setting up a development environment, Understanding JSX syntax, Creating and rendering React components, Introduction to React hooks (useState, useEffect)	7 Hrs.

Text Books

1. PHP: The Complete Reference, By Steven Holzner. Publisher: Tata McGraw Hill
2. Laravel: Up and Running, By Matt Stauffer. Publisher: O'Reilly Media
3. 3. Node.js in Action, By Mike Cantelon, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich. Publisher: Manning publications.
4. React.js Design Patterns: Learn how to build scalable React apps with ease by Anthony Onyekachukwu Okonta

Reference Books

Sites to be added

CO – PO – PSO Mappings

COs	**Programme Outcomes (POs)**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	2	2	2	1								
CO2	3	2	3	2	2	1								
CO3	3	2	3	2	2	1						1		2
CO4	3	2	3	2	2	1						1		
CO5	3	2	3	2	2	1								2

CSE(BC) Semester: VI	Code BC-603(C) –	Subject Cyber Security using Block chain	LTP C 3 0 0 3
Prerequisite: basic understanding of computer systems and networks			
Course Objective: 1. To provide an understanding Computer forensics fundamentals 2. To analyze various computer forensics technologies 3. To provide computer forensics systems 4. To identify methods for data recovery. 5. To apply the methods for preservation of digital evidence.			
CO1	Understand the definition of computer forensics fundamentals.		Level 2: Understand

CO2	Describe the types of computer forensics technology**.**	Level 3: Understand
CO3	Analyze various computer forensics systems.	Level 4: Analyze
CO4	Illustrate the methods for data recovery, evidence collection and data seizure.	Level 6: Create
CO5	Summarize duplication and preservation of digital evidence.	Level 4: Analyze
UNITs	**Descriptions**	**Hrs.**
I	Definition and Origins of Cybercrime, information Security, Classifications of Cybercrimes. Cyber-cafe and Cybercrimes, Bot-nets, Attack Vector,Introduction to Cyber laws In indian Context- Information technology act 2000,Amendments made in the indian ITA 2000, Positive Aspects of ITA 2000, The Weak Areas of ITA 2000, Challenges in India Law and Cyber-crime scenario in india.	**7hrs**
II	Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Right-source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Losing.	7hrs
III	Copy Right-Source of risks, Pirates, Internet Infringement, Fair Use, postings, Criminal Liability, First Amendments, Losing Data, Trademarks, Defamation, Privacy-	10hrs
IV	Duty of Care, Criminal Liability, Procedural issues, Electronic Contracts & Digital Signatures, Misappropriation of information, Civil Rights, Tax, Evidence.	7hrs
V	Ethics, Legal Developments, Late 1990 to 2000,Cyber security in Society, Security in cyber laws case studies, General law and Cyber Law-a Swift Analysis.	8hrs

Text Books

1. Law Relating to computer internet and E commerce by Nandan Kamath, 2nd Edition Universal Law Publishing Co. Pvt Limited.
2. Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 2297.
3. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge University Press.

Reference Books

1. https://www.coursera.org/learn/smarter-contracts
2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-inethereum- blockchain/
3. Introduction to Blockchain Technology and Applications,

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	1							2		
CO2	1	1	1	1	1			2				1		2
CO3	1	1	1	3	2			2						
CO4	1	2	2	2	1			2				2		2
CO5	1	2	1	1										

CSE(BC) **Semester: VI**	**Code** **Subject** **BC - 604 (A)** **Soft Computing**	**L T P C** **3 0 0 3**
Prerequisite: Discrete mathematics		
CO1	Learn soft computing techniques and their applications.	Level 2: Understand
CO2	Analyze various neural network architectures.	Level 3: Apply

CO3	Define the fuzzy systems.	Level 3: Apply
CO4	Understand the genetic algorithm concepts and their applications..	Level 3: Apply
CO5	Identify and select a suitable Soft Computing technology to solve the problem.	Level 4: Analyze
UNITs	**Descriptions**	**Hrs.**
Unit - I	Introduction to Soft Computing Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.	6 Hrs.
Unit - II	Perceptron networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network –Architecture, Training algorithm.	7 Hrs.
Unit - III	Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets,fuzzy relations - operations on fuzzy relations.Fuzzy membership functions, fuzzification, Methods of membership value assignments – intuition – inference – rank ordering, Lambda –cuts for fuzzy sets, Defuzzification methods.)	7 Hrs.
Unit - IV	Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules - Decomposition of rules – Aggregation of rules, Fuzzy Inference Systems - Mamdani and Sugeno	7 Hrs.
Unit - V	Introduction to genetic algorithm, operators in genetic algorithm -coding - selection - crossover – mutation, Stopping condition for genetic algorithm flow,	8 Hrs.
Text Books		
• S. N. Sivanandam and S. N.Deepa, Principles of soft computing – John Wiley & Sons, 2007. • Timothy J. Ross, Fuzzy Logic with engineering applications , John Wiley		
Reference Books		

- N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
- Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc.1998
- R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
- Driankov D., Hellendoorn H. and Reinfrank M., An Introduction to Fuzzy Control- Narosa Pub., 2001.
- Bart Kosko, Neural Network and Fuzzy Systems- Prentice Hall, Inc., Englewood Cliffs, 1992
- Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning-Addison Wesley, 1989.

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2		2	2										
CO2	1		2	2	1								2	2
CO3	2	2	2	2	2								2	2
CO4		1	2	2	1								2	2
CO5	2	2	2	2	1						1		2	2

Prerequisite: To study the image fundamentals , mathematical transforms necessary for image processing.		
CO1	Ability to apply principles and techniques of digital image processing in applications related to design and analysis of digital imaging systems.	Level 2: Understand
CO2	Ability to analyze and implement image processing algorithms to real problems.	Level 3: Apply
CO3	Gaining of hands-on experience in using software tools for processing digital images.	Level 3: Apply
CO4	Interpret image segmentation and representation techniques.	Level 3: Apply
CO5	Apply Mathematical Morphology using Polynomial approximation.	Level 3: Apply
UNITs	**Descriptions**	**Hrs.**
Unit - I	**Digital Image Fundamentals:** Introduction and signal digitization, A simple image model, Sampling and Quantization, Pixel relationship, Camera models & imaging geometry, Image interpolation, Image acquisition systems, Different types of digital images.	6 Hrs.
Unit - II	**Image Transformations:** Introduction to Fourier transforms, Discrete Fourier transforms, Fast Fourier transform, Walsh transformation, Hadmord transformation, Discrete Cosine Transformation.	7 Hrs.
Unit - III	**Image Enhancement:** Filters in spatial and frequency domains, Histogram based processing. Image subtraction, Averaging, Image smoothing, Nedion filtering, Low pass filtering, Image sharpening by High pass filtering, Image restoration & Image registration, Colour image processing.	8 Hrs.
Unit - IV	**Image Encoding and Segmentation Encoding:** Mapping, Quantizer, Coder. Error free compression, Lossy Compression schemes. JPEG Compression standard. Detection of discontinuation by point detection, Line detection, edge detection, Edge linking and boundary detection, Local analysis, Global processing via Hough transforms and graph theoretic techniques.	7 Hrs.
Unit - V	**Morphological image processing:** Mathematical Morphology, Binary, Dilation, crosses, Opening and closing, Simple methods of representation, Signatures, Boundary segments, Skeleton of a region, Polynomial approximation, Object representation, description and recognition.	7 Hrs.
Text Books		
Digital Image Processing, Second Edition by Rafel C. Gonzalez and Richard E. Woods, Pearson Education		
Reference Books		

1. Rafael C Gonzalez, Richard E Woods 3rd Edition, Digital Image Processing Pearson.
2. Sonka, Digital Image Processing & Computer Vision, Cengage Learning.
3. Jayaraman, Digital Image Processing, TMH.
4. Pratt, Digital Image Processing, Wiley India.
5. Annadurai, Fundamentals of Digital Image Processing,Pearson Education.

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	1		1						2	2	1
CO2	2	2	2	1								2	1	1
CO3	2	2	3	2								1	1	2
CO4	2	2	2	2								1	1	1
CO5	1	2	2	2								1		

Prerequisite: DBMS and Fundamentals of Algorithms		
CO1	Understand the need of designing Enterprise data warehouses and will be enabled to approach business problems analytically by identifying opportunities to derive business.	Level 2: Understand
CO2	Compare and contrast, various methods for storing & retrieving data from different data sources/repository.	Level 3: Apply
CO3	Ascertain the application of data mining in various areas and Preprocess the given data and visualize it for a given application or data exploration/mining task.	Level 3: Apply
CO4	Apply supervised learning methods to given data sets such as classification and its various types.	Level 3: Apply
CO5	Apply Unsupervised learning methods to given data sets such as clustering and its various types.	Level 3: Apply
UNITs	**Descriptions**	**Hrs.**
Unit - I	**Data Warehousing:** Introduction to Data warehousing, needs for developing data Warehouse, Data warehouse systems and its Components, Design of Data Warehouse, Dimension and Measures, Data Marts, Conceptual Modelling of Data Warehouses, Star Schema, Snowflake Schema, Fact Constellations. Multidimensional Data Model and Aggregates.	6 Hrs.
Unit - II	**OLAP:** Characteristics of OLAP System, Motivation for using OLAP, Multidimensional View and Data Cube, Data Cube Implementations, Data Cube Operations, Guidelines for OLAP Implementation, Difference between OLAP and OLTP, OLAP Servers: ROLAP, MOLAP, HOLAP Queries.	7 Hrs.
Unit - III	**Data Mining:** Data Mining task primitives, Integration of Data Mining system with the database, Major issues in Data Mining, Data Pre-processing, Descriptive data summarization, Data cleaning, Data integration and transformation, Data reduction, Data Discretization, Association Rule Mining, Apriori Algorithms, Improving the efficiency of the Apriori Algorithm, FP-Growth ,Performance Evaluation of Algorithms.	8 Hrs.
Unit - IV	**Supervised Learning:** Classification: Statistical-based algorithms, Distance-based algorithms, Decision tree-based algorithms, Neural network-based algorithms, Rule-based algorithms, Probabilistic Classifiers	7 Hrs.
Unit - V	**Clustering:**Hierarchical algorithms, Partitional algorithms, Clustering large databases – BIRCH, DBSCAN, CURE algorithms	7 Hrs.
Text Books		
1. Pang – ningTan , Steinbach & Kumar, “Introduction to Data Mining”, Pearson Edu, 2019. 2. Jaiwei Han, Micheline Kamber, “Data Mining : Concepts and Techniques”, Morgan Kaufmann		
Reference Books		

1.Margaret H. Dunham, “Data Mining : Introductory and Advanced topics”, Pearson Edu., 2009. 2. Anahory& Murray, “Data Warehousing in the Real World”, Pearson Edu., 2009.
3. G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.

CO – PO – PSO Mappings

COs	ProgrammeOutcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1											2	1
CO2	3	3		2	3								2	
CO3	3	2	2	3	2								3	3
CO4	2		1	2	1								2	1
CO5	2	3		1									2	

CSE Semester: VI	Code Subject BC –605(A) Machine Learning	LTP C 3 0 0 3
Prerequisite: Linear Algebra, Basic probability theory		
CO1	Understand, visualize, analyze and preprocess the data from a real-time source.	Level 2: Understand
CO2	To understand and build supervised learning models - part -1	Level 3: Apply
CO3	To understand and build supervised learning models- part -1I	Level 3: Apply
CO4	To understand and build unsupervised learning models.	Level 3: Apply
CO5	Analyze the results of algorithm and convert to appropriate information as per the requirement.	Level 4: Analyze
UNITs	**Descriptions**	**Hrs.**
Unit - I	Introduction to Machine Learning – Examples of machine learning applications Learning Paradigms – Probably Approximately Correct (PAC) learning – Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off. Role of Machine Learning in Artificial Intelligence applications.	6 Hrs.
Unit - II	Supervised Learning - 1: Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm.	7 Hrs.
Unit - III	Supervised Learning – II: Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.	7 Hrs.
Unit - IV	Unsupervised learning - K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization, Principal Component Analysis – Kernel PCA.	7 Hrs.
Unit - V	Ensemble Learning: Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance.	8 Hrs.
Text Books		
"Introduction to Machine Learning", Ethem Alpaydin, MIT Press, Fourth Edition, 2020.		
Reference Books		

1. “Machine Learning: An Algorithmic Perspective, Stephen Marsland “Second Edition”, CRC Press, 2014.
2. "Foundations of Machine Learning”, Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, MIT Press, 2012.
3. “Machine Learning”, Tom Mitchell, McGraw Hill, 3rd Edition,1997.

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	2	1								
CO2	3	3	3	2	2	1								
CO3	3	3	3	2	2	1								
CO4	3	3	3	2	2	1						1		
CO5	3	3	3	2	2	1						1		2

CSE(BC)	Code	Subject	L T P C
Semester: VI	BC –605(B)	Exploratory Data Analysis & Data Science	3 0 0 3

Prerequisites: Discrete Mathematics

Course Objective:

- To provide the knowledge and expertise to become a proficient data scientist;
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
- Produce Python code to statistically analyze a dataset;
- Critically evaluate data visualizations based on their design and use for communicating stories from data;

CO1	To explain how data is collected, managed and stored for data science.
CO2	To understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
CO3	To implement data collection and management scripts using Mongo DB.
CO4	Examine the techniques of Data xVisualization.
CO5	Identification of various applications of Data Science

Units	Descriptions	Hrs.
Unit - I	Data Science-What is Data Science, Need for Data Science, Difference between Data Science & Business Intelligence, Data Science Components, Tools for Data Science, Data Science Life cycle, Applications of Data Science, Data Science Ethics. Representation of Data- Types of data, primary, secondary, quantitative and qualitative data. Types of Measurements, nominal, ordinal, discrete and continuous data.	**6**
Unit - II	Presentation of data by tables, construction of frequency distributions for discrete and continuous data. Graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions. Data Pre-processing- Knowing Data, Data Cleaning, Data Integration, Data Selection, Data Transformation	8
Unit - III	Descriptive Statistics-Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean. Partition values: Quartiles, Deciles and percentiles. Measures of dispersion: Mean deviation, Quartile deviation, Standard deviation, Coefficient of variation. Moments: measures of skewness, Kurtosis	8
Unit - IV	Correlation-Scatter plot, Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient, multiple and partial correlations. Regression: Concept of errors, Principles of Least Square, Simple linear regression and its properties. Types of Regressions.	10
Unit - V	Basics of Big Data, Problem handling large data, general techniques for handling large data, Basic concept of Machine Learning, training model, validating model, supervised & unsupervised learning.	8

Text Book & Reference Books-

1. Joel Grus, Data Science from Scratch, Shroff Publisher/O'Reilly Publisher Media
2. Annalyn Ng, Kenneth Soo, Num sense Data Science for the Layman, Shroff Publisher Publisher
3. Cathy O 'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher.

List/Links of e-learning resource

https://nptel.ac.in/courses/106106179

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO_{11}	PO_{12}	PSO1	PSO2
CO-1	3	2											3	
CO-2	3	3			1									
CO-3	3	3	1		1							3		3
CO-4	3	3	2	1								1	2	3
CO-5	3	3										1	2	

CSE(BC) Semester: VI	Code BC –605(C)	Subject Introduction to Smart Contract	L T P C 3 0 0 3
Prerequisites: Basic concepts in networking in Blockchain			
Course Objective: 1. To learn how to use Blockchain Technology. 2. To implement Smart Contract 3. To implement solidity algorithm 4. Analyze Truffle Framework and Ganache 5.To implement DApp			
CO1	To understand the working and importance of smart contracts and Ethereum.		
CO2	To learn the Issues in Application of Smart Contract		
CO3	To understand and build the working of Solidity		
CO4	To Analyze the Truffle Framework & Ganache		
CO5	Analyze the results of the algorithm and convert to appropriate information as per the requirement		
UNITs	**Descriptions**		**Hrs.**
I	Smart Contracts: Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum , Ethereum Virtual Machine(EVM), Sample examples of working Ethereum Smart Contract		**7**
II	Issues in Application of Smart Contract: Market Impact and Scientific innovation, Trust, Future resistance features, Security Merkle's Tree, Notable Smart Contract related Hacks & Scandals, Workflow of developing a Smart Contract		7
III	Introduction to Solidity: Contracts, Constructors & Functions, Variables, Getters &Setters, Arrays, Memory vs Storage, Mappings in Solidity Advanced Solidity: Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, Abstract Contracts, Inheritance, And Interfaces, Events		10
IV	Truffle Framework & Ganache: Environment Setup for Truffle & Ganache, Truffle Project Creation, Truffle Compile, Migrate and Create Commands.		7
V	Decentralized App Creation: Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.		8
Text Book & Reference Books-			

1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
3. Building Blockchain Projects, Narayan Prusty, Packt Publishing.
4. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas

List/Links of e-learning resource

1. https://www.coursera.org/learn/smarter-contracts
2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-inethereum- blockchain/
3. Introduction to Blockchain Technology and Applications,

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2
CO-1	3	2						3		2	2	3	2	2
CO-2	3	2						3	3	3	3	3	1	2
CO-3	3	2	3	3	3	2		3	3		3	3	2	3
CO-4	3	3		3	3			3	3		3	3	2	3
CO-5	3	3	3	3				3	3		3	3	2	

CSE(BC) Semester: VI	Code BC – 606	Subject Programming Lab-III	LTP C 0 0 4 2

Course Objectives :

1. To learn how to use Blockchain Technology.
2. To implement Smart Contract
3. To implement solidity algorithm
4. Analyze Truffle Framework and Ganache
5.To implement DApp

Course Outcomes:

Student who successfully completes this course should be able to

1: To understand the working and importance of smart contracts and Ethereum.

2: To learn the Issues in Application of Smart Contract

3: To understand and build the working of Solidity

4: To Analyse the Truffle Framework & Ganache

5:Analyse the results of the algorithm and convert to appropriate information as per the requirement.

List of Experiments :

1. Setting up Ethereum network by using the Geth command line interface.
2. Identifying and setting up a testnet, like Ropsten or Kovan, so that free ethers can be used as a transaction.
3. Transfer ethers from one account to another on an Ethereum testnet. 4. Constructing Solidity code for a decentralized application where the owner can create a contract (with a tenant) which can be replicated to all nodes. 5. In a rented house setup with the owner and the tenants, the tenant can submit a deposit and the contract's state changes on all the decentralized nodes.
6. The owner should be able to check the balance of the contract from any one of the nodes.
7. Using Remix on the Solidity code to develop, compile and deploy the contract.
8. Using setter and getter functions to interact with the contract
9. Withdrawing funds from a contract to a restricted account, preferably the owner's, with different levels of security restrictions.
10. Deploying a contract on an external blockchain by using Ganache and/or MyEtherwalllet, Metamask.

CSE(BC) Semester: VI	Code BC – 607	Subject Minor Project-I	LTP C 0 0 8 4

A minor project requires comparatively less time than major projects. They are comparatively simpler and have shorter duration. Minor Project helps students to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. Minor Project can help them to boost their skills and widen their horizon of thinking. It will act like a beginners guide to undertake the major project/dissertation during the final year and will ensure preparedness of students to undertake major projects/dissertation. Students will be required to select the topic relevant to their specialization and that has value addition. Students will get an opportunity to work in actual industrial environment if they opt for internship. Based on the selected topic student will also prepare seminar report based on the literature survey.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc. Minor Project will have mid semester presentation and end semester presentation. Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

- Mid Semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.
- End Semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection, and analysis of data, determining solutions highlighting individuals' contribution.

CO1	To identify engineering problems and reviewing available literature.	Level 2: Understand
CO2	To study different techniques used to analyze complexsystems	Level 3: Apply
CO3	To solve a live problem using software/ analytical/ computational tools and present solution by using his/her technique applying engineering principles.	Level 3: Apply
CO4	To inculcate innovative thinking and thereby preparing students for major project.	Level 3: Apply
CO5	To learn technical report writing and develop skills to present and defend their work in front of technically qualified audience.	Level 4: Analyze
Guidelines:	Introductory talk by HoD, Project Coordinator and Faculties. **Project Area Selection and Necessary Approvals:** • Identify students to work in a team and decide a team leader. • Get necessary approval from mentor of choice and submit	

	to coordinator. • Pre-review evaluation and follow ups by mentor. • Out of 10 lab sessions (4 hours) few lab sessions will be used for FTR (Formal Technical Review) Meetings, Experts presentation, Expert's Guidance meet, etc. **Project Topic Selection &Problem Identification** • Do literature review and identify needs. • Analysis of exiting tools/techniques • Participation in project-based competitions, etc. which shall be converted into problem statements for mini projects in consultation with faculty supervisor/head of department/internal committee of faculties. **Planning,Implementation& Deployment:** • Students shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini projects. • A logbook to be prepared by each group, wherein the group can record weekly work progress, guide/supervisor can verify and record notes/comments. • Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning. • The student(s) shall carryout project based on one or more of the following aspects – Prototype Design,Product Preparation/ Development, Working Model, Fabrication of Set up, Laboratory Experiments,Process Modification / Development, Simulation, Software Application / Development, Integration ofSoftware and Hardware, Data Analysis, Survey etc. • Follow SDLC (Software Development Life Cycle) for analyzing and developing the project. **Testing & Result Analysis:** • Test your project and get feedback from all stockholders and benefited society. • Analyze and conclude the identified results. • Technology enhancement by self-learning and byreviews (Internal). **Report writing& presentation making**: • Follow the format given as below. • The diagrams, charts, tables, etc. should be properly numbered and referred to. • Prepare presentation of project carried out by you for	

	Examination viva-voce. • The student is required to present project and submit a project report based on the work carried out. **Present your work-** • Participate in project competition, poster presentation, etc. • Publish paper in conferences/ journals, technical articles, book chapters, etc. • File patent.	
Distribution of Marks & Evaluation Phases	The project work is examined through- • Marks awarded by guide/supervisor based on logbook and by analyzing which parts could be added, improved, changed or removed as per review comments. • Anonymous questionnaire during meeting between mentor and student and its progress • Review of written artifact and oral examination • Oral and practical demonstration of implemented project. • Review of implementation plan, project synopsis, project report and project presentation Three reviews will be conducted for continuous assessment, First shall be for finalization ofproblem and proposed solution. Second shall be for implementation and testing of solution. Third will be for final evaluation	
Project Evaluation Committee	HoD, Project Coordinator, Mentor, &External Experts	
Project Evaluation Criteria	Mini Project shall be assessed based on following criteria: 1. Quality of survey/ need identification 2. Clarity of Problem definition based on need. 3. Innovativeness in solutions 4. Feasibility of proposed problem solutions and selection of best solution 5. Cost effectiveness 6. Societal impact 7. Innovativeness 8. Cost effectiveness and Societal impact 9. Full functioning of working model as per stated requirements 10. Effective use of skill sets 11. Effective use of standard engineering norms 12. Contribution of an individual's as member or leader 13. Clarity in written and oral communication	

Format of the Report	Following should be the order of contents for the report and should be strictly maintained. I. Cover Page II. Candidate's Declaration III. College/Institute Certificate IV. Acknowledgement V. Abstract. VI. Notations, Naming Convention and Abbreviations VII. List of Figures VIII. List of Tables IX. Table of Contents X. CHAPTERS that include but not limited to progress chart, role of each group member, literature work, research gap, motivation, needs, objective, problem statement, proposed methodology, technology used, innovative features, use case, result, testing, feedback from stockholders/ benefited society, conclusion, future work, your publications, etc. XI. References	

Project Evaluation Committee

Text Books:

Reference Books:

S. M. LaValle, "Planning Algorithms", Cambridge UniversityPress, 2006. (Available: http://planning.cs.uiuc.edu/)
Project management - David I Cleland - Mcgraw Hill InternationalEdition.
Project Management – Gopalakrishnan – Mcmillan India Ltd.

CO – PO – PSO Mappings

COs	**ProgrammeOutcomes (POs)**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	1	1		2					1	2	2	2
CO2	2	1	1	2	2	2						2	3	3
CO3	2	1	1	1	1	1			3				3	3
CO4	1	1	1	1		3	3	3			2	2	3	3
CO5	1	1	1	1	1	3	1			3	1		2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)