

Savitribai Phule Pune University Third Year of Information Technology (2019 Course) (With effect from Academic Year 2021-22)																						
Semester-VI																						
Course Code	Course Name	Teaching Scheme (Hours/ week)			Examination Scheme and Marks						Credit Scheme											
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term Work	Practical	Oral	Total	Lecture	Practical	Tutorial									
<u>314451</u>	Computer Networks& Security	03	-	-	30	70	-	-	-	100	03		03									
<u>314452</u>	Data Science and Big Data Analytics	03	-	-	30	70	-	-	-	100	03		03									
<u>314453</u>	Web Application Development	03	-	-	30	70	-	-	-	100	03		03									
<u>314454</u>	Elective-II	03	-	-	30	70	-	-	-	100	03		03									
<u>314455</u>	Internship	-	04	-	-	-	100	-	-	100		04	04									
<u>314456</u>	Computer Networks& Security-Lab	-	04	-	-	-	25	-	50	75		02	02									
<u>314457</u>	DS & BDA-Lab	-	02	-	-	-	25	25	-	50		01	01									
<u>314458</u>	Laboratory Practice-II	-	04	-	-	-	50	25	-	75		02	02									
<u>314459</u>	Audit Course 6	-	-	-	-	-	-	-	-	-	-	-	-									
Total										Total	12	09	-	21								
Total																						
Abbreviations: TH: Theory, TW: Term Work, PR: Practical , OR: Oral, TUT: Tutorial																						
Elective-II: <u>314454A</u> - Artificial Intelligence <u>314454B</u> - Cyber Security <u>314454C</u> -Cloud Computing <u>314454D</u> - Software Modeling and Design					Audit Course 6: <u>314459A</u> - Green and Unconventional Energy <u>314459B</u> - Leadership and Personality Development <u>314459C</u> - Foreign Language-(Japanese Language- IV)																	
Laboratory Practice-II: Assignments from Web Application Development and Elective-II.																						
Note: Students of T.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)																						

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314451: Computer Network and Security

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

Prerequisite Courses:

1. Basics of Computer Network

Companion Course:

1. Cyber Security

Course Objectives:

To familiarize students with-

1. The application layer services, responsibilities and protocol.
2. Fathom wireless network and different wireless standards
3. Differences in different wireless networks and to learn different mechanism used at layers of wireless network.
4. The concept of network security.
5. Basic cryptographic techniques in application development.
6. Cyber security vulnerabilities & study typical threats to modern digital systems.

Course Outcomes:

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

CO1: Explain Responsibilities, services offered and protocol used at application layer of network

CO2: Apply concepts of wireless network and different wireless standards.

CO3: Recognize the Adhoc Network's MAC layer, routing protocol and Sensor network architecture. **CO4:**

Implement the principal concepts of network security and Understand network security threats, security services, and countermeasures

CO5: Apply basic cryptographic techniques in application development.

CO6: Gain a good comprehension of the landscape of cyber security

Vulnerabilities & describe typical threats to modern digital systems.

COURSE CONTENTS

Unit I	APPLICATION LAYER	(06 hrs)
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Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, Application Layer Protocols: DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, DHCP, TELNET.



Mapping of Course Outcomes for Unit I	CO1	
Unit II	WIRELESS STANDARDS	(06 hrs)
Wireless LANs: Fundamentals of WLAN, Design goals, Characteristics, Network Architecture, IEEE 802.11 components in IEEE 802.11 network, Physical Layer, MAC Sub Layers : DCF, PCF, Hidden and exposed station problem, Frame format, Addressing Mechanism, IEEE 802.15.1 Bluetooth: ArchitectureLayers operational states, IEEE 802.16 WiMax: Services, Architecture, Layers, comparison between Bluetooth IEEE 802.11 and IEEE 802.16.		
Mapping of Course Outcomes for Unit II	CO2	
Unit III	ADHOC AND WSN	(06 hrs)
Infrastructure Network and Infrastructure-less Wireless Networks, Issues in Adhoc Wireless Network, Adhoc Network MAC Layer: Design Issues, Design Goal, Classification, MACAW, Adhoc Network Routing Layer: Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks – Classifications of Routing Protocols, DSDV, AODV, DSR, Applications of Sensor Network, Comparison with Ad Hoc Wireless Network, Sensor node architecture Issues and Challenges in Designing a Sensor Network, Classification of sensor network protocols, SENSOR NETWORK ARCHITECTURE: Layered Architecture, Clustered Architecture		
Mapping of Course Outcomes for Unit III	CO3	
Unit IV	INTRODUCTION TO NETWORK SECURITY	(06 hrs)
Importance and Need for Security, Network Attacks- Passive, Active Network Security Threats: Unauthorized access, Distributed Denial of Service (DDoS) attacks, Man in the middle attacks, Concept of Security Principles: Confidentiality and Privacy, Authentication, Authorization and Access Control, Integrity, Non- repudiation, Stream Ciphers: Substitution Cipher – Mono alphabetic Cipher, Polyalphabetic Substitution Cipher., Transposition Cipher: Rail-Fence Block Ciphers modes: Electronic Code Book (ECB) Mode., Cipher Block Chaining (CBC) Mode., Cipher Feedback Mode (CFB) , Output Feedback (OFB) Mode.		
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	CRYPTOGRAPHIC ALGORITHM	(06 hrs)
Mathematical preliminaries: Groups, Rings, Fields, Prime numbers, Symmetric key algorithms: Data Encryption Standards, Advanced Encryption Standard, Public Key Encryption and Hash function: RSA Digital signatures, Digital Certificates and Public Key Infrastructure: Private Key Management, Diffie Hellman key exchange, The PKIX Model		

Mapping of Course Outcomes for Unit V	CO5			
Unit VI	INTRODUCTION TO CYBER SECURITY	(06 hrs)		
Introduction to Cyber Security: Basic Cyber Security Concepts, Layers of security, Vulnerability, Threat, Harmful Acts-Malware, Phishing, MIM Attack, DOS Attack, SQL Injection, Internet Governance – Challenges and Constraints, Computer Criminals, Assets and Threat, Motive of Attackers, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber Stalking, Cyber Terrorism, Cyber Espionage, Comprehensive Cyber Security Policy				
Mapping of Course Outcomes for Unit VI	CO6			
Text Books:				
<ol style="list-style-type: none"> 1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition. 2. C. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols, Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition. 3. Atul Kahate Cryptography and Network Security, 3e, McGraw Hill Education, 4. B. A. Forouzan Cryptography and Network Security McGraw Hill Education 5. William Stallings Cryptography and Network Security: Principles and Practice, 4th Edition. 6. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley 				
Reference Books:				
<ol style="list-style-type: none"> 1. Kazem Sohraby, Daniel Minoli, TaiebZnati, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley India, ISBN: 9788126527304 2. Schneir, Bruce, "Applied Cryptography: Protocols and Algorithms" 3. Charles E. Perkins, Adhoc Networking, Pearson Education, 978-81-317-2096-7 4. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3. 5. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878- 6. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978-81-203-5082-3 				
E- Books / E- Learning References :				
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/106/105/106105160/ 2. https://nptel.ac.in/courses/106/105/106105031/ 3. An Introduction to Cyber Security A Beginner's Guide 				

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314452: Data Science and Big Data Analytics

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

Prerequisites:

1. Engineering and discrete mathematics.
2. Database Management Systems, Data warehousing and Data mining.
3. Programming skill.

Companion Course:

1. Machine Learning
2. Advance Database Management

Course Objectives:

1. To introduce basic need of Big Data and Data science to handle huge amount of data.
2. To understand the basic mathematics behind the Big data.
3. To understand the different Big data processing technologies.
4. To understand and apply the Analytical concept of Big data using Python.
5. To visualize the Big Data using different tools.
6. To understand the application and impact of Big Data.

Course Outcomes:

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

CO1: Understand Big Data primitives.

CO2: Learn and apply different mathematical models for Big Data.

CO3: Demonstrate Big Data learning skills by developing industry or research applications.

CO4: Analyze and apply each learning model comes from a different algorithmic approach and it will perform differently under different datasets.

CO5: Understand, apply and analyze needs, challenges and techniques for big data visualization.

CO6: Learn different programming platforms for big data analytics.

COURSE CONTENTS

Unit I	INTRODUCTION: DATA SCIENCE AND BIG DATA	(06 Hrs)
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Introduction to Data science and Big Data: Defining Data science and Big Data, Big Data examples, **Data Explosion:** Data Volume, Data Variety, Data Velocity and Veracity. Big data infrastructure and challenges
Big Data Processing Architectures: Data Warehouse, Re-Engineering the Data Warehouse, shared everything and shared nothing architecture, Big data learning approaches. **Data Science – The Big Picture:** Relation between AI, Statistical Learning, Machine Learning, Data Mining and Big Data Analytics

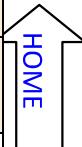
Mapping of Course Outcomes for Unit I	CO1	
Unit II	MATHEMATICAL FOUNDATION OF BIG DATA	(07 Hrs)
<p>Probability: Random Variables and Joint Probability, Conditional Probability and concept of Markov chains, Tail bounds, Markov chains and random walks, Pair-wise independence and universal hashing Approximate counting, Approximate median. Data Streaming Models and Statistical Methods: Flajolet Martin algorithm, Distance Sampling and Random Projections, Bloom filters, Mode, Variance, standard deviation, Correlation analysis and Analysis of Variance.</p>		
Mapping of Course Outcomes for Unit II	CO2	
Unit III	BIG DATA PROCESSING	(06 Hrs)
<p>Big Data Analytics- Ecosystem and Technologies, Introduction to Google file system, Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration, Introduction to NOSQL, Textual ETL processing.</p>		
Mapping of Course Outcomes for Unit III	CO3	
Unit IV	BIG DATA ANALYTICS	(06 Hrs)
<p>Big Data Analytics- Architecture and Life Cycle, Types of analysis, Analytical approaches, Data Analytics with Mathematical manipulations, Data Ingestion from different sources (CSV, JSON, html, Excel, mongoDB, mysql, sqlite), Data cleaning, Handling missing values, data imputation, Data transformation, Data Standardization, handling categorical data with 2 and more categories, statistical and graphical analysis methods, Hive Data Analytics.</p>		
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	BIG DATA VISUALIZATION	(06 Hrs)
<p>Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Proprietary Data Visualization tools, Open – source data visualization tools, Case Study: Analysis of a business problem of Zomato using visualization, Analytical techniques used in Big data visualization, Data Visualization using Tableau Introduction to: Candeila, D3.js, Google Chart API</p>		

Mapping of Course Outcomes for Unit V	CO5			
Unit VI	BIG DATA TECHNOLOGIES APPLICATION AND IMPACT	(05 Hrs)		
<p>Social media analytics, Text mining, Mobile analytics, Data analytics life cycle of case studies, Organizational impact, understanding decision theory, creating big data strategy, big data value creation drivers, Michael Porter's valuation creation models, Big data user experience ramifications, Identifying big data use cases, Big Data Analytics Challenges and Research directions.</p>				
Mapping of Course Outcomes for Unit VI	CO6			
Text Books:				
<ol style="list-style-type: none"> 1. Krish Krishnan, Data warehousing in the age of Big Data, Elsevier, ISBN: 9780124058910, 1stEdition. 2. DT Editorial Services, Big Data, Black Book, DT Editorial Services, ISBN: 9789351197577, 2016Edition. 				
Reference Books:				
<ol style="list-style-type: none"> 1. Mitzenmacher and Upfal, Probability and Computing: Randomized Algorithms and ProbabilisticAnalysis, Cambridge University press, ISBN : 521835402 . 2. Dana Ron, Algorithmic and Analysis Techniques in Property Testing, School of EE. 3. Graham Cormode, Minos Garofalakis, Peter J. Haas and Chris Jermaine, Synopses for Massive Data: Samples, Histograms, Wavelets, Sketches, Foundation and trends in databases, ISBN:10.1561/1900000004. 4. Alex Holmes, Hadoop in practice, Dreamtech press, ISBN:9781617292224. 5. AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends forToday's Business, Wiely CIO Series. 6. ArvindSathi, Big Data Analytics: Disruptive Technologies for Changing the Game, IBMCorporation, ISBN:978-1-58347-380-1. 7. EMC Education Services, Data Science and Big Data Analytics- Discovering, analyzing Visualizingand Presenting Data. 8. Li Chen, Zhixun Su, Bo Jiang, Mathematical Problems in Data Science, Springer, ISBN :978-3-319-25127-1. 9. Philip Kromer and Russell Jurney, Big Data for chips, O'Reilly, ISBN :9789352132447. 10. EMC Education services, Data Science and Big Data Analytics, EMC2 Wiley, ISBN :978812655653- 11. Mueller Massaron, Python for Data science, Wiley, ISBN :9788126557394. 12. EMC Education Services, Data Science and Big Data Analytics, Wiley India, ISBN:9788126556533 13. Benoy Antony, Konstantin Boudnik, Cheryl Adams, Professional Hadoop, Wiley India,ISBN :9788126563029 14. Judith Hurwitz, Alan Nugent, Big Data For Dummies, Wiley India, ISBN : 9788126543281 				

E Books / E Learning References :

1. Zomato dataset Link: <https://www.kaggle.com/shrutimehta/zomato-restaurants-data>
2. Link for dataset: <https://www.kaggle.com/tanmoyie/us-graduate-schools-admission-parameters>

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314453: Web Application Development



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

Prerequisite Courses:

1. Programming languages C++, Java.

Companion Course:

1. Advanced Database Management system
2. Design Thinking

Course Objectives: -

1. To familiarize students with Web Programming basic concepts
2. To learn and understand Web scripting languages.
3. To explore the Front end & Backend web programming skills.
4. To understand and learn Mobile web development.
5. To understand and learn Web application deployment.

Course Outcomes: -

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

CO1: Develop Static and Dynamic website using technologies like HTML, CSS, Bootstrap.

CO2: Demonstrate the use of web scripting languages.

CO3: Develop web application with Front End & Back End Technologies.

CO4: Develop mobile website using JQuery Mobile.

CO5: Deploy web application on cloud using AWS.

COURSE CONTENTS

Unit I	INTRODUCTION TO WEB TECHNOLOGIES	(06 hrs)
HTML: Getting started with HTML, Why HTML, Tags and Elements, Attributes, Properties, Headings list, Links, Tables, Images, HTML Form, Media (Audio, Video), Semantic HTML5 Elements.		
CSS: Why CSS, Types of CSS, How to use CSS, Properties, Classes, Child-Class (Nested CSS), Colors, Text Background, Border, Margin, Padding, Positioning (flex, grid, inline, block), Animation, Transition.		
BOOTSTRAP: Why Bootstrap, CSS over Bootstrap, How to Use Bootstrap, Bootstrap Grid System, Bootstrap Responsive, Bootstrap Classes, Bootstrap Components (i.e., Button, Table, List, etc.), Bootstrap as a Cross Platform.		
W3C: What is W3C , How W3C handles/Supports Web Technologies.		

Mapping of Course Outcomes for Unit I	CO1	
Unit II	WEB SCRIPTING LANGUAGES	(06 hrs)
<p>JavaScript: Introduction to Scripting languages, Introduction to JavaScript (JS), JS Variables and Constants, JS Variable Scopes, JS Data Types, JS Functions, JS Array, JS Object, JS Events.</p> <p>Advanced JavaScript: JSON - JSON Create, Key-Value Pair, JSON Access, JSON Array, JS Arrow Functions, JS Callback Functions, JS Promises, JS Async-Await Functions, JS Error Handling.</p> <p>AJAX: Why AJAX, Call HTTP Methods Using AJAX, Data Sending, Data Receiving, AJAX Error Handling.</p> <p>JQUERY :Why JQuery, How to Use, DOM Manipulation with JQuery, Dynamic Content Change with JQuery, UI Design Using JQuery.</p>		
Mapping of Course Outcomes for Unit II	CO2	
Unit III	FRONT END TECHNOLOGIES	(06 hrs)
<p>Front-End Frameworks: What is web framework? Why Web Framework? Web Framework Types.</p> <p>MVC: What is MVC, MVC Architecture, MVC in Practical, MVC in Web Frameworks.</p> <p>TypeScript: Introduction to TypeScript (TS), Variables and Constants, Modules in TS.</p> <p>AngularVersion 10+: Angular CLI, Angular Architecture, Angular Project Structure, Angular Lifecycle, Angular Modules, Angular Components, Angular Data Binding, Directives and Pipes, Angular Services and Dependency Injections (DI), Angular Routers, Angular Forms.</p> <p>ReactJS: Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook useContext() hook.</p>		
Mapping of Course Outcomes For Unit III	CO3	
Unit IV	BACK END TECHNOLOGIES	(06 hrs)
<p>Node.JS: Introduction to Node.JS, Environment Setup, Node.JS Events, Node.JS Functions, Node.JS Built-in Modules, File System, NPM, Install External Modules, Handling Data I/O in Node.JS, Create HTTP Server, Create Socket Server, Microservices- PM2.</p> <p>ExpressJS: Introduction to ExpressJS, Configure Routes, Template Engines, ExpressJS as Middleware, Serving Static Files, REST HTTP Method APIs, Applying Basic HTTP Authentication, Implement Session Authentication.</p> <p>MongoDB: NoSQL and MongoDB Basics, MongoDB-Node.JS Communication, CRUD Operations using Node.JS, Mongoose ODM for Middleware, Advanced MongoDB.</p>		

Mapping of Course Outcomes for Unit IV	CO3			
Unit V	MOBILE WEB DEVELOPMENT	(06 hrs)		
Mobile-First: What is Mobile-First? What is Mobile Web? Understanding Mobile Devices and Desktop.				
JQuery Mobile: Introduction to the jQuery Mobile Framework, Set-up jQuery Mobile, Pages, Icons, Transitions, Layouts Widgets, Events, Forms, Themes, Formatting Lists, Header and Footer, CSS Classes, Data Attributes, Building a Simple Mobile Webpage.				
Mapping of Course Outcomes for Unit V	CO4			
Unit VI	WEB APPLICATION DEPLOYMENT	(06 hrs)		
Cloud: AWS Cloud, AWS Elastic Compute, AWS Elastic Load Balancer and its types, AWS VPC and Component of VPC, AWS storage, Deploy Website or Web Application on AWS, Launch an Application with AWS Elastic Beanstalk.				
Mapping of Course Outcomes for Unit VI	CO5			
Text Books:				
<ol style="list-style-type: none"> 1. Kogent Learning Solutions Inc, Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP , XML and AJAX, Blackbook, Dreamtech Press, Second Edition, ISBN: 9788177228496. 2. Raymond Camden, Andy Matthews, JQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891. 				
Reference Books:				
<ol style="list-style-type: none"> 1. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81-265-1635-3 2. Dr.Hiren Joshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93-5004-088-1 3. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, Fourth Edition,978- 81-265-1635-3 4. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, JavaScript,DHTML and PHP, BPB Publications,4th Edition, ISBN:978-8183330084. 5. Brain Fling, Mobile Design and Development, O'REILLY, First Edition, ISBN: 13:978-81- 8404-817-9 6. Adam Bretz& Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256. 7. JavaScript: The Definitive Guide - Master The World's Most-Used Programming Language, Seventh Edition 8. Java Script, D.Flanagan, O'Reilly, SPD. 9. Programming Typescript: Making Your JavaScript Applications Scale, Boris Cherny 				

E- Books / E- Learning References :

1. Learning Amazon Web Services AWS - A Hands-on Guide to the Fundamentals of AWS Cloud
Author: Mark Wilkins.
2. <https://www.meanacademy.in/web-technologies>
3. <https://www.meanacademy.in/angular>
4. <https://www.meanacademy.in/mongodb>
5. <https://www.meanacademy.in/nodejs>
6. <https://www.meanacademy.in/aws>
7. <https://www.w3schools.com/Css>
8. <https://www.javatpoint.com/angularjs-tutorial>
9. <https://www.tutorialspoint.com/reactjs/index.htm>
10. https://www.tutorialspoint.com/web_development_tutorials.htm
11. https://www.tutorialspoint.com/angular_material/index.htm
12. <https://www.javaguides.net/2020/07/angular-10-example-tutorial.html>
13. <https://www.javatpoint.com/reactjs-tutorial>
14. https://www.tutorialspoint.com/jquery_mobile/index.htm
15. <https://www.tutorialspoint.com/nodejs/index.htm>
16. <https://www.tutorialspoint.com/expressjs/index.htm>
17. <https://www.tutorialspoint.com/mongodb/index.htm>
18. https://www.tutorialspoint.com/mongodb/mongodb_tutorial.pdf
19. <https://www.tutorialspoint.com/ajax/index.htm>.
20. <https://www.udemy.com/ajax/online-course>.

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314454 (C): Elective-II- (Cloud Computing)

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

Prerequisite Courses:

1. Basics of Computer Networks
2. Operating Systems

Course Objectives:

1. To provide students with the fundamentals and essentials of cloud computing
2. To learn basics of virtualization and its importance
3. To provide students a sound foundation of the cloud computing so that they are able to start using and adopting cloud computing services and tools in their real life scenarios
4. To enable students exploring some important cloud computing driven commercial systems and applications
5. To understand cloud storage technologies and relevant file systems
6. To be exposed to Ubiquitous Cloud and Internet of Things

Course Outcomes:

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

CO1: Articulate the main concepts, key technologies and fundamentals of cloud computing.

CO2: Understand cloud enabling technologies and virtualization.

CO3: Analyze various cloud programming models and apply them to solve problems on the cloud.

CO4: Explain data storage and major security issues in the cloud.

CO5: Understand trends in ubiquitous cloud and internet of things.

CO6: Explore future trends of cloud computing.

COURSE CONTENTS

Unit I	FUNDAMENTALS OF CLOUD COMPUTING	(06 hrs)
Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds.		
Mapping of Course Outcomes for Unit I	CO1	
Unit II	CLOUD-ENABLING TECHNOLOGY AND VIRTUALIZATION	(06 hrs)

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

Mapping of Course Outcomes for Unit II	CO2	
Unit III	COMMON STANDARDS AND CLOUD PLATFORMS	(06 hrs)
<p>Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP), Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security.</p> <p>Amazon web services: Compute services Storage Services Communication Services Additional services</p> <p>Google AppEngine: Architecture and core concepts, Application life cycle, Cost model</p> <p>Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance</p>		
Mapping of Course Outcomes for Unit III	CO3	
Unit IV	DATA STORAGE AND SECURITY IN CLOUD	(06 hrs)
<p>Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB Gautam Shrauf, Cloud Storage-Overview, Cloud Storage Providers.</p> <p>Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.</p>		
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	UBIQUITOUS CLOUDS AND THE INTERNET Of THINGS	(06 hrs)
<p>Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking.</p>		
Mapping of Course Outcomes for Unit V	CO5	
Unit VI	FUTURE OF CLOUD COMPUTING	(06 hrs)
<p>How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing. Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow</p>		

Mapping of Course Outcomes for Unit VI	CO6
Text Books:	
<ol style="list-style-type: none">1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.	
Reference Books:	
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