6th SEM CSE SYLLABUS

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			L	T	P	Total Hours		TAE	CAE	ESE	INT	EXT	
SEMESTER-VI													
23BTCSL303/23BTCSP303	Design and Analysis of Algorithms	PCC9	3		2	5	4	10	15	50	25	25	125
23BTCSL307	Data Mining and Warehousing	PCC12	3		2	5	4	10	15	50	25	25	125
23BTCSL321 23BTCSL322 23BTCSL323 23BTCSL324	Programme Elective Core2 1)Salesforce 2)Big Data Computing 3) User Interface Design 4) Blockchain Technology	PEC2	3		2	5	4	10	15	50	25		100
23BTCSL331 23BTCSL332 23BTCSL333	Programme Elective Core3 1)Agile Scrum Master 2)Mobile Computing 3)Distributed Computing	PEC3	4			4	4	10	15	50			75
23BTCSL308	Multi-Disciplinary Minor-IV(Introduction to Cloud Computing)	MDM4	2			2	2	10	15	50			75
23BTCSL309	Vocational and Skill Enhancement Elective – IV(Web Technology)	VSEC4	1		2	3	2	10	15		25	-	50
23BTSHP302	Research Methodology	RM			4	4	2				50		50
TOTAL			**16**		**12**	**28**	**22**	**60**	**90**	**250**	**150**	**50**	**600**

Department of Computer Science and Engineering

Course Title: Design and Analysis of Algorithms										
Semester	VI	Teaching Scheme				Evaluation Scheme				
Term	EVEN					Theory			Practical	
Course Category	PCC9	Th	Tu	Pr	Credits	TAE	CAE	ESE	Int	Ext
Course Code	23BTCSL303/ 23BTCSP303	3 Hrs	NA	2 Hrs	4	10	15	50	25	25
Teaching Mode	Offline									
Duration of ESE	3 Hrs	5 Hrs			Total	75			50	
						125				

Course Objectives	This course introduces students the general idea of analysis and design of algorithms while making them aware of basic methods of algorithm analysis and design.
	It is also aimed at developing skills to solve real life applications which involve algorithm development
	The course also provides career opportunities in analysis, design, and optimization technique in algorithms
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Understand basic concepts of algorithm in analysis and Design of algorithms and Examine Recurrence relations, solutions of recurrence of searching sorting methods
	CO2: Apply Greedy methods used for analysis and Design of Algorithm.
	CO3: Analyze Dynamic Programming concepts in designing algorithm.
	CO4: Describe Branch & Bound concepts in designing algorithm.
	CO5: Evaluate advanced techniques and tools available for algorithm analysis and development

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CO1	3	2	--	--	--	--	--	--	--	--	--	--	2	--	
CO2	--	3	--	--	--	--	--	--	--	--	--	--	1	--	
CO3	--	--	--	3	--	--	--	--	--	--	--	--	2	--	
CO4	--	--	3	--	--	--	--	--	--	--	--	--	3	--	
CO5	--	--	--	--	3	--	--	--	--	--	--	--	--	3	

Course Contents:

Unit	Contents	Hours
I	**Unit – I: Introduction of Algorithms** Analysis of algorithms: Space Complexity, Time Complexity, recurrence relation and Asymptotic Notation, Divide and Conquer: General Methods, Analysis and Design, Binary Search, Quick sort, Merge sort, Strassen's matrix multiplication.	7
II	**Unit – II: Greedy Strategy** Introduction, examples of greedy method like optimal merge pattern, Huffman coding, Minimum spanning trees, knapsack problem, job sequencing with deadlines single source shortest path algorithms.	7
III	**Unit – III: Dynamic Programming** Introduction, Problem based on this approach such as 0/1 Knapsack, Multistage graph, Floyd-warshall algorithms, Job sequencing with deadlines problem, single source shortest path, optimal binary search trees.	7
IV	**Unit IV: Backtracking & Branch & Bound** Backtracking concept and its example like 8 Queen's problem, Hamiltonian cycle, Graph coloring problem, 15 Puzzle problem, Least Cost Search. Introduction to branch & bound method, examples of branch & bound methods like traveling sales man problem, meaning of lower bound theory and its use in solving algebraic problem. Concept of graph, traversal techniques and its operations.	7
V	**Unit V: P NP Class** P, NP-completeness & NP hard problems. Basic Concept of non-deterministic algorithms. NP hard and NP complete classes, Polynomial reduction.	7

Text Books	1.	Thomas H. Cormenet. al. "Introduction to Algorithms," Prentice Hall of India.
	2.	Design & Analysis of Computer Algorithms by Aho, Horowitz, Sahani, Rajsekharam, Pearson education
E Books	1	Algorithms: Design and Analysis By Harsh Bhasin, All it Books .net.
	2	Advanced Algorithms by Prof. Michel Goemans.

Reference Books	1.	"Computer Algorithms", Galgotia Publications Pvt. Ltd. Brassard, Bratley, "Fundamentals of Algorithms", Prentice Hall
	2.	Computer Algorithms: Introduction to Design and analysis, 3rd Edition, By Sara Baase& A. V. Gelder Pearson Education.
On-line TL Material	1.	NPTEL course on Design and Analysis of Algorithms: https://www.class-central.com/course/nptel-design-and-analysis-of-algorithms- 3984

Department of Computer Science and Engineering

Sr. No.	Name of Practicals
1	To Implement and analyze time complexity of Searching & sorting Algorithm.
2	To Implement Strassen Matrix multiplication on the given matrix.
3	To Implement and analyze time complexity o f optimal merge pattern
4	To Implement and analyze time complexity o f Job sequencing problem.
5	To Implement and analyze time complexity of Floyd warshall algorithm.
6	To implement and analyze time complexity of Single source shortest path Algorithm.
7	To implement and analyze 8-queen problem using backtracking.
8	To implement and analyze 0/1 knapsack using branch and bound.
9	To implement and analyze time complexity of BFS Algorithm.
10	To implement and analyze time complexity of DFS Algorithm.
Open Ended Experiments / New Experiments.	
1	Open-Source Practical: NP Complete
2	Open-Source Practical: Graph Coloring
Details of on-line Laboratory Resource Material Instruction / Operating Manuals	
1	Virtual Lab: Graphs traversing https://virtual-labs.github.io/exp-bfs-iiith/bfs/bfs_demo.html
2	**Virtual Lab:** Spanning Trees http://cse01- iiith.vlabs.ac.in /exp9/Introduction.html?domain=Computer%20Science&lab=Data%20Structures

Department of Computer Science and Engineering

Course Title: Data Mining and Warehousing										
Semester	**VI**	**Teaching Scheme**				**Evaluation Scheme**				
						Theory			**Practical**	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC10	3 Hrs		2 Hrs	4	10	15	50	25	25
Course Code	23BTCSL307/ 23BTCSP307									
Teaching Mode	Offline	5 Hrs			Total	75			50	
Duration of ESE	3 Hrs					125				

Course Objectives	To understand the principles concepts and applications of Data warehousing and Data Mining.
	Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
	Develop skill in selecting the appropriate data mining algorithm for solving practical problems. To perform classification and prediction of data.
Course Outcomes	**CO1**: Understand the functionality of the various data mining components.
	CO2: Describe warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions.
	CO3: Characterize the kinds of patterns that can be discovered by association rule mining.
	CO4: Apply the techniques of classification and clustering to real world data
	CO5: Explore recent trends in data mining.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	2	1	--	--	--	--	--	--	--	--	--	--	--	
CO2	2	--	2	--	--	--	--	--	--	--	--	--	--	--	
CO3	2	2	--	2	--	--	--	--	--	--	--	--	2	3	
CO4	--	--	--	2	2	--	--	--	--	--	--	2	--	--	
CO5	--	3	--	--		--	--	--	--	--	2	--	3	--	

Course Contents:

Unit	Contents	Hours
I	**Introduction to data mining**: Motivation, Importance, Definition of Data Mining, Kind of Data, Data Mining Functionalities, Kinds of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Major Issues In Data Mining, Major Tasks in Data Pre-processing, Data Reduction, Data Discretization and Concept Hierarchy Generation	8
II	**Data Warehouse**: Introduction to Data Warehouse, characteristics, Architecture and its components, Extraction-Transformation-Loading, Schema Design, Fact Table, Star and Snow-Flake Schema, Fact Constellation, Dimension Table characteristics, OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP, OLAP vs. OLTP.	7
III	**Mining Frequent Patterns, Associations and Correlations:** Basic concepts, efficient and scalable frequent item set mining algorithms-Apriori, FP Growth, ECLAT, mining various kinds of association rules – multilevel and multidimensional, association rule mining versus correlation analysis, constraint based association mining.	7
IV	**Classification:** Classification techniques: Decision trees, Naïve-Bayes Classifier, Support Vector Machine; K-Nearest Neighbor classification, **Cluster Analysis** - Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, Outlier Analysis.	8
V	**Data mining on complex data and applications:** Algorithms for mining of spatial data, multimedia data, text data; Data mining applications, social impacts of data mining, trends in data mining.	5

Text Books	1.	Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.
	2.	Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
E-Books	1.	https://dl.ebooksworld.ir/motoman/Cambridge.University.Press.Data.Mining.and.Data.Warehousing.www.EBooksWorld.ir.pdf
Reference Books	1.	G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
	2.	Margaret H Dunham (2006), Data Mining Introductory and Advanced Topics, 2nd edition, Pearson Education, New Delhi, India.
	3.	Amitesh Sinha (2007), Data Warehousing, Thomson Learning, India.
	4.	Xingdong Wu, Vipin Kumar (2009), the Top Ten Algorithms in Data Mining, CRC Press, UK
online TL Material	1.	https://onlinecourses.nptel.ac.in/noc21_cs06/preview

List of Practical

Prac. No.	Practical List	Mapping With CO	Mapping With PO & PSO
1	Perform Data Exploration, Data Visualization on dataset	CO1	PO1,PO2,PO3,PO4 ,PO12& PSO1,PSO3
2	Demonstrate the process of identifying missing values in a dataset.	CO1	PO1,PO2,PO3,PO4,PO12& PSO1,PSO3
3	Perform OLAP operations using SQL	CO2	PO1,PO2,PO3,PO4 ,PO12& PSO1,PSO3
4	Implement the ETL process	CO2	PO1,PO2,PO3,PO4 ,PO12& PSO1,PSO3
5	Demonstration of association rule mining using apriori algorithm	CO3	PO1,PO2,PO3,PO4 ,PO12& PSO1,PSO3
6	Implement Decision Tree algorithm using R	CO4	PO1,PO2,PO3,PO4 ,PO12& PSO1,PSO3
7	Perform the cluster analysis by K-Means method using R.	CO4	PO1,PO2,PO3,PO4,PO12& PSO1,PSO3
8	To apply the web mining technique clustering algorithm for the given dataset./ Perform an experiment to find association between data and to find the frequent item set for text mining.	CO5	PO1,PO2,PO3,PO4,PO12& PSO1,PSO3
Practical Beyond Syllabus			
9	Data Clustering: MST based using Virtual Lab	CO5	PO1,PO2,PO3,PO4,PO12 & PSO1,PSO3
Open Ended Practical			
10	Introduction to WEKA toolkit- Demonstration of WEKA Explorer, Mining techniques and Attribute Relation File Format (ARFF).	CO5	PO1,PO2,PO3,PO4,PO12 & PSO1,PSO3

Programme Elective Core-2

Course Title: SALESFORCE										
Semester	**VI**	**Teaching Scheme**				**Evaluation Scheme**				
						Theory			**Practical**	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC2	3 Hrs		2 Hrs	4	10	15	50	25	
Course Code	23BTCSL321/ 23BTCSP321									
Teaching Mode	Offline	5 Hrs			Total	75			25	
Duration of ESE	3 Hrs					100				

Course Objectives	1. To provide a foundational understanding of Salesforce concepts, tools, and applications, enabling learners to manage and develop Salesforce platforms effectively.
	2. To equip learners with the skills to configure Salesforce orgs, automate business processes, and implement data security and access controls.
	3. To develop proficiency in Salesforce development tools, including Apex, Lightning Web Components, and integration frameworks, for building robust and scalable applications.
Course Outcomes	CO1: Understand the Salesforce ecosystem, its architecture, and the platform's key features, demonstrating knowledge of its role in enterprise solutions.
	CO2: Design and implement data models, security controls, and automation processes to meet specific business requirements in Salesforce
	CO3: Develop and test Apex classes, triggers, and Lightning Web Components, ensuring scalability and adherence to Salesforce development
	CO4: Analyze and troubleshoot data management, user experience, and integration challenges using Salesforce tools and techniques.
	CO5: Create reports, dashboards, and integrated workflows using Salesforce to enhance decision-making

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	**Program Outcomes and Program Specific Outcomes**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	--	--	--		--	--	--	--	--	--	2	--	
CO2	-	--	3	2	3	--	--	--	--	--	--	--	3	--	
CO3	-	2	3	2	--	--	--	--	--	--	--	--	--	3	
CO4	-	--	3	--	2	--	--	--	--	--	--	--	2	--	
CO5	-	--	2	--	3	--	--	--	--	--	2	--	2	--	

Course Contents:

Unit	Contents	Hours
I	**Salesforce Basics and Platform Overview:** Introduction of Salesforce ecosystem, its editions, and pricing models. Fundamentals of multitenancy and metadata-driven architecture Salesforce's cloud offerings, the AppExchange, and the platform's navigation. Basic org setup, profiles, roles, and permissions, developer console.	7
II	**Data Modelling and Security:** Understanding standard and custom objects, field types, and relationships, including master-detail and lookup. Schema design with schema builder, permission sets, role hierarchies, and sharing rules, record-level security and Salesforce shield basics and data management practices, validation rules, and handling duplicate records.	8
III	**Business Logic and Automation:** Automation tools, Workflow Rules, Process Builder, and Flow Builder, Introduces Apex programming, classes, triggers, and SOQL/SOSL queries, approval processes and their automation using flows.	6
IV	**User Experience and Advanced Development:** UI customization, Page layouts, compact layouts, and dynamic forms. Introduction of the Lightning Web Components (LWC) Bulk triggers, governor limits, and exception handling. Deployment tools like Change Sets and Salesforce CLI.	7
V	**Integration and Analytics:** Introduces Salesforce APIs (REST, SOAP, Bulk) and integration patterns. External objects and Salesforce Connect. Report and dashboard creation, including filters and custom report types. Einstein Analytics and its applications.	7

Text Books	1.	**Salesforce for Beginners"** by Sharif Shaalan
	2.	**Mastering Salesforce Administration"** by Rakesh Gupta
E-Books	1.	https://resources.docs.salesforce.com/latest/latest/en-us/sfdc/pdf/sales_core.pdf
Reference Books	1.	**Learning Apex Programming"** by Matt Kaufman and Sagar Pareek
	2.	**Advanced Apex Programming in Salesforce"** by Dan Appleman
online TL Material	1.	https://trailhead.salesforce.com/

Sr. No	Name of Experiments / Mini Projects/ Case Studies	COs
1	Create a new Salesforce Developer Org, configure company settings, and set up user profiles with specific roles and permissions.	CO1
2	Create custom objects for project with fields. Establish relationships (Lookup and Master-Detail) between objects as per requirement of project.	CO1
3	Implement a validation rule and formula fields for project.	CO2
4	Use Workflow Rules to send email alerts or update fields automatically based on specific criteria.	CO2
5	Automate a business process using Process Builder, such as updating records or triggering actions.	CO3
6	Create a Flow to collect user inputs and update related records dynamically.	CO3
7	Import, update, and delete records using Data Import Wizard and Data Loader while managing data integrity.	CO4
8	Write a simple Apex trigger to perform actions, such as creating or updating related records automatically.	CO4
9	Create custom reports and dashboards to visualize business data, such as different trends or performance metrics.	CO5
10	Use Change Sets to migrate customizations (objects, workflows, and fields) from one Salesforce org to another.	CO5
Open Ended Experiments / New Experiments		
1	Design and implement a custom Salesforce application, including custom objects, business logic, and automation, to solve a real-world problem.	
2	Develop an integration to consume an external REST API, process the data, and store it in a Salesforce custom object.	
Details of online Laboratory Resource Material Instruction / Operating Manuals		
1	https://trailhead.salesforce.com/content/learn/trails/force_com_admin_beginner	
2	https://trailhead.salesforce.com/users/strailhead/trailmixes/prepare-for-your-salesforce-platform-developer-i-credential	

Course Title: Big Data Computing										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	23BTCSL322 23BTCSP322	3Hrs.	--	2Hrs.	4 Credits	10	15	50	25	-
Course Code										
Teaching Mode	Offline	5 Hrs per Week			Total	75 Marks			25 Marks	
Duration of ESE	3 Hrs.					100 Marks				

Course Objectives	1. Introduction of basic concepts and techniques of Big data. 2. To Learn Hadoop Distributed File System (HDFS) & its applications 3. Understand MapReduce and its qualities and retain advanced MapReduce thoughts.
Course Outcomes	Upon successful completion of this course, student will be able to: CO 1. Acquire basic concepts and techniques of Hadoop and Big data computing. CO 2. Develop skills for implementation of various Hadoop ecosystem component. CO 3. Shall able to apply ecosystem knowledge to real time problems of moderate complexity. CO 4. Implement and Design different Big Data framework. CO 5. Implementing data science and big data analysis in various applications.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		2	3	-	3	-	-	-	-	-	-	-	-	2	2
CO2		2	3	-	3	-	-	-	-	-	-	-	-	3	2
CO3		3	3	-	3	-	-	-	-	-	-	-		2	3
CO4		3	3	-	3	-	-	-	-	-	-	-		3	3
CO5		3	3	-	3	-	-	-	-	-	-	-	-	3	2

Course Contents:

Unit	Contents	Hours
I	**Unit I: Big data and Hadoop:**Introduction to Hadoop and Big Data, Big data, challenges for processing big data, technologies support big data, History of Hadoop, Use cases of Hadoop, RDBMS vsHadoop When to use and when not to use Hadoop.	8
II	**Unit II: HDFS:**Hadoop Distributed File System, Significance of HDFS in Hadoop, Features of HDFS,Data Storage in HDFS: Introduction about Blocks, Data replication. Accessing HDFS:CLI (Command Line Interface) and admin commands, Java Based Approach, Fault tolerance. Download Hadoop, Installation and set-up of Hadoop., Start-up & Shut down process	8
III	**Unit III: Map Reduce :**Map Reduce: Map Reduce Story, Map Reduce Architecture, How Map Reduce works, Developing Map Reduce, Map Reduce Programming Model, Different phases of Map Reduce Algorithm, Different Data types in Map Reduce	8
IV	**Unit IV: Pig And HIVE:**Introduction to Apache Pig, Map Reduce Vs. Apache Pig, Modes of Execution in Pig, Loading data, Exploring Pig Latin commands, HIVE: Hive introduction, Hive architecture, Data types and schemas, Partitions and buckets, Concept of HBASE.	8
V	**Unit V: Spark :**Spark Shell, Spark Application, Flume, SQOOP introduction and application.	8

Text Books	1.	Tom White, "Hadoop: The Definitive Guide", 3rd edition, O'Reilly Media.
	2.	Big Data (Black Book), Wiley
E-Books	1.	BigData Now current perspective from O'Reilly Media
	2.	Data-Intensive Text Processing with MapReduce, Jimmy Lin and Chris Dyer
References Books	1.	V. Ankam, Big Data Analytics, Packt Pub Ltd.
	2.	N. Dasgupta, Practical Big Data Analytics, Packt Pub Ltd.
on line TL Material	1.	https://www.udemy.com/big-data-hadoop-the-complete-course/
	2.	https://www.cloudera.com/more/training/certification.html
	3.	https://www.edureka.co/big-data-and-hadoop https://www.simplilearn.com/big-data-and-analytics/big-data-and-hadoop-training

Sr. No.	Name of the Experiments	Course Outcomes
1	To install Hadoop framework, configure it and setup a single node cluster. Use web based tools to monitor your Hadoop setup	CO1
2	To implement file management tasks in Hadoop HDFS like adding, retrieving and deleting files	CO1
3	To implement a word count application using the MapReduce API.	CO2
4	Creating the HDFS tables and loading them in Hive	CO2
5	To create HDFS tables and load them in Hive and implement joining of tables in Hive.	CO3
6	To install, deploy & configure Apache Spark Cluster. To Select the fields from the dataset using Spark SQL. To explore Spark shell and read from HDFS	CO3
7	To install and run Pig and then write Pig Latin scripts to sort, group, join, project, and filter your data.	CO4
8	To perform Graph analytics and visualization using Tableau.	CO4
9	To implement basic functions and commands in R Programming. better visualization than a data table.	CO5
10	To use following platforms for solving any big data analytic problem of your choice. (1) Amazon web services,(2) Microsoft Azure, (3)Google App engine	CO5

Department of Computer Science and Engineering

Course Title: **User Interface Design and User Experience**											
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC2	3 Hrs.	NA	2	4	10	15	50	25	NA
Course Code	23BTCSL323 23BTCSP323									
Teaching Mode	Online	5 Hrs			Total	75			25	
Duration of ESE	3 Hrs.					100				

Course Objectives	To analyze an interaction design problem and propose a user-centered process, Justifying the process and identifying the trade-offs.
	To create a high quality, professional documentation and artifacts relating to the Design process for preparation for a professional portfolio.
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Describe the Characteristics of User Interface design and its Principles
	CO2: Discuss the issues and challenges for achieving a user-centered design process, especially with regard to prototyping and evaluation techniques.
	CO3: Use, adapt and extend design standards, design components, guidelines, and patterns focusing on user experience.
	CO4: Identify best practices of web color management, principles of designing APP, and web usability in designing responsive web pages.
	CO5: Create storyboards, video scenarios, and experience prototypes for a small system and plan and perform a real world deployment study of a user experience.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	--	--	--	--	--	--	--	1	--	--	1	2	1	
CO2	--	3	--	--	--	--	--	--	1	--	--	2	2	1	
CO3	--	--	3	--	--	--	--	--	2	--	--	2	3	2	
CO4	--	--	3	--	--	--	--	--	2	--	--	2	3	3	
CO5	--	--	--	--	3	--	--	--	3	--	--	3	2	3	

Course Contents:

Unit	Contents	Hours
I	**Introduction:** - Introduction to User Interface Design (UI), Brief History of UI Design. Human Computer Interface, Characteristics of Graphics Interface, Direct Manipulation Graphical System, Web User Interface: Popularity, Characteristic & Principles.	9
II	**User Design Process:** - Introduction to design process, User centered design process, Usability Engineering and Task centered Approaches. Introduction toDesign centered Approaches, Design Centered Methods. Prototyping in practice- Design rationale and Evaluation techniques, Model View Controller Framework(MVC).	10
III	**User Experience design** component in Interface Design, Visual Communication design component in Interface Design. System menus and navigation schemes, Structures of menus, Functions and contents of menus, Formatting, Phrasing, Navigating, Selecting menu choices, and kinds of graphical menus. Windows: Characteristics components presentation styles Type's Management's organizations operations. Web systems device based controls, characteristics Screen -based controls, operate control - text boxes-selection control combination control-custom and control-presentation control.	10
IV	**Web Design,** Design techniques such as scenarios, personas, storyboards, wire framing, and information architecture. App Design and its principles. Prototyping tools, both low-fidelity and high-fidelity. Design for small screens, responsive design. Non-GUI design (e.g., auditory interfaces, gesture interfaces). Understanding the Designing language of Desktop, Web and Mobile. Flow & Layout & Organizational structures. Swing Programming Introduction& Widgets. UI Widgets & Input Devices.	10
V	**Case Studies** and Best Practices based on advance and recent technology for designing UI/UX.AI and Animation tools like-CANVA, AdobeXD, Figma etc	6

Text Books	1.	Wilbent. O. Galitz ,"The Essential Guide to User Interface Design", John Wiley& Sons, 2001.
	2.	Ben Sheiderman, "Design The User Interface", Pearson Education, 1998.
E--Books	1.	https://www.uxpin.com/studio/ebooks/ux-design-definitive-beginner-guide-signup/
	2.	https://www.userfocus.co.uk/fable/index.html
Reference Books	1.	Greenberg, S., Carpendale, S., Marquart, N., and Buxton, B. (2011) Sketching User Experiences: The Workbook. San Francisco: Morgan
	2.	Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd.,2002.
	3.	Buxton, B. (2007) Sketching User Experiences. Sketching User Experiences. San Francisco: Morgan Kaufmann. (Amazon)
on line TL Material	1.	Introduction to UI Design https://www.coursera.org/learn/ui-design?

	2.	Introduction to User Experience Design https://www.coursera.org/learn/user-experience-design

Sr. No	Name of Experiments / Mini Projects/ Case Studies	COs
1	Identification of Project. Conduct a survey to understand user needs for a basic app (e.g., fitness or to-do app). Based on the results, create 2–3 personas that represent typical users, including demographics, goals, and pain points.(**Tool**: Google Forms, SurveyMonkey for surveys; Miro for persona development.)	CO1
2	To perform following activity on the project: Choose 2–3 similar applications, analyze their strengths and weaknesses, and summarize findings. Create a mood board with inspiring UI elements to guide your own design.(**Tool**: Pinterest or Dribbble for design inspiration; Miro or Notion for documentation.)	CO1
3	To Perform the following: Map a user's journey in completing a task within an app, like signing up or making a purchase. Identify the steps involved, user emotions, and pain points along the journey. (**Tool**: Miro or Lucidchart.)	CO2
4	To Perform the following Create a site map for a small app or website (e.g., an e-commerce platform) showing the primary pages and their relationships. Ensure logical navigation paths for different user goals.(**Tool**: Figma or Miro for creating site maps.)	CO2
5	To Perform the following Develop wireframes for the main screens (e.g., homepage, product page, checkout page) of the app or website. Focus on layout and positioning of elements without detailed design.(**Tool**: Balsamiq or Figma.)	CO2
6	Convert the wireframes into a high-fidelity prototype by adding design details, colors, typography, and interactive components. Use real data where possible for authenticity. (**Tool**: Figma or Adobe XD.)	CO2, CO3
7	Create a basic design system, including a color palette, typography, button styles, and iconography. Document component usage guidelines for consistency across the interface.(**Tool**: Figma for component libraries.)	CO3

8	Create responsive versions of key screens (desktop, tablet, and mobile) by adjusting layouts and components to fit different screen sizes. Focus on usability for each device.(**Tool**: Figma for responsive layouts.)	CO4
9	Evaluate your high-fidelity prototype for accessibility issues, such as color contrast and text size. Make adjustments based on WCAG (Web Content Accessibility Guidelines) standards.(**Tool**: Stark (Figma plugin) for color contrast checking.)	CO4
10	Open Ended Practical :Design microinteractions for actions like button clicks, loading indicators, and form submissions. Add animations that enhance usability without overwhelming the user. (**Tool**: Figma (Prototyping) or Adobe After Effects for detailed animations.)	CO5
Open Ended Experiments / New Experiments		
1	Name of case based practical: Develop a Home page and registration page. 1. Library information system a. Engineering b. MBA 2. Inventory control system a. Computer Lab b. College Store 3. Student information system a. Academic b. Finance 4. Time table development system a. CSE, IT & MCA Departments b. Electrical & Mechanical Departments etc.	
Details of online Laboratory Resource Material Instruction / Operating Manuals		
1	https://www.geeksforgeeks.org/user-experience-or-ux-design/	
2	https://www.learnui.design/blog/identifying-fonts.html	
3	https://webflow.com/blog/ui-ux-design-tools	
4	https://www.w3schools.com/css/css3_user_interface.asp	

Course Title: **BLOCKCHAIN TECHNOLOGY**										
Semester	**VI**	**Teaching Scheme**				**Evaluation Scheme**				
						Theory			**Practical**	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC2	3 Hrs		2 Hrs	4	10	15	50	25	
Course Code	23BTCSL324/ 23BTCSP324									
Teaching Mode	Offline	5 Hrs			Total	75			25	
Duration of ESE	2 Hrs 30 mins					100				

Course Objectives	1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work
	2. Demonstrate blockchain network, smart contracts and distributed applications
	3. Integrate ideas from blockchain technology into their own projects
Course Outcomes	CO1: Understand and explore the working of Blockchain technology
	CO2: Interpret the concept of blockchain network
	CO3: Analyze mining process of crypto currency in learning with hyperledger
	CO4: Justify security, privacy, and efficiency of a given blockchain system.
	CO5: Investigate Blockchain applications in a structure manner.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	**Program Outcomes and Program Specific Outcomes**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	-	
CO2	-	-	-	3	3	-	-	-	-	-	-	-	3	-	
CO3	-	-	2	3	3	-	-	-	-	-	-	-	-	-	
CO4	-	2	-	-	2	-	-	-	-	-	-	-	-	-	
CO5	-	3	-	-	3	-	3	-	-	-	-	-	-	-	

Course Contents:

Unit	Contents	Hours
I	**Fundamentals of Blockchain:**tion to distributed computing, Introduction is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, types of Blockchain, Life of Blockchain application.	7
II	Blockchain Network: Advantage over conventional distributed database, P2P Systems, Blockchain Network, Distributed Consensus, Merkle Patricia Tree, Mining Mechanism, Reward, Transactional Blocks in blockchain, Anonymity, Chain Policy, Soft & Hard Fork, Private and Public blockchain.	7
III	BitCoin and Hyperledger: What is Bitcoin, Digital Currency, The Bitcoin Mining Process, Mining Developments, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, and Introduction to Hyperledger, Distributed Ledger Technology & its Challenges, Hyperledger Fabric, Hyperledger Composer.	7
IV	Distributed Consensus & Cryptocurrency: Nakamoto consensus, Validation, Gas Limit, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Bitcoin protocols, Ethereum Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin	7
V	Cryptocurrency Regulation & Applications: Stakeholders, Legal Aspects-Crypto currency Exchange Applications: Internet of Things, Medical Record Management System, Domain Name Service, Recent trends in Blockchain.	7

Text Books	1.	Block chain technology: concepts and applications, Kumar Saurabh, Ashutosh Saxena ,Wiley Publication edition (2020)
	2.	Blockchain Technology And Applications 1St Edition by Pethuru Raj, Kavita Saini , Taylor & Francis Ltd, September 2020.
E-Books	1.	BLOCKCHAIN ,Cybrosys Limited Edition, E-BOOK https://www.blockchainexpert.uk/book/blockchain-book.pdf
Reference Books	1	Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies. Mastering Blockchain - Imar Bashir - Second edition - Packt - 2018.
	2	DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
	3	Antonopoulos and G. Wood, Mastering Ethereum.
online TL Material	1.	Block chain technology: concepts and applications, Kumar Saurabh, Ashutosh Saxena ,Wiley Publication edition (2020)
	2.	Introduction to Blockchain Technology and Applications, Prof. Sandeep Shukla, IIT Kanpur https://nptel.ac.in/courses/106/104/106104220/

Sr. No	Name of Experiments / Mini Projects/ Case Studies	COs
1	A. Understanding Block using https://tools.superdatascience.com/Blockchain/block B. Understanding Blockchain using https://tools.superdatascience.com/Blockchain/Blockchain	CO1
2	A. Understanding Distributed Blockchain using https://tools.superdatascience.com/Blockchain/distributed B. Understanding Tokens using https://tools.superdatascience.com/Blockchain/tokens	CO1
3	To Design and Implement Transactional Blocks in a Blockchain Using C++ to Simulate Secure and Immutable Data Exchange	CO2
4	Write a program for building a Merkle Patricia Tree for Efficient Data Validation in Blockchain	CO2
5	Implement a simplified Bitcoin mining process using the Proof of Work (PoW) mechanism	CO3
6	Implement basic functionalities of asset creation, transactions, and ledger updates.	CO3
7	Implementing Proof of Work (PoW) and Difficulty Adjustment in a Cryptocurrency Blockchain Using C++	CO4
8	Implement gas limits for smart contract execution and resource optimization	CO4
9	Building a Blockchain-Based Ledger for Medical Records in Python. Task: To store and retrieve medical records securely using blockchain principles	CO5
10	Case Study: Blockchain Applications in Cryptocurrency Exchange and IoT Integration for Secure Transactions. Target: This case study focuses on the regulatory challenges, stakeholder roles, and practical implementation of blockchain-based solutions for cryptocurrency exchanges and IoT device management.	CO5
Open Ended Experiments / New Experiments		
1	Name of case based practical: Construction of a blockchain capable of handling transactions and executing smart contracts	

Programme Elective Core -3

Course Title: **Agile Scrum Master**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC3	4	NA	NA	4	10	15	50	NA	NA
Course Code	23BTCSL331									
Teaching Mode	Offline	4 Hrs			Total	75				
Duration of ESE	3 Hrs					75				
Course Objectives	1. Understand Scrum project management design, development, and deployment									
	2. Use Scrum project management tools, techniques, and skills									
	3. Align critical resources for effective Scrum project implementation									
Course Outcomes	After completion of the course student will be able to									
	CO1: Identify the core values and principles of Scrum.									
	CO2: Understand the difference between the defined process and Scrum, an empirical process.									
	CO3: Determine myths, user stories that are often attributed with a Scrum implementation									
	CO4: Analyse day-to-day role of a Scrum Master.									
	CO5: Evaluate, practice and Implement the entire Scrum framework.									

Mapping of **Course Outcomes** with **Program Outcomes** and **Program Specific Outcomes**:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	
CO2	2	-	3	-	2	-	-	-	-	-	-	-	2	-	
CO3	2	2	2	2	3	-	-	-	-	-	-	3	-	3	
CO4	2	2	2	-	-	-	-	-	-	-	2	-	2	-	
CO5	2	-	3	-	-	-	2	-	2	-	-	2	-	3	

Course Contents:

Unit	Contents	Hours
I	Introduce Agile Principles & Scrum Overview: Introduce Agile Principles Lean Principles, Process control models ,Incremental and Iterative product development ,Shifting the focus on product management ,Overview of the Scrum process	9 Hrs
II	Project Strategies : Understand Dedicated cross functional teams , Conditions for Self-Organization , T-shaped people, Product backlog characteristics ,User Stories , Getting your first backlog	9 Hrs
III	Project Organization: Project Why comparative estimation works, Planning Poker, Getting backlog items Ready, Slicing User stories	8 Hrs
IV	Sprint Planning Project Sprint Planning Team capacity Facilitating the sprint planning meeting The Sprint backlog, Sprint Burndown chart, Scrum Meetings , Reviews Retrospectives	9 Hrs
V	Scrum Roles and Responsibilities: The Sprint, Definition of Done, How the team should work in a sprint, Tools for the ScrumMaster ,Sustainable Pace, Scrum Roles and Responsibilities , The Team and building effective teams , Scrum Master Responsibilities , Product Owner Responsibilities , The Scrum Project Community, What happens to traditional roles in Scrum. Certification course Safe Scrum Master and Agile Framework.	10 Hrs

Text Books	1.	Shore, David A., Launching and Leading Change Initiatives in Health Care Organizations: Managing Successful Projects. San Francisco: Jossey-Bass, 2014. ISBN 978-1-118-09914-8
	2.	Gregory Horine, PMP, Project Management Absolute Beginner's Guide, third edition, published in October 2012.
	3.	James P. Lewis, Fundamentals of Project Management, Published in 1995.
	4.	Chandanla Pataray, The Scrum Master Guidebook, Notion Press
On line TL Material	1.	Scrum Agile Framework https://www.tutorialspoint.com/scrum/scrum_tutorial.pdf
	2.	Agile Project Management for Dummies by Mark C. Layton, Steven J. Ostermiller, and Dean J. Kynaston https://www.coursera.org/articles/project-management-books
	3.	Project Management, Adrienne Watt https://open.umn.edu/opentextbooks/textbooks/456
Certification Courses		1. **Certified SAFe Scrum Master (SSM) Courses** https://www.udemy.com/topic/certified-safe-scrum-master-ssm/

Department of Computer Science and Engineering

Course Title: MOBILE COMPUTING										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC	4			4	10	15	50		
Course Code	23BTCSL332									
Teaching Mode	Offline	4Hrs.			Total	75				
Duration of ESE	3 Hrs.									

Course Objectives	1. To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
	2. To provide an opportunity for the students to understand the key components and technologies involved in building mobile applications.
	3. To understand latest network architecture and its interfaces.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand the mobile computing architecture, foundation for mobile computing.
	CO2: Analyze GSM technologies, SMS concepts in mobile Computing
	C03: Explore the Services & application of GPRS
	CO4: Apply the concept of mobile IP network & Transport Layer.
	CO5: Understanding data Dissemination and data synchronization in mobile computing

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	-	-	3	3	2	3	2	2	3
CO2	3	3	2	2	2	2	-	-	3	3	2	3	2	2	3
CO3	3	3	2	2	2	2	-	-	3	3	2	3	2	2	3
CO4	3	2	2	2	2	1	-	-	3	3	2	3	2	2	3
CO5	3	2	2	2	2	1	-	-	3	3	2	3	2	2	3

Course Contents:

Unit	Contents	Hours
I	**Introduction**: Mobile Computing, Middleware and gateways, application and services, security in mobile computing. Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Mobile IP, Internet Protocol version 6(IPV6).	7
II	**GSM & GPRS:** Global Systems for Mobile Communication,(GSM) GSM Architecture, GSM Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Message Service (SMS): Mobile Computing over SMS, value added service through SMS, accessing the SMS bearer. General Packet Radio Service (GPRS):GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Limitations of GPRS, Billing and Charging in GPRS. Wireless Application Protocol (WAP): WAP, MMS, GPRS applications. CDMA (3G & 2G), GSM (3G & 2G), LTE (4G), 5G: spread spectrum technology, IS-95, CDMA versus GSM versus LTE, Wireless data, 3rd/4th/5th Generation Networks, applications of 3G/4G/5G.	9
III	**Mobility Support in IP and TCP:** Mobile IP – Mobile Agent, Foreign Agent, Care of Address, Registration, Advertisement and Discovery, Tunneling, IP within IP – Mobility Support in IPV6 – Mobility Header, Mobility Options, Dynamic Home Agent Address Discovery, Cache Management, Bidirectional Tunneling – TCP Over Wireless Networks – Indirect TCP -Snoop TCP – Mobile TCP.	8
IV	**Mobile IP Network and Transport Layer:** IP & Mobile IP Network Layers, Packet Delivery & Handover Management, Location Management, Registration, Tunneling & Encapsulation, Route Optimization, Dynamic Host Configuration Protocol, IPSec, Mobile Transport Layer, Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Mobile Ad-hoc Networks(MANET), Routing and Routing Algorithms in MANET, security in ad-hoc networks.	8
V	**Data Dissemination and Synchronization:** Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization–Introduction, Software, and Protocols.	8

Text Books	1.	Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
	2.	Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, Wireless and Mobile Networks, concepts and protocols, Wiley, India.
E-Books	1.	http://www.e-booksdirectory.com/details.php?ebook=11901
	2.	https://doi.org/10.29085/9781856048996
Reference Books	1.	Martyn Mallik: Mobile and wireless design essentials, Wiley ,India,2003
	2.	Raj Kamal, Mobile Computing, 2/e , Oxford University Press-New Delhi
	3.	Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.
On-line TL Material	1.	https://www.cet.edu.in/noticefiles/270_Lecture%20note%20@%20MC.pdf
	2.	https://mrcet.com/downloads/digital_notes/CSE/III%20Year/AIML/140224/Mobie%20Computing.pdf
	3.	https://www.skdavpolytech.ac.in/news_files/mc_1586805280.pdf
	4.	https://annamalaiuniversity.ac.in/studport/download/sci/cis/resources/MCA-Second%20Year-Mobile%20Computing-MCAC403.pdf

Department of Computer Science and Engineering

Course Title: **Distributed Computing**										
Semester	**VI**	**Teaching Scheme**				**Evaluation Scheme**				
						Theory			**Practical**	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC3	4 Hrs			4	10	15	50	-	-
Course Code	23BTCSL333									
Teaching Mode	Offline	4 Hrs			Total	75			-	
Duration of ESE	3 Hrs					75				

Course Objectives	1. To provide students with contemporary knowledge in distributed systems
	2. To equip students with skills to analyze and design distributed applications.
	3. To provide master skills to measure the performance of distributed synchronization algorithms
Course Outcomes	**CO1:** Understand of the basic elements and concepts related to distributed system technologies
	CO2: Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.
	CO3: Analyze the various techniques used for clock synchronization and mutual exclusion
	CO4: Demonstrate the concepts of Resource and Process management and synchronization algorithms
	CO5: Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	**Program Outcomes and Program Specific Outcomes**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	--	--	--	--	2	--	--	--	--	--	--	2	--
CO2	1	3	3	--	--	--	--	--	--	--	--	--	3	--
CO3	1	--	3	3	--	--	--	--	--	--	--	--	--	3
CO4	2	--	--	--	3	--	--	--	--	--	--	--	2	--
CO5	--	2	--	--	2	3	--	--	--	--	--	--	2	--

Course Contents:

Unit	Contents	Hours
I	**Introduction to Distributed Systems :** Introduction and motivation to Distributed Systems, Characteristics, Applications, Challenges, Architecture types, Fundamental models, Inter-process and inter-node communication .	7
II	**Communication :** Layered Protocols, Inter process communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI), Message Oriented Communication, Stream Oriented Communication, Group Communication, Distributed File System Design and Implementation, Case Studies of NFS, Andrew File Systems, HDFS, Distributed Resource Management	10
III	**Synchronization :** Clock Synchronization Techniques, Network Time Protocol, Logical Clocks, Vector Clocks, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure, Non Token based Algorithms: Lamport Algorithm, Causally Ordered Broadcast and Unicast, Termination Detection – Ring based and Dijkstra Scholten algorithms, Leader Election – Ring based, Franklin's algorithm and Bully Algorithm	10
IV	**Resource and Process Management :** Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach, Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration	8
V	**Distributed Deadlock Detection**: Resource and Communication Deadlocks – Centralized technique, Distributed technique - edge chasing and path pushing algorithms, Hierarchical technique, Recovery from Deadlocks, Fault Tolerance, Handling Crash faults –Two phase commit protocol, non-blocking three phase commit protocol, Birman-Joseph Atomic Broadcast Protocol, Voting techniques for fault tolerance.	10

Text Books	1.	Singhal and Shivratri, "Advanced concepts in Operating Systems", McGraw Hill
	2.	Coulouris, "Distributed Systems", AWL Press. Pearson Education
E-Books	1.	https://link.springer.com/book/10.1007/978-3-031-02012-4
Referenc e Books	1.	https://freecomputerbooks.com/Parallel-and-Distributed-Computing.html
	3.	A. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
	4.	M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison Wesley, 2004
online TL Material	1.	https://www.youtube.com/watch?v=w8KFPWkK0bI&list=PLawkBQ15NDEkDJ5IyLIJUTZ1rRM9YQq6N

Department of Computer Science and Engineering

Multidisciplinary Minor-IV

Course Title: Introduction to Cloud Computing										
Semester	**VI**	**Teaching Scheme**				**Evaluation Scheme**				
						Theory			**Practical**	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	MDM4	2 Hrs			2	10	15	50	NA	NA
Course Code	23BTCSL308									
Teaching Mode	Offline	2 Hrs			Total	75				
Duration of ESE	3 Hrs					75				

Course Objectives	To understand Cloud Computing concepts, technologies, architecture and applications
	To understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization
	To understand different cloud programming platforms and tools to develop and deploy applications on cloud
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Describe fundamental concepts of cloud computing and identify key services offered by popular cloud platforms.
	CO2: Apply cloud development techniques to configure virtual machines, build private cloud environments, and deploy scalable cloud-based applications.
	CO3: Analyze the suitability of different PaaS environments for specific cloud applications and evaluate their performance for enterprise use cases.
	CO4: Design and develop cloud-based solutions tailored to enterprise needs by leveraging best practices and cloud technologies.
	CO5: Critically evaluate various cloud programming models and create innovative solutions to address complex real-world challenges using cloud infrastructure.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	**Program Outcomes and Program Specific Outcomes**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	3	2	--	--	--	2	--	--	--	--	--	3	--	
CO2	1	--	--	2	3	--	--	--	--	--	--	--	3	--	
CO3	--	--	3	--	--	--	--	--	--	--	--	--	3	--	
CO4	--	--	--	3	--	--	--	--	--	--	--	--	--	2	
CO5	--	--	--	--	3	--	--	--	--	--	--	--	--	2	

Course Contents:

Unit	Contents	Hours
I	**Introduction to Cloud Computing and Virtualization**: Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy. Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service (SaaS), Hardware-as-a-service: (HaaS), Oriented Architecture (SOA)	7
II	**Cloud Computing Architecture and Service Management in Cloud** Computing :Cloud architectural principles, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors. Cloud Services, Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment	8
III	**Data and Resource Management in Cloud Computing**: Data storage, migration, security, backup, and analytics, along with efficient resource allocation, auto-scaling, performance monitoring, cost optimization, and energy-efficient practices in cloud environments.	6
IV	**Cloud Security and Risk Management:** Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity& Access Management, Risk Management in cloud, Governance and Enterprise Risk Management.	7
V	**Open Source and Commercial Clouds:** Openstack, AWS, Google Cloud, Microsoft Azure, Cloud Simulator and IoT Cloud Framework, Research trend in Cloud Computing, Fog Computing,	7

Text Books	1.	Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011
	2.	Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
E-Books	1.	CLOUD COMPUTING Principles and Paradigms Link: http://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/CLOUD%20COMPUTING%20Principles%20and%20Paradigms.pdf
Reference Books	1.	Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
	2.	Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India,2010
online TL Material	1.	https://nptel.ac.in/courses/106/105/106105167/

Department of Computer Science and Engineering

Vocational andSkill Enhancement Elective –IV

Course Title: **Web Technology**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC4	1	--	2	2	10	15	--	25	--
Course Code	23BTCSL309 23BTCSP309									
Teaching Mode	Offline	3			Total	25			25	
						50				

Course Objectives	To understand the basic principles of web designing
	To learn web page creation using HTML
	To Visualize the basic concept of HTML
	To Introduce and understand the basic concept of CSS
	To learn dynamic website design using CSS
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Explain the basic principles of web designing
	CO2: Implement all basic tags in HTML
	CO3: Design web page using HTML
	CO4: Apply the basic concept of CSS.
	CO5: Apply CSS for designing of Box Model

Mapping of Course Outcomes with Program Outcomes & PSOs:

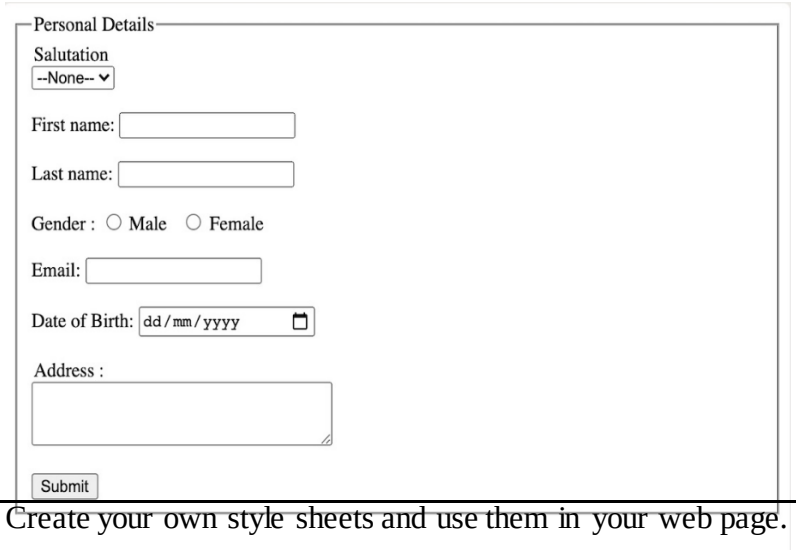
Course Outcomes	Program Outcomes														
	PO 1	PO2	PO	PO4	PO 5	PO	PO 7	PO 8	PO 9	PO	PO 11	PO 12	PSO 1	PSO2	PSO 3
CO1	-	3	3	-	-	-	-	-	-	-	-	1	2	-	-
CO2	-	1	3	-	-	-	-	-	2	-	-	2	3	-	-
CO3	-	1	2	2	-	-	-	-	3	-	-	2	3	-	-
CO4	-	1	2	2	-	-	-	-	3	-	-	2	3	-	-
CO5	-	1	2	2	-	-	-	-	3	-	-	2	3	-	-

Course Content :

Unit	Contents	Hours
I	**Web Design Principles:** Basic principles involved in developing a website, Planning process, Five Golden rules of web designing, Designing navigation bar, Page design, Home Page Layout, Design Concept.	3
II	**Introduction to HTML:**What is HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags.	3
III	**Elements of HTML:**What is World Wide Web, Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.	3
IV	**Introduction to Cascading Style Sheets:** Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables.	3
V	**Cascading Style Sheets:**CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties).	3

List of Experiments:

Sr. No.	Name of Experiments	CO
1	Write an HTML page to print HELLO WORLD in bold and italic.	CO1
2	Write a program to create a profile page to display educational details, Hobbies, Achievements, Your Ideals, etc, using basic tags in HTML.	CO1
3	Write a program to implement HTML code for your own study timetable as shown below. (Hint: use the colspan and rowspan attributes). **Time Table** Hours: **mon** | **tues** | **Wed** | **Thrus** | **Fri** Science | Maths | Science | Maths | Arts Science | Maths | Science | Maths | Arts **Lunch** Science | Maths | Science | Maths | Project Science | Maths | Science | Maths	CO2
4	Create a HTML page given below Lists of Subjects 1. Computer Engineering Department a. Web Development b. Database Management System c. Software Engineering 2. Electrical Engineering Department • Electrical Machine	CO2
5	Write a program to implement a web page with one or multiple frames	CO3

6	Create a HTML Form given below.  	CO3
7	Create your own style sheets and use them in your web page.	CO4
8	Create a webpage using CSS Box Model.	CO4
9	Design a website using any open source tool.	CO4
10	Open Ended Practical.	CO4

Text Books	1.	HTML 5 in simple steps by Kogent Learning Solutions Inc. Dreamtech Press
	2.	HTML, XHTML, and CSS Bible, 5ed Steven M. Schafer , Wiley India
E-Books	1.	HTML 5 in simple steps by Kogent Learning Solutions Inc. Dreamtech Press
Reference Books	1.	Web Technologies: HTML, Javascript, Kogent Learning, Wiley India

Department of Computer Science and Engineering

Course Title: Research Methodology										
Semester	**VI**	**Teaching Scheme**				**Evaluation Scheme**				
						Theory			**Practical**	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	RM			4	2				50	
Course Code	23BTSHP302									
Teaching Mode	Offline	4 Hrs			Total	50				
Duration of ESE										

Name of Subject: Research Methodology	**Semester: VI**
COURSE OUTCOME	
CO1	Knowledge on various kinds of research questions and research designs
CO2	Formulate research problems (task) and develop a sufficiently coherent research
CO3	Assess the appropriateness of different kinds of research designs
CO4	Knowledge on qualitative, quantitative and mixed methods of research, as well as relevant
CO5	Assess the Intellectual Property Rights related with research work

Sr.No.	**Practical List**	**Mapping With CO**
1	Select a problem from your area of interest, identifying the type of research problem it is and perform the SWOT analysis of the existing literature.	CO1
2	Generate research questions and hypotheses for a problem from your area of interest.	CO1
3	Identify the population and sample for the study (highlighting the technique used for sample selection) for a problem from your area of interest	CO2
4	Design a questionnaire for the problem of interest.	CO2
5	Compile a literature review on the chosen topic, highlighting key findings and gaps in existing research.	CO3
6	Based on the literature review, formulate hypotheses related to the chosen research problem.	CO3
7	Perform basic statistical analyses like measures of relationship, simple regression analysis, and multiple correlation and regression.	CO4
8	Develop a research report based on the conducted study, following the principles of writing and data analysis reporting.	CO4
9	Perform the process for filing a Patent.	CO5
10	Perform the process for filing a Copyright.	CO5