DEPARTMENT OF EMERGING TECHNOLOGIES IN COMPUTER SCIENCE
HONORS IN CSE (DS)
Scheme of Instruction and Examination
(Effective from 2020-2021)

S.No	Semester	Course Title	Credits	Scheme of Instruction periods/week			Scheme of Examination Maximum Marks		
				L	T/D	P	End Exam Marks	Internal Assessment Marks	Total Marks
Theory									
1.	**IV**	Introduction to Data Mining	4	4	0	0	60	40	100
2.	**V**	Data Visualization	4	3	0	2	60	40	100
3.	**VI**	Object Oriented Analysis & Design	4	3	0	2	60	40	100
4.	**VII**	AdHoc and Sensor Networks	4	4	0	0	60	40	100
5.		MOOC – 1	2	0	0	0	0	0	100
6.		MOOC - 2 / Mini Project	2	0	0	0	0	0	100
			20						

CSE (DS)	**MOOC - 1**
1	Machine Learning with Big Data
2	High Performance Computing
3	Digital Image Processing
4	Software Project Management

CSE (DS)	**MOOC - 2**
1	Practical Machine Learning
2	Reinforcement Learning
3	Advanced Distributed Systems
4	Software Quality & Testing

INTRODUCTION TO DATA MINING (IDMG)

Honors IV Semester: Common for CSE (AIML) & CSE (DS)						**Scheme: 2020**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
HCM01	**H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		4	**0**	**0**	**4**	**40**	**60**	**100**
Sessional Exam Duration: 1½ Hrs						**EndExamDuration:3 Hrs.**		

Course Outcomes: At the end of the course students will be able to

CO1: Understand the importance of data mining and the principles of business intelligence.

CO2: Organize and Prepare the data needed for data mining using preprocessing techniques.

CO3: Understand data mining classification techniques.

CO4: Implement association rule mining using Market basket analysis.

CO5: Analyze unsupervised clustering mining algorithms.

UNIT– I

Data Mining:
Introduction, What is Data Mining, Motivating Challenges, Data Mining Tasks, Types of Data, Similarity and Dissimilarity between Simple Attributes and Data Objects.

UNIT– II

Data Preprocessing:
Why Pre-process the Data?, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

UNIT– III

Classification:
Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, Building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for Decision Tree Induction, Rule Base, Nearest-Neighbour Classifier, Bayes Theorem, using the Bayes theorem for classification, Naive Bayes Classifier.

UNIT– IV

Association Analysis:
Basic Concepts and Algorithms: Frequent Item Set generation, The Apriori Principle, Apriori Algorithm, Candidate Generation and Pruning, Rule Generation, Confidence-Based Pruning, Rule Generation with an example, FP-Growth Algorithm.

UNIT– V

Cluster Analysis:
What is Cluster Analysis, Types of Clustering, K-Means Algorithm, Agglomerative Hierarchical Clustering Algorithm, Key Issues in Hierarchical Clustering, DBSCAN Algorithm.

TextBooks :

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, PEA
2. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier,2006

Reference Books :

1. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
2. Data Mining Techniques, Arun K Pujari, Universities Press.

Web References:

1. https://onlinecourses.nptel.ac.in/noc18_cs14/
2. https://freevideolectures.com/course/3758/databases-data-mining

QuestionPaperPattern:

Sessional Examination:

The question paper for sessional examination shall be for 25 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. The question paper shall consist of three sections with Two Questions (EITHER/ OR Type) in each section. The student shall answer one question from each section.

End Examination:

The question paper for End examination shall be for 60 marks. The Question paper shall contain Five Units with Two Questions (Either or Type) from each unit. Each of these questions may contain sub question and the student should answer any one question from each unit. Each Question carries 12 marks.

DATA VISUALIZATION (DV)

Honors V Semester: Common for CSE (AIML) & CSE (DS)						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HCM02	H	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	2	4	40	60	100
Sessional Exam Duration : 1½ Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Identify the different data types, visualization types to bring out the insight.

CO2: Relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large dataset.

CO3: Design visualization dashboard to support the decision making on large scale data.

CO4: Demonstrate the analysis of large dataset using various visualization techniques and tools.

CO5: Ability to create and interpret plots using R/Python..

UNIT – I

Introduction to Data Visualization: Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation.

UNIT – II

Visualization Techniques: Scalar and point techniques- Coloring and contouring, Height Plots. Vector Visualization techniques- Vector Properties – Vector G1, Vector color coding, Matrix Visualization techniques.

UNIT – III

Visual Analytics: Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map.

UNIT – IV

Visualization Tools & Techniques: Introduction to various data visualization tools: R —basics, Data preprocessing, Statistical analysis, Plotly and ggplot library, Tableau, D3.js, Gephi

UNIT – V

Diverse Types of Visual Analysis: Time- Series data visualization — Text data visualization — Multivariate data visualization and casestudies.

Visualization of Streaming Data: Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.

Text Books:

1. Tamara Munzer, Visualization Analysis and Design, CRC Press 2014.
2. Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018.

Reference Books:

1. Dr.Chun-hauh Chen, W.K.Hard1e, A.Unwin, Handbook of Data Visualization, Springer publication, 2016.
2. Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020.
3. Alexandra C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014.

Web References:

1. https://www.kaggle.com/learn/data-visualization
2. https://www.tutorialspoint.com/business_writing_skills/data_visualization.htm

3. https://www.javatpoint.com/what-is-data-visualization

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List of Experiments:

1. Implement data acquisition and plotting data.
2. Demonstrate the Financial analysis using Clustering, Histogram and Heat Map.
3. Implement Statistical Analysis — such as Multivariate Analysis, PCA, LDA, Correlation regression and analysis of variance.
4. Time-series analysis — stock market.

OBJECT ORIENTED ANALYSIS AND DESIGN (OOAD)

Honors VI Semester: Common for CSE (AIML) & CSE (DS)					Scheme : 2020			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
HCM03	H	3	0	2	4	40	60	100
Sessional Exam Duration 1½ Hrs					End Exam Duration: 3 Hrs			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the importance of model, UML and Class diagrams.

CO2: Describe the structural and behavioral modeling of a software system.

CO3: Design an event driven system with dynamic dimensions.

CO4: Design logical elements of a system.

CO5: Construct an architectural template for applications and deployment diagrams.

UNIT – I

Introduction to UML

Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, Software Development Life Cycle, Mechanisms, Artifacts, Hello World.

Basic Structural Modeling

Classes, Relationships, Common mechanisms, Diagrams, Class diagrams.

UNIT – II

Advanced Structural Modeling

Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Instances, Object diagrams, Components.

Basic Behavioral Modeling

Interactions, Use cases, Use case diagrams, Interaction diagrams, Activity diagrams.

UNIT – III

Advanced Behavioral Modeling

Events and signals, state machines, processes and Threads, Time and Space, State diagrams.

UNIT – IV

Architectural Modeling

Artifacts, Deployment, Collaborations, Common modeling techniques.

UNIT – V

Architectural Modeling

Patterns and Frameworks, Artifact diagrams, Deployment diagrams, Systems and Models.

Applying the UML

Case Study- Library management system, Online shopping system.

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson, [2nd Edition], The Unified Modeling Language User Guide, Pearson Education, 2015.

Reference Books:

1. Craig Larman, Appling UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development,Pearson Education,2015.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, UML 2 Toolkit, WILEY Dreamtech India Pvt. Ltd,2004.

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List of Experiments:

1. Exam registration
2. E-ticketing
3. Credit card processing
4. Library management system

ADHOC AND SENSOR NETWORKS (ASN)

Honors VII Semester: Common for CSE (AIML) & CSE (DS)						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
HCM04	H	4	0	0	4	40	60	100
Sessional Exam Duration 1½ Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Explain the concepts, network architectures and applications of ad hoc and wireless Sensor networks.

CO2: Describe MAC protocols of ad hoc wireless networks.

CO3: Explain characteristics, design issues and classification of routing and transport layer protocols in ad hoc wireless networks.

CO4: Summarize the architecture of WSN along with MAC protocols for WSNs.

CO5: Understand routing issues, localization and QoS in WSN.

UNIT – I

Introduction: Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio propagation Mechanisms, Characteristics of the Wireless Channel.
Mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks, Design Challenges in Ad hoc and Sensor Networks.

UNIT – II

MAC Protocols for Ad Hoc Wireless Networks: Issues in designing a MAC Protocol, Classification of MAC Protocols, Contention based protocols, Contention based protocols with Reservation Mechanisms, Contention based protocols with Scheduling Mechanisms, Multi channel MAC-IEEE 802.11.

UNIT – III

***Routing Protocols and Transport Layer in Ad Hoc Wireless Networks*:** Issues in designing a routing and Transport Layer protocol for Ad hoc networks, proactive routing, reactive routing (on-demand), hybrid routing, Classification of Transport Layer solutions, TCP over Ad hoc Wireless Networks.

UNIT – IV

Wireless Sensor Networks (WSNs) and MAC Protocols: Single node architecture: hardware and software components of a sensor node, WSN Network architecture: typical network architectures, data relaying and aggregation strategies, MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

UNIT – V

***WSN Routing, Localization & QoS*:** Issues in WSN routing, OLSR, Localization: Indoor and Sensor Network Localization, absolute and relative localization, triangulation, QOS in WSN, Energy Efficient Design, Synchronization, Transport Layer issues.

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj, *Ad Hoc Wireless Networks: Architectures and Protocols*, Prentice Hall Professional Technical Reference, 2008.

Reference Books:

1. Carlos De Morais Cordeiro and Dharma Prakash Agrawal, *Ad Hoc & Sensor Networks: Theory and Applications*, World Scientific Publishing Company, 2006.
2. Jagnnathan Sarangapani, *Wireless Ad Hoc and Sensor Networks-Protocols, Performance and Control*, CRC press, Taylor & Francis group, 2007.

Web References:

1. http://cse.iitkgp.ac.in/~smisra/course/wasn.html
2. https://www.youtube.com/playlist?list=PLJ5C_6qdAvBHroAfekCO7K4xphEF74UPc

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