SEMESTER S6

ADVANCED DATABASE SYSTEMS

(Common to CS/CM/CR/AM/AD)

Course Code	**PECST634**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs: 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To learn the fundamentals of data modeling, query processing, and design in advanced databases and study the working principles of distributed databases.
2. To learn emerging databases such as XML and NoSQL.
3. To enable the student to use tools, methodologies, and skills for working successfully with databases in today's global, data driven business model.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Query Processing and Optimization - Measures of query cost, Algorithms for Selection with cost analysis, Algorithms for Join with cost analysis, Evaluation of expressions; Heuristics in Query Optimization - Optimization of Relational Algebra expressions; Physical Database Design and Tuning - Introduction to Physical Database Design, Overview of Database Tuning, Tuning the Conceptual Schema, Tuning Queries and Views; Impact of Concurrency.	**9**
2	Distributed Databases - Distributed Systems, Introduction, Architecture, Distributed Database Concepts, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control; Query Processing and Decomposition - Query Processing Objectives, Characterization of Query Processors, Layers of Query Processing, Query Decomposition, Localization of Distributed Data.	**9**
3	XML and Non Relational Databases - Introduction to Semi Structured Data and XML Databases, XML Data Model – XSD, XML: DTD and XML	**9**

	Schema, XML Presentation, XPath Queries, XQuery; NoSQL Databases - CAP Theorem, Document based; MongoDB Operation - Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment; Cassandra - Data Model, Key Space, Table Operations, CRUD Operations.	
4	Graph database - Introduction, Data Modelling with Graphs, Building a Graph Database application, Data Modeling, Predictive Analysis with Graph Theory; Depth and Breadth First Search; Path-Finding with Dijkstra's Algorithm; Graph Theory and Predictive Modeling	**9**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply various measures for query processing and optimization, and apply techniques to tune database performance.	**K3**
CO2	Explain the architecture and fundamental concepts of distributed databases.	**K2**
CO3	Utilize semi-structured data, XML, and XML queries for effective data management	**K3**
CO4	Utilize NoSQL database systems to manage and manipulate data in real-time applications	**K3**
CO5	Develop advanced skills in graph database concepts, covering data modeling, application building, and the application of graph theory for predictive analysis and modeling.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2									3
CO2	3	2	2									3
CO3	3	2	2		2							3
CO4	3	2	2		2							3
CO5	3	3	3		3							3

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B. Navathe	Pearson	7/e, 2017
2	Database System Concepts	A. Silberschatz, H. Korth, S. Sudarshan	McGraw-Hill	7/e, 2021
3	Database Management Systems	R. Ramakrishnan, J. Gehrke	McGraw Hill	3/e, 2018
4	Graph Databases	Ian Robinson, Jim Webber & Emil Eifrem	O'Reilly	2/e, 2015
5	Database Systems	T. M. Connolly, C. Begg	Pearson	6/e, 2019

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data	W. Lemahieu, S. vanden Broucke and B. Baesens	Cambridge University Press	1/e, 2018
2	Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems	M. Kleppmann	O'Reilly	1,e2017
3	Database Systems: The Complete Book	Hector Garcia-Molina Jeffrey D. Ullman Jennifer Widom	Prentice Hall	2/e, 2009
4	Next generation databases: NoSQL, newSQL, and big data. Apres.	Guy Harrison	Apress	1/e, 2015
5	Foundations of Multidimensional and Metric Data Structures	Hanan Samet	Morgan Kaufmann	1/e, 2006

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	CAP Theorem https://nptel.ac.in/courses/106104189
2	Advanced database Queries https://archive.nptel.ac.in/courses/106/104/106104021
3	Database design https://archive.nptel.ac.in/courses/106106093/
4	Introduction to modern application development https://archive.nptel.ac.in/courses/106/106/106106156