Course Handout

Institute/ School Name	School of Engineering and Technology		
Department Name	Department of Computer Science & Engineering		
Program Name	Bachelor of Engineering (Computer Science & Engineering): B.E (CSE)		
Course Code	24CS010	Course Name	Database Management System
L-T-P (Per Week)	3-0-2	Course Credits	04
Academic Year	2024-25	Semester/Batch	3rd/2023-2027
Course Coordinator	Dr. Praveen Kantha		

1. Course Outline:

Introduction, Schemas, Architecture for DBMS, ER Model, Keys and their types, Relational Algebra, Normalization, Functional Dependencies, Introduction to Database Security, Transaction processing Concepts, ACID Properties, Schedules, Serializability, Concurrency Control, Locking, Modes of Locking, Multiple Granularity.

2. Programme Outcomes (POs):

At the end of the programme, students will be able to achieve knowledge about the following:	
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3. Course Learning Outcomes (CLO):

After completing the course, the students will be able to:

CLO1: Understand the importance of integrated database development and its related concepts in the context of application software development.

CLO2: Understand various data modeling techniques and their advantages and disadvantages in the context of database operations.

CLO3: Explain the process of formalizing data using various normalization forms.

CLO4: Acquire proficiency in executing data definition, manipulation, and transaction control operations.

CLO5: Understand and be able to implement data security through integrity constraints and various techniques for ensuring secure database transactions.

4. CLO-PO Mapping Matrix:

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	L				L		L				H	
CLO2			L		H						L	
CLO3	L		M								H	
CLO4	M		M								H	
CLO5	M	H				M			L		M	M

5. ERISE Grid Mapping:

Feature Enablement	Level (1-5, 5 being highest)
Entrepreneurship	1
Research/Innovation	1
Skills	3
Employability	3

6. Recommended Books (Reference Books/Text Books):

B01: Elmasri, R., & Navathe, S. B. (5th Edition) Database systems: models, languages, design, and application programming. Pearson Education India.

B02: Dubey, A. K. (2nd Edition). Database Management Concepts.S.K. Kataria & Sons.

B03: Miller, L.(Latest Edition). Oracle Autonomous Database for Dummies. Oracle Cloud.

B04: Loney, K. (Latest Edition). Oracle database 10g: the complete reference. London: McGraw-Hill/Osborne.

B05: Silberschatz, A., Korth, H. F., & Sudarshan, S. (6th Edition). Database system concepts.McGraw-Hill.

7. Other readings and relevant websites:

Resources	Link of Journals, Magazines, Websites and Research Papers
R1	https://onlinecourses.nptel.ac.in/noc23_cs79/preview
R2	https://www.c-sharpcorner.com/article/what-are-object-oriented-databases-and-their-advantages2/
R3	https://nptel.ac.in/courses/106106220
R4	https://cse.iitkgp.ac.in/~pabitra/course/dbms/dbms_new.html
R5	Sharma, A., Karamchandani, A., Dave, D., Patel, A., & Doshi, N. (2022). Database Management Systems—An Efficient, Effective, and Augmented Approach for Organizations. In ICT with Intelligent Applications: Proceedings of ICTIS 2021, Volume 1 (pp. 465-478). Springer Singapore.https://link.springer.com/chapter/10.1007/978-981-16-4177-0_47

Resources	Link of Audio-Video resources
V1	https://tinyurl.com/IITDBMS
V2	https://www.youtube.com/@databasemanagementsystem-i4463
V3	https://nptel.ac.in/courses/106104135

* Resources uploaded on ERP system is accessible to all the students registered for the course.

8. Recommended Tools and Platforms:

- Code Quotient (online platform- https://codequotient.com/)

- Livesql(https://signon.oracle.com/signin)

9. Course Plan:

Lecture Number	Topics	Weightage in ETE (%)	Instructional Resources
1-4	Introduction to database, Characteristics of database approach, Advantages and Disadvantages of DBMS approach	30	B01, R1, V1
5-7	Introduction to data models, Introduction to ER model, Introduction to Relational Model		B01, B02, R2, V2
8-9	Practice Problem: Design and draw an ER diagram.		Annexure-I
10-11	Schemas, Instances, Schema architecture, Data Independence and its types, Architecture for DBMS- One Tier, Two-Tier, Three Tier Architecture		B02, V2
12-15	Practice Problems: • Queries for Creating, Dropping, and Altering Tables and inserting rows into a table (use constraints while creating tables) examples using Select Command.		Annexure-I
16-19	ER Model: Database design process, Entity Types, Entity sets, Attributes, Strong and Weak entity, Keys and their types, Integrity Constraints, ER diagrams, E.F Codd Rules.		B01, R3
20-23	Practice Problems: • Queries (Along with Sub Queries) Using Any, All, In, Exists, Not Exists, Union, Intersect.		Annexure-I
24-26	Introduction to Relational Algebra: Unary operation, Relational Algebra Operations from Set Theory, Binary Relational Operations (Join, Division)	40	B01, B03, V2
27-30	Practice Problems: • Queries using Aggregate functions (Count, Sum, Avg, Max, and Min) Group by and Having clause		Annexure-I
31-33	Introduction to Normalization, Functional Dependencies (Trivial and non-trivial), Types of Functional Dependencies (Full, Partial).		B01, B02, R2, V2
34-39	Types of Functional Dependencies (Transitive, Multi-valued & Join Dependencies), 1stNormal Form and anomalies, Inference rules and questions on proving them, Closure of attribute set and closure of functional dependency set, Covers, and equivalence, non-redundant cover		B01, B02, B05, R2, V2
40-42	Canonical cover, Find candidate key, prime and non-prime attributes, Decomposition and its desirable properties, 2ndNormal Form, and conversion.		B01, B02, B05, R2, V2
43-46	Practice Problems: • Queries Using Conversion Functions (To_Char, To_Number and To_Date), String Functions (Concatenation, LPAD, RPAD, LTRIM, RTRIM, LOWER, UPPER, INITCAP, LENGTH, SUBSTR And INSTR), Date Functions (Sysdate, Next_Day, Add_Months, Last_Day, Months_Between, Least, Greatest, Trunc, Round, To_Char).		Annexure-I

47-52	3rdNormal Form and conversion, Boyce Codd Normal Form and conversion, 4thNormal Form (what is the highest normal form),5th Normal Form database, Introduction to transaction processing Concepts (transaction system, transaction operations), ACID Properties (transaction state, types of failures), Introduction to Schedules		B01, B02, B05, R2, V2
53-56	Practice Problems: • Write SQL queries for Employee Database schema. • Write SQL queries for Teacher Database schema.		Annexure-I
57-60	Types of Schedules (Serial and Non-Serial Schedule), Introduction to Serializability (testing), Introduction to Conflict and View Serializability (numerical), Introduction to Recoverability, Checkpoints (recovery from transaction failure), Cascade less schedule, log-based recovery, Deferred database modification, Immediate database modification		B01, B02, B05, R2, V2
61-65	Practice Problem: • Write SQL queries for Library Database schema. • Write SQL queries for Flight Database schema.	30	Annexure-I
66-69	Introduction to Concurrency, Problems in Concurrency techniques, Introduction to Concurrency techniques, Locking, Modes of Locking (shared lock and exclusive lock)		B01, B02, B05, R2, V2
70-71	Practice Problem: Write SQL queries for Client master Database schema.		Annexure-I
72-75	Two-phase locking protocol (growing and shrinking phase), Protocols (static, dynamic, and strict), Concurrency Control based on Timestamp Ordering Protocol, and Multiple Granularity.		B01, B02, B05, R2, V2

10. Industry Interventions:

This module will enable students to undergo industry-oriented certifications and related experiences etc.

• https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

11. Innovative Pedagogies:

• Case-based study (Annexure-II)
• Quiz (Annexure-III)
• Flip leaning (Annexure-IV)
• Presentation (Annexure-V)
• Blended Learning (Annexure-VI)

12. Action plan for different types of learners

Slow Learners	Average Learners	Advanced Learners
Remedial Classes	Workshops/ Practice Assignment	Coding/Interclass Competition

13. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment (Offline/ Online)
Internal Component 1	Formative Assessments (FAs)	01*	10%	Offline
Internal Component 2	Sessional Tests (STs)	03**	30%	Offline
External Component	End Term Examination	01	60%	Offline
Total			**100%**	

* Formative Assessments (FA) is mandatory.
** Out of 03 STs, the ERP system automatically picks the best 02 ST marks to evaluate final marks.

14. Details of Evaluation Components:

Evaluation Component	Description	Syllabus Covered (%)	Timeline of Examination	Weightage (%)
Internal Component 1	FA1	Up to 50% (Lectures 1-38)	Will be intimated in due course	10%
Internal Component 2	ST 01	Up to 40% (Lectures 1-30)		30%
	ST 02	40% - 80% (Lectures 31-60)		
	ST 03	100% (Lectures 1-75)		
External Component	End Term Examination*	100%		60%
Total				100%

* Minimum 75% attendance is required to become eligible for appearing in the End Semester Examination

15. Format of Evaluation Components:

Type of Assessment	Total Marks	Certifications and Module	1 Mark MCQ	2 Marks	5 Marks	10 Marks
*Formative Assessments	20	20*	-	-	-	-
Sessional Tests	40	-	5	5	3	1
End Term Examination	60	-	5	5	5	2

*Formative assessment will carry weightage: 10 marks for Infosys Infyspringboard certifications and 10 marks for code quotient module completion.

16. This Document is.

Designation	Name	Signature
Prepared by Course Coordinator	Dr. Praveen Kantha	
Verified by Program Incharge/HoD	Dr. Hakam Singh	
Approved by Pro VC	Prof (Dr.) Meenu Khurana	
Date		

Incase of revision in earlier document:

Date of Creation of earlier document		Percentage of Revision	

Annexure-I

S.No	Experiment
1.	Design and draw an ER diagram. Consider the following information about a university database: a) Professors have an SSN, a name, an age, a rank, and a research speciality. b) Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget. c) Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.). d) Each project is managed by one professor (known as the project's principal investigator). e) Each project is worked on by one or more professors (known as the project's co-investigators). f) Professors can manage and/or work on multiple projects. g) Each project is worked on by one or more graduate students (known as the project's research assistants). h) When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one. i) Departments have a department number, a department name, and a main office. j) Departments have a professor (known as the chairman) who runs the department. k) Professor work in one or more departments, and for each department they work in, a time percentage is associated with their job. l) Graduate students have one major department in which they are working on their degree. m) Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take. Use only the basic ER model here: entities, relationships, and attributes. Be sure to indicate any key and participation constraints.
2.	Queries for Creating, Dropping, and Altering Tables and inserting rows into a table (use constraints while creating tables) examples using Select Command.
3.	Queries (Along with Sub Queries) Using Any, All, In, Exists, Not Exists, Union, Intersect.
4.	Queries using Aggregate functions (Count, Sum, Avg, Max, and Min) Group by and Having clause
5.	Write SQL queries for Employee Database schema. Consider the Employee Database. EMPLOYEE (employee-name, street, city) WORKS (employee-name, company-name, salary) COMPANY (company-name, city) MANAGES (employee-name, manager-name) Give an expression in SQL for each of the following queries. a) Modify the database so that Jones now lives in Newtown. b) Give all employees of First Bank Corporation a 10 percent raise. c) Give all managers of First Bank Corporation a 10 percent raise. d) Give all managers of First Bank Corporation a 10 percent raise unless the salary becomes greater than $100,000; in such cases, give only a 3 percent raise. e) Delete all tuples in the works relation for employees of Small Bank Corporation
6.	Write SQL queries for Employee Database schema. Consider the schema for Company Database: EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo,DLoc) PROJECT (PNo, PName, PLocation, DNo) WORKS_ON (SSN, PNo, Hours) Write SQL queries to

	a) Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. b) Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. c) Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department d) Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). e) For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
7.	Write SQL queries for Teacher Database schema. Create Teacher table with the following fields (Name, DeptNo, Date of joining, DeptName,Location, Salary) a) Insert five records b) Give Increment of 25% salary for Mathematics Department. c) Perform Rollback command. d) Give Increment of 15% salary for Commerce Department. e) Perform commit command
8.	The Library Database schema includes the following tables: BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER (Name, Address, Phone) BOOK_COPIES (Book_id, Programme_id, No-of_Copies) BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date) LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address) Write SQL queries to a) Retrieve details of all books in the library – Book_id, title, name of publisher, authors, number of copies in each Programme, etc. b) Get the particulars of borrowers who have borrowed more than 3 books, but from July 2023 to Dec 2023. c) Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
9.	Consider the following relations: FLIGHTS (flno: integer, from: string, to: string, distance: integer, departs: time, arrives: time, price: real) AIRCRAFT (aid: integer, aname: string, cruisingrange: integer) CERTIFIED (eid: integer, aid: integer) EMPLOYEES (eid: integer, ename: string, salary: integer) Note that the Employees relation describes pilots and other kinds of employees; every pilot is certified for some aircraft, and only pilots are certified to fly. Write each of the following queries in SQL. a) Find the names of aircraft such that all pilots certified to operate them have salaries of more than 80,000. b) For each pilot certified for more than three aircraft, find the eid and the maximum cruising range of the aircraft for which she or he is certified. c) Find the names of pilots whose salary is less than the price of the cheapest route from Los Angeles to Honolulu. d) For all aircraft with cruising ranges over 1000 miles, find the aircraft's name and the average salary of all pilots certified for this aircraft. e) Find the names of pilots certified for some Boeing aircraft.

	f)	Find the aids of all aircraft that can be used on routes from Los Angeles to Chicago.
10.		Write SQL queries for Client_master Database schema.
		Create Client_master with the following fields (ClientNO, Name, Address, City, State, bal_due)
		a) Insert five records
		b) Find the names of clients whose bal_due> 5000.
		c) Change the bal_due of ClientNO "C123" to Rs. 5100.
		d) Change the name of Client_master to Client12.
		e) Display the bal_due heading as "BALANCE"

Annexure-II

S. No	Topics
1	E-R Model
2	Deadlock
3	Transaction Control

Description: Case study to be discussed with the students and students will prepare similar case study.

Annexure-III

S. No	Topics
1	Normalization
2	Concurrency Control

Description: Quiz to be conducted during academic schedule.

Annexure-IV

S. No	Topics
1	Functional Dependency

Description: The students will be provided with the subject content and on that basis they will be given home assignment.

Annexure-V

S. No	Topics
1	Normalization
2	Introduction to Schedules
3	Introduction to Serializability
4	Introduction to Concurrency
5	Locking and its Mode in Database
6	Multiple Granularity

Description: Presentation will be done by the student on different topics.

Annexure-VI

S. No	Topics
1	Codequotient Platform

Description: Student will be allowed to perform experiment/ query using code quotient platform.