INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**DATABASE MANAGEMENT SYSTEMS**				
Course Code	ACS005				
Programme	B.Tech				
Semester	IV	CSE			
	III	IT			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Dr. K. Suvarchala, Professor				
Course Faculty	Ms K. Radhika, Assistant Professor Ms K. Mayuri, Assistant professor Ms.E. Uma Shankari, Assistant Professor				

I. COURSE OVERVIEW:

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business, scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	ACS002	II	Data Structures	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Database Management Systems	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✔	MOOCs
✔	LCD / PPT	✔	Seminars	✔	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Theory**		**Total Marks**
Type of Assessment	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz / Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignment /Quiz
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	2	Seminar
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.	3	Mini Project
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	Laboratory Practices
PO 12	**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.	2	Seminar

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	2	Seminar
PSO 2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	2	Assignment / Quiz
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	3	Mini Project

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Discuss the basic database concepts, applications, data models, schemas and instances.
II	Design Entity Relationship model for a database.
III	Demonstrate the use of constraints and relational algebra operations.
IV	Describe the basics of SQL and construct queries using SQL.
V	Understand the importance of normalization in databases.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACS005.01	CLO 1	Define the terminology, features, and characteristics of database system	PO 1	2
ACS005.02	CLO 2	Differentiate database systems from file systems by enumerating various features provided by database systems.	PO 1, PO 2	3
ACS005.03	CLO 3	Describe Data Models, Schemas, Instances, Three Schema Architecture and DBMS Component Modules	PO 1	3
ACS005.04	CLO 4	Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram.	PO 2, PO 3	3
ACS005.05	CLO 5	Model the real world database systems using Entity Relationship Diagrams (ERD) from the requirements specification.	PO 2, PO 3	2
ACS005.06	CLO 6	Describe basics of the relational data model.	PO 1	3
ACS005.07	CLO 7	Define and illustrate the Relational Data Model, Constraints and Schemas	PO 1	3
ACS005.08	CLO 8	Transform an information model into a relational database schema and implement schema using data definition language and/or utilities.	PO 2, PO 3	2
ACS005.09	CLO 9	Formulate solutions to a broad range of query problems using relational algebra.	PO 2, PO 3	3
ACS005.10	CLO 10	Apply relational calculus to solve broad range of query problems.	PO 2, PO 3,	3
ACS005.11	CLO 11	Illustrate the Functional Dependencies , Inference Rules, Minimal Sets of FDs	PO 1, PO 2	2
ACS005.12	CLO 12	Understand normalization theory and criticize a database design and improve the design by normalization.	PO 2, PO 3	2
ACS005.13	CLO 13	Explain various Normal Forms and Apply to normalize a database.	PO 1, PO 2	3
ACS005.14	CLO 14	Understand the SQL Data definition statements to formulate solutions to a broad range of query and data update problems	PO 1,PO 2, PO 5	2
ACS005.15	CLO 15	Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.	PO 2 , PO 5	3
ACS005.16	CLO 16	Use SQL queries for data aggregation, calculations, views, sub-queries, embedded queries, manipulation, and report generation.	PO 2 , PO 5	2
ACS005.17	CLO 17	Demonstrate PL/SQL including stored procedures, stored functions, cursors, packages.	PO 2, PO 3, PO 5, PO 12	3
ACS005.18	CLO 18	Gain knowledge on transaction processing to maintain consistency and integrity of data in database systems.	PO 1, PO 2	2
ACS005.19	CLO 19	Describe concurrency control techniques to implement data integrity in database systems.	PO 1,PO 2	2
ACS005.20	CLO 20	Illustrate various backup and recovery techniques	PO 1,PO 2	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
		for database systems.		
ACS005.21	CLO 21	Analyze transaction processing , concurrency control, Database recovery techniques	PO 1, PO 2	3
ACS005.22	CLO 22	Define disk storage devices, files of records, unordered files, ordered files and hashed files and organizations	PO 1	3
ACS005.23	CLO 23	Familiar with basic database storage structures and access techniques- file and page organizations, indexing methods	PO 1, PO 2	2
ACS005.24	CLO 24	Illustrate various operations in implementing data indices using various hashing techniques.	PO 1, PO 2, PO 5	3
ACS005.25	CLO 25	Possess the knowledge and skills for employability and to succeed in national and international level competitive examinations.	PO 5, PO 12	3

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X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CLO 1	3												1		
CLO 2	3	2													
CLO 3	3												2		
CLO 4		3	3												
CLO 5		3	3											2	1
CLO 6	3														
CLO 7	3													2	
CLO 8		2	3											2	
CLO 9		3	2											3	
CLO 10		3	2											3	
CLO 11	3	2													
CLO 12		3	2											2	
CLO 13	3	3											2		
CLO 14	3	2											2		
CLO 15		2			3										3
CLO 16		2			3									2	

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
CLO 17		2	3		3							3			3
CLO 18	3	2											2		
CLO 19	3	2												2	
CLO 20	3	2												2	
CLO 21	3	2											3		
CLO 22	3												3		
CLO 23	3	2												2	
CLO 24	2	3			3										
CLO 25					3							2			3

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2, PO 3, PO 5	SEE Exams	PO 1, PO 2, PO 3, PO 5	Assignments	PO 1	Seminars	PO 2
Laboratory Practices	PO 2	Student Viva	PO 3	Mini Project	PO 3	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Unit-I	CONCEPTUAL MODELING
Introduction to file and database systems: Database system structure, data models, introduction to network and hierarchical models, ER model, relational model.	
Unit-II	**RELATIONAL APPROACH**
Relational algebra and calculus: Relational algebra, selection and projection, set operations, renaming, joins, division, examples of algebra queries, relational calculus, tuple relational calculus, domain relational calculus, expressive power of algebra and calculus	
Unit-III	**BASIC SQL QUERY**
SQL data definition; Queries in SQL: updates, views,integrity and security,relational database design. Functional dependencies and normalization for relational databases up to five normal forms.	
Unit-IV	**TRANSACTION MANAGEMENT**
Transaction processing: Introduction, need for concurrency control, desirable properties of transaction, schedule and recoverability, serializability and schedules, concurrency control; Types of locks: Two phases locking, deadlock, time stamp based concurrency control, recovery techniques , concepts, immediate update, deferred update, shadow paging.	

Unit-V	DATA STORAGE AND QUERY PROCESSING
Record storage and primary file organization, secondary storage devices, operations on files, heap File, sorted files, hashing techniques,and index structures for files; Different types of indexes, B tree, B+ tree, query processing.	
Text Books:	
1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 4th Edition, 2002. 2. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 3rd Edition, 2003	
Reference Books:	
1. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2003. 2. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", PearsonEducation, United States 1st Edition, 2000. 3. Peter Rob, Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003.	

XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	CLOs	Reference
1-2	Introduction, Data base System Applications, Purpose of data base Systems, View of Data – Data Abstraction, Instances and Schemas Data Models,, Database Languages, Data base access for applications Programs	CLO 1	T2: 1.1- 1.5
3-4	Transaction Management component of DB architecture, Data base users, History of database systems, Database design, ER Diagrams.	CLO 2	T2: 1. 6 - 1.8,, 1.10,T1: 2.1
5-6	Entities, Attributes and entity sets, Relationships and relationship sets, Additional features of ER model,Conceptual design with ER model, Conceptual design for large enterprises	CLO 3, CLO4, CLO5	T1: 2.2-2.6
7-8	Relational Model: Introduction to the Relational Model – Integrity Constraint Over relations, Enforcing Integrity constraints – Querying relational data	CLO 6, CLO 7, CLO 8	T1: 3.1-3.7
9-10	Relational Algebra and Calculus: Relational Algebra – Selection and projection –set operations – renaming, Joins – Division	CLO 8, CLO 9	T1: 4.1, 4.2.2
11-12	Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.	CLO 10	T1:4.3, 4.4
13-14	Form of Basic SQL Query – Examples of Basic SQL Queries Comparison Operators – Aggregative Operators, NULL values , Logical connectivity's – AND, OR and NOT,,mplex Integrity Constraints in SQL	CLO 14, CLO 15	T1: 5.2-5.5
15-16	Introduction to Nested Queries – Correlated Nested Queries Set Comparison Operators – Aggregative Operators, Triggers and Active Data bases	CLO 16, CLO 17	T1: 5.6- 5.8
17-18	Introduction to Schema refinement – Problems Caused by redundancy ,Decompositions – Problem related to decomposition	CLO 11	T1: 19.1, 19.1.3
19-21	Functional dependencies, reasoning about FDS ,Lossless join Decomposition , Dependency preserving Decomposition	CLO 12	T2: 19.4-19.8
22-25	Schema refinement in Data base Design, Normal Forms, MVDs, JDs	CLO 13, CLO 14	T2: 19.8-19..9
26-29	Transaction Management: Transaction Concept-Transaction State-Implementation of atomicity and Durability, Concurrent Executions, Serializability , Recoverability, Implementation of Isolation, Testing for Serializability.	CLO 18	T2: 15.1-15.29

Lecture No	Topics to be covered	CLOs	Reference
30-33	Concurrency Control: Lock-Based Protocols –time Stamp Based protocols-,Validation Based Protocols-Multiple Granularity	CLO 19	T2: 16.1, 16.2 T2: 16.3, 16.4
34-37	Recovery System-Failure Classification-storage Structure recovery and Atomicity-Log Based Recovery-,Recovery with, Concurrent Transactions, Buffer Management-Failure with loss of Non Volatile Storage, Advance Recovery Systems-Remote Backup Systems	CLO 20, CLO 21	T2: 17.1 - 17.10
38-39	Overview of Storage and Indexing: Data on External Storage , File Organization and Indexing – Cluster Indexes, Primary and Secondary Indices	CLO 22	T1: 8.1,8.2
40-41	Index data Structures – Hash Based Indexing ,Tree base Indexing – Comparison of File Organizations	CLO 24	T1: 8.3- 8.4
42	Tree Structured Indexing: Intuitions for tree Indexes Indexed Sequential Access Methods (ISAM)	CLO 22	T1: 10 10.2
43	B+ Trees: A Dynamic Index Structure-Search, insert, Delete operations	CLO 22	T1: 10.3 - 10.6
44	Hash Based Indexing: Static Hashing – Extendable hashing ,Linear Hashing –Extendable vs. Liner hashing	CLO 24	T1: 11.1 – 11.4
45	Query Processing	CLO 24	T1:12.1-12.3

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

Sno	Description	Proposed Action	Relevance with POs	Relevance with PSOs
1	Conversion of ER model into Relational Model	Seminars /Guest Lecture	PO 2, PO 12	PSO 1
2	Practical Implementation of triggers and assertions using PL/SQL	Assignments/ Lab experiments	PO 3, PO 5, PO 12	PSO 2
3	Implementation of Transaction and security restriction using SQL.	Assignments/ Lab experiments	PO 2, PO 5, PO 12	PSO 2

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