INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**DATABASE MANAGEMENT SYSTEMS**				
Course Code	ACSB08				
Programme	B.Tech				
Semester	IV	CSE | IT			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr.U Sivaji, Assistant Professor				
Course Faculty	Mr. N PoornaChandra Rao, Assistant Professor Mr. N Bhaswanth, Assistant Professor Ms. B Ramya sree, Assistant Professor Ms. K Mayuri, Assistant Professor Ms. B Vijaya Durga, 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	ACSB08	III	Data Structures	3

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 modules and each module 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 module. 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 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	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 20 marks of 2 hours duration consisting of five descriptive type questions out of which four 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 - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignment/Quiz
PO2	**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	Guest Lectures
PO3	**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	5 minutes Video/ Seminars
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

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:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	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	Quiz/AAT
PSO 3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become technocrats.	3	Mini Project

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand the role of database management system in an organization and learn the database Concepts.
II	Design databases using data modeling and Logical database design techniques
III	Construct database queries using relational algebra and calculus and SQL.
IV	Understand the concept of a database transaction and related concurrent, recovery facilities.
V	Learn how to evaluate a set of queries in query processing

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Describe Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Various Components of overall DBS architecture, Various Concepts of ER Model, Basics of Relational Model	CLO 1	Describe the Purpose of Database Systems, Data Models, and View of Data.
		CLO 2	Summarize the concept of Database Languages, Database Users.
		CLO 3	Identify the Various Components of overall DBS architecture.
		CLO 4	Use the concept of ER Model.
		CLO 5	Describe Basics of Relational Model.
CO 2	Determine Relational algebra, selection and projection, set operations, renaming, joins, division, examples of algebra queries, relational	CLO 6	Determine Relational algebra, The Self variable.
		CLO 7	Understand selection and projection, set operations.
		CLO 8	Determine renaming, joins, division.
		CLO 9	Use examples of algebra queries.

COs	Course Outcome	CLOs	Course Learning Outcome
	calculus: Tuple relational calculus, Domain relational calculus, expressive power of algebra and calculus	CLO 10	Illustrate Tuple relational calculus, Domain relational calculus, and also expressive power of algebra and calculus.
CO 3	Understand SQL – Data Definition commands, Queries with various options, Mata manipulation commands, Views, Joins, views, integrity and security; Relational database design: Pitfalls of RDBD, Lossless join decomposition, Functional dependencies , Armstrong Axioms, Normalization for relational databases 1st , 2nd and 3rd Normalization, Basic definitions of MVDs and JDs, 4th and 5th normal forms	CLO 11	Understand SQL – Data Definition commands, Queries with various options.
		CLO 12	Analyze the concept of Mata manipulation commands, Views, Joins, views.
		CLO 13	Illustrate Calling a function, Returning multiple values from a function.
		CLO 14	Contrast the Usage of Relational database design, Functional dependencies, Armstrong Axioms
		CLO 15	Define Normalization, 2nd and 3rd Normalization, Basic definitions of MVDs and JDs, 4th and 5th normal forms.
CO 4	Explore the concept of Transaction, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability. Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularities, Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery with Concurrent Transactions Buffer Management.	CLO 16	Discuss the concept of Transaction, Transaction State.
		CLO 17	Understand Atomicity and Durability, Concurrent Executions.
		CLO 18	Summarize the concept of Serializability, Recoverability.
		CLO 19	Discuss the Concurrency Control and various Protocols.
		CLO 20	Understand the concept of Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery with Concurrent Transactions Buffer Management.
CO 5	Knowledge the Physical Storage Media, Magnetic	CLO 21	Knowledge about the Physical Storage Media, Magnetic Disks, Storage Access.

COs	Course Outcome	CLOs	Course Learning Outcome
	Disks, Storage Access, File Organization, Organization of Records in Files. Indexing and Hashing: Basic Concepts: Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing. Query Processing: Overview, Measures of Query Cost	CLO 22	Apply Working with File Organization, Organization of Records in Files.
		CLO 23	Understand Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing.
		CLO 24	Comparison of Ordered Indexing and Hashing.
		CLO 25	Illustrate Query Processing: Overview, Measures of Query Cost.

X. 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
ACSB08.01	CLO 1	Describe the Purpose of Database Systems, Data Models, and View of Data.	PO1	2
ACSB08.02	CLO 2	Summarize the concept of Database Languages, Database Users.	PO2	3
ACSB08.03	CLO 3	Identify the Various Components of overall DBS architecture.	PO1	3
ACSB08.04	CLO 4	Use the concept of ER Model.	PO2,PO3	3
ACSB08.05	CLO 5	Describe Basics of Relational Model.	PO1	2
ACSB08.06	CLO 6	Determine Relational algebra, The Self variable.	PO2	3
ACSB08.07	CLO 7	Understand selection and projection, set operations.	PO2, PO3	3
ACSB08.08	CLO 8	Determine renaming, joins, division.	PO2	2
ACSB08.09	CLO 9	Use examples of algebra queries.	PO3	3
ACSB08.10	CLO 10	Illustrate Tuple relational calculus, Domain relational calculus, and also expressive power of algebra and calculus.	PO2, PO3	3
ACSB08.11	CLO 11	Understand SQL – Data Definition commands, Queries with various options.	PO2,PO5	3
ACSB08.12	CLO 12	Analyze the concept of Mata manipulation commands, Views, Joins, views.	PO2,PO5	2
ACSB08.13	CLO 13	Illustrate Calling a function, Returning multiple values from a function.	PO2, PO3	2
ACSB08.14	CLO 14	Contrast the Usage of Relational database design, Functional dependencies, Armstrong Axioms	PO2	2
ACSB08.15	CLO 15	Define Normalization, 2nd and 3rd Normalization, Basic definitions of MVDs and JDs, 4th and 5th normal forms.	PO2, PO3	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACSB08.16	CLO 16	Discuss the concept of Transaction, Transaction State.	PO1, PO2	2
ACSB08.17	CLO 17	Understand Atomicity and Durability, Concurrent Executions.	PO1, PO2	3
ACSB08.18	CLO 18	Summarize the concept of Serializability, Recoverability.	PO1,PO2	2
ACSB08.19	CLO 19	Discuss the Concurrency Control and various Protocols.	PO2	2
ACSB08.20	CLO 20	Understand the concept of Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery with Concurrent Transactions Buffer Management.	PO1, PO2	3
ACSB08.21	CLO 21	Knowledge about the Physical Storage Media, Magnetic Disks, Storage Access	PO1, PO2	3
ACSB08.22	CLO 22	Apply Working with File Organization, Organization of Records in Files.	PO1	3
ACSB08.23	CLO 23	Understand Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing.	PO1	3
ACSB08.24	CLO 24	Comparison of Ordered Indexing and Hashing.	PO5	3
ACSB08.25	CLO 25	Illustrate Query Processing: Overview, Measures of Query Cost.	PO3	3

3= High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)		Program Outcomes (POs)					
	PO1	PO2	PO3	PO5	PSO1	PSO2	PSO3
CO1	2	3	3		2		
CO2		2	3			3	
CO3		2	2	2		3	
CO4	2	2				3	
CO5	3	3		3			2

3= High; 2 = Medium; 1 = Low

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

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	
CLO 17		2	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										

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 25					3										3

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2,PO3, PO5, PSO1,PSO 2,PSO3	SEE Exams	PO1, PO2,PO3, PO5, PSO1,PSO2, PSO3	Assignments	PO1, PO2,PSO2	Seminars	PO2
Laboratory Practices	PO2	Student Viva	PO3	Mini Project	PO3	Certification	-
Term Paper	-						

XIV. ASSESSMENT METHODOLOGIES – INDIRECT

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

XV. SYLLABUS

Module-I	CONCEPTUAL MODELING INTRODUCTION
Introduction to Data bases: Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Various Components of overall DBS architecture, Various Concepts of ER Model, Basics of Relational Model	
Module-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.	
Module-III	**SQL QUERY - BASICS , RDBMS - NORMALIZATION**
SQL – Data Definition commands, Queries with various options, Mata manipulation commands, Views, Joins, views, integrity and security; Relational database design: Pitfalls of RDBD, Lossless join decomposition, Functional dependencies , Armstrong Axioms, Normalization for relational databases 1st , 2 nd and 3rd normal forms, Basic definitions of MVDs and JDs, 4th and 5th normal forms	
Module-IV	**TRANSACTION MANAGEMENT**
Transaction processing: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability. Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery With Concurrent Transactions Buffer Management	

Module-V	DATA STORAGE AND QUERY PROCESSING
Data storage: Overview of Physical Storage Media, Magnetic Disks, Storage Access, File Organization, Organization of Records in Files. Indexing and Hashing: Basic Concepts: Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing. Query Processing: Overview, Measures of Query Cost.	
Text Books:	
1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 6 th Edition, 2017.	
Reference Books:	
1. Michael H.Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007. 2. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2007. 3. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States, 1st Edition, 2000. 4. Peter Rob, Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003	

XVI. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Describe the Purpose of Database Systems, Data Models, and View of Data.	CLO 1	T1: 1.1- 1.5
2-3	Summarize the concept of Database Languages, Database Users.	CLO 2	T1: 1.1- 1.5
4-5	Identify the Various Components of overall DBS architecture.	CLO 3	T1: 1. 6 - 1.8, 1.10,T1: 2.1
6-7	Use the concept of ER Model.	CLO 4	T1: 2.2-2.6
8-9	Describe Basics of Relational Model.	CLO 5	T1: 3.1-3.7
10-11	Determine Relational algebra, The Self variable.	CLO 6	T1: 4.1, 4.2.2
12-13	Understand selection and projection, set operations.	CLO 7	T1: 4.1, 4.2.2
14-15	Determine renaming, joins, division.	CLO 8	T1: 4.1, 4.2.2
16-18	Use examples of algebra queries.	CLO 9	T1: 5.2-5.5
19-20	Illustrate Tuple relational calculus, Domain relational calculus, and also expressive power of algebra and calculus.	CLO 10	T1:4.3, 4.4
21-22	Understand SQL – Data Definition commands, Queries with various options.	CLO 11	T1: 5.2-5.5
23	Analyze the concept of Mata manipulation commands, Views, Joins, views.	CLO 12	T1: 4.1, 4.2.2
24-25	Illustrate Calling a function, Returning multiple values from a function.	CLO 13	T1: 5.6- 5.8

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
26-27	Contrast the Usage of Relational database design, Functional dependencies, Armstrong Axioms	CLO 14	T1: 19.1, 19.1.3
28-29	Define Normalization, 2nd and 3rd Normalization, Basic definitions of MVDs and JDs, 4th and 5th normal forms.	CLO 15	T2: 19.4-19.8
30	Discuss the concept of Transaction, Transaction State.	CLO 16	T1:9.6
31	Understand Atomicity and Durability, Concurrent Executions.	CLO 17	T1: 15.1-15.29
32	Summarize the concept of Serializability, Recoverability.	CLO 18	T1: 16.1, 16.2 T1: 16.3, 16.4
33-34	Discuss the Concurrency Control and various Protocols.	CLO 19	T1: 16.1, 16.2 T1: 16.3, 16.4
35-36-37-38	Understand the concept of Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery with Concurrent Transactions Buffer Management.	CLO 20	T1: 16.1, 16.2 T1: 16.3, 16.4
39	Knowledge about the Physical Storage Media, Magnetic Disks, Storage Access	CLO 21	T1: 8.1,8.2
40	Apply Working with File Organization, Organization of Records in Files.	CLO 22	T1: 8.3- 8.4
41-42	Understand Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing.	CLO 23	T1: 10.3 - 10.6
43	Comparison of Ordered Indexing and Hashing.	CLO 24	T1: 11.1 – 11.4
44-45	Illustrate Query Processing: Overview, Measures of Query Cost.	CLO 25	T1:12.1- 12.3

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

S no	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Conversion of ER model into Relational Model.	Seminars /Guest Lecture	PO2	PSO1
2	Practical Implementation of triggers and assertions using PL/SQL	Assignments/ Lab experiments	PO3,PO5	PSO2
3	Implementation of Transaction and security restriction using SQL	Assignments/ Lab experiments	PO2,PO5	PSO2

Prepared by:
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