INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**DATABASE MANAGEMENT SYSTEMS**			
Course Code	**A40507**			
Regulation	**R15 - JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	3	1	-	3
Course Coordinator	Dr, M, Madhu Bala, Professor			
Team of Instructors	Ms. K Mayuri, Assistant Professor Mr. A V Srinivas, 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. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	3	4	Basic concepts of files, data structures and design of database systems

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks

Mid Semester Test There shall be two midterm examinations. Each midterm examination consists of subjective type and objective type tests. The subjective test is for 10 marks of 60 minutes duration. Subjective test of shall contain 4 questions; the student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks of 20 minutes duration. It consists of 10 Multiple choice and 10 objective type questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.	75	100

Sessional Marks	University End Exam marks	Total marks
Assignment Five marks are earmarked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSE OBJECTIVES:

I. **Learn** the basic concepts on design and querying RDBMS applications.

II. **Understand** the query building skills using relational algebra and calculus.

III. **Improve** the schemas using normal forms to address the problems like decomposition, functional dependency and redundancy.

IV. **Demonstrate** the basic issues of transaction processing and concurrency control.

V. **Study** the concepts of database storage structures and identify the access techniques.

VI. COURSE OUTCOMES:

At the end of the course the students are able to:

1. **Distinguish** between a Traditional File System and a database System.
2. **Describe** basic database concepts, Data Models, Schemas, Instances, and Components in the DBMS architecture.
3. **Identify** the entities, relationships and demonstrate the features of E-R model.
4. **Design** the real world database systems using Entity Relationship Diagrams (ERD) from the requirements specification.
5. **Apply** normalization techniques to normalize a database.
6. **Identify** the data integrity and security requirements of the database.
7. **Apply** techniques for managing the transactions, concurrency control and recovery of database.
8. **Write** queries in Relational Algebra and Relational Calculus.
9. **Write** queries in SQL for database creation and maintenance.
10. **Use** SQL queries for data aggregation, calculations, views, joins, sub-queries, embedded queries, manipulation, triggers and report generation.
11. **Differentiate** Static and Dynamic hashing techniques, indexes, costs for file operations, B+trees with ISAM.
12. **Design** and implement a full real size database system.

VII. HOW PROGRAMS ARE ACCESSED:

Program Outcomes		Level	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.	H	Exercises
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.	H	Exercises
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.	H	Assignments
PO4	**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.	S	Projects
PO5	**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.	H	Mini Projects
PO6	**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.	N	--
PO7	**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.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	H	Projects
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.	N	--
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.	S	Projects
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.	N	--

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** The ability to research, understand and implement	S	Lectures,

Program Specific Outcomes		Level	Proficiency assessed by
	computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.		Assignments
PSO2	**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.	H	Projects
PSO3	**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.	S	Guest Lectures

N - None **S - Supportive** **H - Highly Related**

IX. SYLLABUS:

UNIT – I

Introduction -Data base System Applications, Purpose of data base Systems, View of Data – Data Abstraction – Instances and Schemas – data Models, Database Languages – DDL – DML – database Access for applications Programs, Transaction Management, Data Storage and Querying, Database architecture, Database users and administrators, History of database systems, Introduction to database design, ER Diagrams, Beyond ER design, Entities, Attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual design with ER model, Conceptual design for large enterprises, Relational Model: Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.

UNIT – II

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.
Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT– Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.

UNIT – III

Introduction to Schema refinement – Problems Caused by redundancy – Decompositions – Problem related to decomposition –Functional dependencies, reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF ,Properties of decompositions, Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – forth Normal Form, Join dependencies, Fifth Normal Form, Inclusion Dependencies.

UNIT – IV

Transaction Management: Transaction Concept-Transaction State- Implementation of atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability. Concurrency Control: Lock-Based Protocols –time Stamp Based Protocols- Validation Based Protocols-Multiple Granularity. 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.

UNIT – V

Overview of Storage and Indexing: Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations . Tree Structured Indexing: Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure-Search, Insert, and Delete-Hash Based Indexing: Static Hashing – Extendable hashing – Linear Hashing –Extendable vs. Linear hashing.

Text books:

1. Raghurama Krishnan, Johannes Gehrke (2003), Database Management Systems, 3rd edition, Tata McGraw Hill, India.
2. Database System Concepts, A.Silberschatz, H.F.Korth, S.Sudharshan, Mc Grab hill, 5th Edition, 2006

References:

1. Database systems, 6th edition, Ramez Elmasri, Shamkant, B.Navathe, Pearson Education, 2013
2. Database system concepts, Peter rob and carles coronel, cengage learning 2008
3. Introduction to database management ML Gillenson & others, Willey student edition.

X. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes.

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1-4	**Understand** the basic concepts of databases and different type s of data models, languages	Introduction, Data base System Applications, Purpose of data base Systems.	T2: 1.1, 1.2
		View of Data – Data Abstraction, Instances and Schemas	T2: 1.3
		Data Models	T2: 1.4
		Database Languages – DDL – DML – Database Access for applications Programs	T2: 1.5
5-8	**Describe** overall architecture of DBMS	Transaction Management, Data Storage and Querying	T2: 1.7, 1.8.1
		Database architecture	T2: 1.8
		Database users and administrators, History of database systems	T2:1.6, 1.10
		Introduction to database design, ER Diagrams Beyond ER design	T1: 2.1
9-12	**Identify** the entities and relationships and demonstrate the features of ER model	Entities, Attributes and entity sets, Relationships and relationship sets	T1: 2.2, 2.3
		Additional features of ER model	T1: 2.4
		Conceptual design with ER model, Conceptual design for	T1: 2.5, 2.6
13-16	**Apply** integrity constraints	Relational Model: Introduction to the Relational Model – Integrity Constraint Over relations	T1: 3.1, 3.2
		Enforcing Integrity constraints – Querying relational data – Logical data base Design	T1:3.3 - 3.5
		Introduction to Views – Destroying /altering Tables and Views	T1:3.6, 3.7
17-19	**Analyze and solve** database problems using relational algebra, relational calculus	Relational Algebra and Calculus: Relational Algebra – Selection and projection –	T1: 4.1, 4.2.1
		set operations – renaming, Joins – Division	T1: 4.2.2 - 4.2.5
20-28	**Analyze and solve** database problems using SQL	Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.	T1:4.3, 4.4
		Form of Basic SQL Query – Examples of Basic SQL Queries	T1: 5.2
		Introduction to Nested Queries – Correlated Nested Queries Set	T1: 5.4
		Comparison Operators – Aggregative Operators	T1: 5.4.3, 5.5

		NULL values – Comparison using Null values , Logical connectivity's – AND, OR and NOT	T1: 5.6
		Disallowing NULL values – Complex Integrity Constraints in SQL ,Triggers and Active Data bases	T1: 5.7, 5.8
29-30	**Discuss** basic concepts of schema refinement	Introduction to Schema refinement – Problems Caused by redundancy	T1: 19.1
		Decompositions – Problem related to decomposition	T1:19.1.3
31-38	**Define and Apply** the normal forms	Functional dependencies, reasoning about FDS – FIRST, SECOND Normal forms	T1: 19.4
		THIRD Normal forms – BCNF ,Properties of decompositions,	T1:19.4, 19.5
		Lossless join Decomposition – Dependency preserving Decomposition	T1: 19.5
		Schema refinement in Data base Design – Multi valued Dependencies	T1: 19.7, 19.8.1
		Forth Normal Form,Join dependencies,Fifth Normal Form,Inclusion Dependencies	T1: 19.8.2 -19.8.5
39-44	**Understand** the basic concepts of transaction and ACID properties	Transaction Management: Transaction Concept-Transaction State-	T2: 15.1, 15.2
		Implementation of atomicity and Durability,	T2: 15.3
	Solve problems of Concurrent Execution and Implement ACID properties	Concurrent Executions, Serializability , Recoverability,	T2: 15.4 - 15.6
		Implementation of Isolation, Testing for Serializability.	T2: 15.7, 15.9
45-47	**Describe** the Concurrency control protocols	Concurrency Control: Lock-Based Protocols – time Stamp Based Protocols-	T2: 16.1, 16.2
		Validation Based Protocols-Multiple Granularity.	T2: 16.3, 16.4
48-53	**Understand** storage structure, recovery process	Recovery System-Failure Classification-storage Structure	T2: 17.1, 17.2
		recovery and Atomicity-Log Based Recovery-	T2: 17.3, 17.4
		Recovery with Concurrent Transactions-	T2: 17.6
		Buffer Management-Failure with loss of Non Volatile Storage	T2: 17.7, 17.8
		Advance Recovery Systems-Remote Backup Systems	T2: 17.9, 17.10
54-56	**Understand** the basic concepts of file organization	Overview of Storage and Indexing: Data on External Storage	T1: 8.1
		File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes	T1: 8.2
57-59	**Differentiate** Index data structures and File Organizations	Index data Structures – Hash Based Indexing	T1: 8.3.1
		Tree base Indexing – Comparison of File Organizations	T1: 8.3.2, 8.4
60-61	**Apply** Indexes ,ISAM on trees	Tree Structured Indexing: Intuitions for tree Indexes	T1: 10.1
		Indexed Sequential Access Methods (ISAM)	T1: 10.2
62-63	**Discuss** Dynamic Index Structures and apply different operations	B+ Trees: A Dynamic Index Structure-Search, insert, Delete	T1: 10.3 - 10.6
64-65	**Differentiate** Static and Dynamic hashing techniques	Hash Based Indexing: Static Hashing – Extendable hashing	T1: 11.1, 11.2
		Linear Hashing –Extendable vs. Liner hashing	T1: 11.3, 11.4

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

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	S	S	H								S		H	S	
II		S	H	S	S								S	H	S
III	H			S	H						S		S	S	S
IV	S			S	H						S		S	S	
V		S		S	H								H	H	S

S – Supportive **H - Highly Related**

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

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		S		H									S		
2	H														
3	H	H	S	H									S		
4		H	H	H									H		
5		H	H	H									H		
6		H	H	H									S		
7		H	H	S									H		
8	H														
9	H														
10		H											H		
11		H	H	H									H		
12	H														

S – Supportive **H - Highly Related**

Prepared by: Dr, M, Madhu Bala, Professor.

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