

# **DATABASE MANAGEMENT SYSTEMS**

Subject Code: **(CS402ES)**

Regulations : R16 JNTUH

Class :III Year B.Tech ECE I Semester



**Department of Electronics and communication Engineering**  
**BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY**

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## DATABASE MANAGEMENT SYSTEMS (CS402ES) COURSE PLANNER

### Course Overview:

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, data definition and manipulation languages, database security and administration. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery and various types of databases like distributed database, and intelligent database, Client/Server. Students undertake a semester project to design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

### Prerequisites:

Concepts of computer programming (like programming in C --Files concepts). The course introduced under the subject ‘C Programming’ or ‘Computer Programming’ or ‘Computer Programming and Data Structures’ of B.Tech 1st Year is sufficient to cope up this subject.

### Course Objectives:

At the end of the course, the students will be able to:

- *Understand* the basic concepts and the applications of database systems.
- *Master* the basics of SQL and construct queries using SQL.
- *Understand* the relational database design principles.
- *Familiar* with the basic issues of transaction processing and concurrency control.
- *Familiar* with database storage structures and access techniques.

### Course Outcomes:

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course the student must demonstrate the knowledge and ability to:		
CO1	<i>Demonstrate</i> the basic elements of a relational database management system.	Application ( Level 2)
CO2	<i>Identify</i> the data models for relevant problems.	Remember( Level 1)
CO3	<i>Design</i> entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.	Analyze, Create ( Level 4, Level 6)

CO4	<i>Demonstrate</i> their understanding of key notions of query evaluation and optimization techniques.	Application ( Level 2)
CO5	<i>Extend</i> normalization for the development of application software's.	

### How Program Outcomes are assessed:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments, Tutorials, Mock Tests
PO2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Assignments, Tutorials
PO3	<b>Design/development of solutions:</b> 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	Assignments, Tutorials, Mock Tests
PO4	<b>Conduct investigations of complex problems:</b> 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.	3	Assignments, Tutorials, Mock Tests
PO5	<b>Modern tool usage:</b> 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	Assignments, Tutorials, Mock Tests
PO6	<b>The engineer and society:</b> 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.	-	-
PO7	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	-
PO9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	-	-
PO10	<b>Communication:</b> 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	<b>Project management and finance:</b> 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.	-	-

Program Outcomes (PO)		Level	Proficiency assessed by
PO12	<b>Life-long learning:</b> 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.	-	-

### How Program Specific Outcomes are Assessed:

Program Specific Outcomes (PSO)		Level	Proficiency assessed by
PSO1	<b>Software Development and Research Ability:</b> Ability to understand the structure and development methodologies of software systems. Possess professional skills and knowledge of software design process. Familiarity and practical competence with a broad range of programming language and open source platforms. Use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.	3	Assignments, Tutorials, Mock Tests
PSO2	<b>Foundation of mathematical concepts:</b> Ability to apply the acquired knowledge of basic skills, principles of computing, mathematical foundations, algorithmic principles, modeling and design of computer-based systems in solving real world engineering Problems.	2	Assignments, Tutorials
PSO3	<b>Successful Career:</b> Ability to update knowledge continuously in the tools like Rational Rose, MATLAB, Argo UML, R Language and technologies like Storage, Computing, Communication to meet the industry requirements in creating innovative career paths for immediate employment and for higher studies.	3	Assignments, Tutorials, Mock Tests

**1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)    -: None**

### Course Content:

**UNIT - I** Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems. Introduction to Data base design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises. Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

**UNIT - II** Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus. SQL: Queries, Constraints, Triggers: Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity All JNTU World Constraints in SQL, Triggers and Active Data bases, Designing Active Databases.

**UNIT - III** Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization, Schema Refinement in Database Design, Other Kinds of Dependencies.

**UNIT - IV** Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity Transaction Isolation Levels, Implementation of Isolation Levels. Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes. Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with loss of nonvolatile storage, Early Lock Release and Logical Undo Operations, Remote Backup systems.

**UNIT - V** Storage and Indexing: Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations. Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete. Hash-Based Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendible vs. Linear Hashing.

### **Books and References:**

#### **Text Books**

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition. (Part of UNIT-I, UNIT-II, UNIT-III, UNIT-V)
2. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill Education(India) Private Limited 1, 6th edition.( Part of UNIT-I,UNIT-IV)

#### **Reference Books**

- 1) Database systems, 6<sup>th</sup> edition, Ramez Elmasri, Shamkant B.Navathe, Pearson Education.
- 2) Database Systems Design, Implementation, and Management, Peter Rob & Carlos Coronel, 7<sup>th</sup> Ed.
- 3) Fundamentals of Database Systems, ElmasriNavrate, Pearson Education
- 4) Introduction to Database Systems, C.J.Date, Pearson Education
- 5) Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis.G

#### **NPTEL Web Course:**

[https://onlinecourses.nptel.ac.in/noc18\\_cs15/preview](https://onlinecourses.nptel.ac.in/noc18_cs15/preview)

<http://nptel.ac.in/courses/106106093/>

<http://nptel.ac.in/courses/106106095/>

#### **NPTEL Video Course:**

<https://www.youtube.com/watch?v=EUzsy3W4I0g>

<https://www.youtube.com/playlist?list=PL52484DF04A264E59>

#### **Relevant syllabus for GATE:**

Databases: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

#### **Relevant syllabus for IES:** Not Applicable

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### Course Plan

S. No.	WEEK	UNIT	Subject Topics / Sub-Topics	Course Learning Outcomes	References Text Books Journals Websites
1	1	1	Introduction-Database System Applications, Purpose of Database Systems	<b>Understand</b> Database System Applications, Purpose of Database Systems	T1
2		1	View of Data - Data Abstraction, Instances and Schemas	<b>Understand</b> Data Abstraction, Instances and Schemas	T1
3		1	Data Models, Database Languages – DDL	<b>Understand</b> Data Models, Database Languages - DDL	T1
4		1	DML, Database Architecture	<b>Understand</b> DML, Database Architecture	T1
5		1	Database Users and Administrators, History of Database Systems	<b>Demonstrate</b> Database Users and Administrators, History of Database Systems	T1
6	2	1	Introduction to Database design, ER diagrams	<b>Understand</b> Database design, ER diagrams	T1
7		1	Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets	<b>Understand</b> Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets	T1
8		1	Additional features of ER Model, Conceptual Design with the ER Model	<b>Demonstrate</b> Additional features of ER Model, Conceptual Design with the ER Model	T1
9		1	Additional features of ER Model, Conceptual Design with the ER Model		
10		1	Conceptual Design for Large enterprises	<b>Understand</b> Conceptual Design for Large enterprises	T1
11	3	1	Relational Model: Introduction to the Relational Model - Integrity Constraints over Relations	<b>Understand</b> Relational Model - Integrity Constraints over Relations	T1
12		1	Enforcing Integrity constraints, Querying relational data	<b>Understand</b> Enforcing Integrity constraints, Querying relational data	T1
13		1	Logical database Design	<b>Demonstrate</b> Logical database Design	T1
14		1	Introduction to Views Destroying/altering Tables and Views.	<b>Apply</b> Destroying/ altering Tables and Views.	T1

15		1	Bridge Class #1		
16	4	2	Relational Algebra and Calculus: Relational Algebra - Selection and Projection	<b>Understand</b> Relational Algebra and Calculus: Relational Algebra - Selection and Projection	T1
17		2	Set operations, Renaming, Joins, Division	<b>Apply</b> Set operations, Renaming, Joins, Division in Relational Algebra	T1
18		2	Examples of Algebra Queries	<b>Apply</b> Examples of Algebra Queries	T1
19		2	Relational calculus - Tuple relational Calculus, Domain relational calculus.	<b>Understand</b> Relational calculus - Tuple relational Calculus	T1
20		2	Expressive Power of Algebra and calculus	<b>State</b> Expressive Power of Algebra and calculus	T1
21		2	MOCK TEST#1		
22	5	2	Form of Basic SQL Query - Examples of Basic SQL Queries	<b>Apply</b> Form of Basic SQL Query - Examples of Basic SQL Queries	T1
23		2	Introduction to Nested Queries	<b>Understand</b> Nested Queries	T1
24		2	Correlated Nested Queries	<b>Understand</b> Correlated Nested Queries	T1
25		2	Set - Comparison Operators, Aggregate Operators	<b>Describe</b> Set - Comparison Operators, Aggregate Operators	T1
25		2	NULL values - Comparison using Null values	<b>Define</b> NULL values - Comparison using Null values	T1
27	6	2	Logical connectives - AND, OR and NOT	<b>Describe</b> Logical connectives - AND, OR and NOT	T1
28		2	Impact on SQL Constructs, Outer Joins, Disallowing NULL values	<b>Explain</b> SQL Constructs, Outer Joins	T1
29		2	Complex Integrity Constraints in SQL Triggers and Active Data bases	<b>Define</b> Disallowing NULL values	T1
30		3	Introduction to Schema Refinement	<b>Understand</b> Schema Refinement	T1
31	7	3	Problems Caused by redundancy	<b>Solve</b> Problems Caused by redundancy	T1
32		3	Decompositions - Problem related to decomposition	<b>Solve</b> Decompositions - Problem related to decomposition	T1

33		3	Functional Dependencies - Reasoning about FDS, Normal Forms – FIRST	<b>Apply</b> Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST	T1
34		3	SECOND, THIRD Normal forms – BCNF	<b>Apply</b> SECOND, THIRD Normal forms - BCNF	T1
35		3	SECOND, THIRD Normal forms – BCNF	<b>Apply</b> SECOND, THIRD Normal forms - BCNF	T1
36	8	3	Properties of Decompositions - Loss less join Decomposition	<b>Describe</b> Properties of Decompositions - Loss less join Decomposition	T1
37		3	Properties of Decompositions - Loss less join Decomposition	<b>Describe</b> Properties of Decompositions - Loss less join Decomposition	T1
38		3	Dependency preserving Decomposition	<b>Describe</b> Dependency preserving Decomposition	T1
39		3	Schema Refinement in Data base Design	<b>Define</b> Schema Refinement in Data base Design	T1
40		3	Multi valued Dependencies - FOURTH Normal Form	<b>Describe</b> Multi valued Dependencies - FOURTH Normal Form	T1
41	9	3	Join Dependencies	<b>Describe</b> Join Dependencies	T1
42		3	FIFTH Normal form, Inclusion Dependencies	<b>Describe</b> FIFTH Normal form, Inclusion Dependencies	T1
43		3	FIFTH Normal form, Inclusion Dependencies	<b>Describe</b> FIFTH Normal form, Inclusion Dependencies	T1
44		4	Transaction Management - Transaction Concept	<b>Understand</b> Transaction Management - Transaction Concept	T2
45		4	Transaction State - Implementation of Atomicity and Durability	<b>Understand</b> Transaction State - Implementation of Atomicity and Durability	T2
46	10	4	Concurrent - Executions - Serializability - Recoverability	<b>Identify</b> Concurrent - Executions - Serializability - Recoverability	T2
47		4	Implementation of Isolation	<b>Implement</b> Isolation	T2
48		4	Bride Class#3		
49		4	Testing for serializability	<b>Define</b> Testing for serializability	T2



50		4	Concurrency Control - Lock - Based Protocols	<b>Explain</b> Concurrency Control - Lock - Based Protocols	T2
50	11	4	Timestamp Based Protocols	<b>Explain</b> Timestamp Based Protocols	T2
52		4	Validation - Based Protocols - Multiple Granularity	<b>Define</b> Validation - Based Protocols - Multiple Granularity	T2
53		4	Recovery System-Failure Classification	<b>Discuss</b> Recovery System-Failure Classification	T2
54		4	Storage Structure-Recovery and Atomicity ,Log-Based Recovery	<b>Define</b> Storage Structure-Recovery and Atomicity	T2
55		4	Recovery with Concurrent Transactions	<b>Define</b> Recovery with Concurrent Transactions	T2
56		12	4	Buffer Management - Failure with loss of nonvolatile storage	<b>Define</b> Buffer Management - Failure with loss of nonvolatile storage
57	4		Advance Recovery systems, Remote Backup systems , Data streaming.	<b>Discuss</b> Advance Recovery systems, Remote Backup systems	T2
58	4		MOCK TEST#2		
59	5		Overview of Storage and Indexing: Data on External Storage	<b>Understand</b> Overview of Storage and Indexing: Data on External Storage	T1
60	5		File Organization and Indexing - Clustered Indexes	<b>Understand</b> File Organization and Indexing - Clustered Indexes	T1
61	13		5	Primary and Secondary Indexes	<b>Identify</b> Primary and Secondary Indexes
62		5	Index data Structures - Hash Based Indexing, Tree based Indexing	<b>Describe</b> Index data Structures - Hash Based Indexing, Tree based Indexing	T1
63		5	Comparison of File Organizations	<b>Understand</b> Comparison of File Organizations	T1
64		5	Bridge Class #4		
65		5	Tree Structured Indexing: Intuitions for tree indexes	<b>Understand</b> Tree Structured Indexing: Intuitions for tree indexes	T1
66	14	5	Indexed Sequential Access Methods(ISAM) B+ Trees	<b>Understand</b> Indexed Sequential Access Methods(ISAM) B+ Trees	T1

67	5	A Dynamic Index Structure, Search, Insert, Delete	<b>Define</b> Dynamic Index Structure, Search, Insert, Delete	T1
68	5	Hash Based Indexing: Static Hashing, Extendable hashing	<b>Distinguish</b> Hash Based Indexing: Static Hashing, Extendable hashing	T1
69	5	Linear Hashing, Extendible vs. Linear Hashing	<b>Distinguish</b> Linear Hashing, Extendible vs. Linear Hashing	T1

Course Outcomes	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	3	2	2	2	3	-	2	-	2	3	-	1	2	3	2
CO2	2	3	3	2	3	-	2	-	2	3	-	2	2	3	2
CO3	2	2	3	2	3	-	2	-	2	3	-	2	2	2	3
CO4	3	2	3	2	2	-	2	-	2	2	-	2	2	3	2
CO5	2	2	3	2	3	-	2	-	2	2	-	2	2	2	3

1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)      -: None

### Question Bank

#### Descriptive Questions

#### Unit-1

#### Short Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Define the terms data and information?	REMEMBERING	1
2	Define (i) Database (ii)DBMS	REMEMBERING	1
3	List the advantages and applications of DBMS?	REMEMBERING	1
4	What are the disadvantages of file processing system?	REMEMBERING	1
5	Define instances and schemas of database?	REMEMBERING	1
6	What is data model? List the types of data models?	REMEMBERING	1
7	Discuss about Data Definition language?	CREATING	6
8	Discuss about Data Manipulation language?	CREATING	6

9	What is data Abstraction? Give the levels of data abstraction?	REMEMBERING	1
10	Who is DBA? What are the responsibilities of DBA?	REMEMBERING	1
11	Discuss Data Independence?	CREATING	6
12	What is an entity relationship model?	REMEMBERING	1
13	Define (i) Entity (ii) Attribute	REMEMBERING	1
14	Define Relationship and Relationship set?	REMEMBERING	1
15	What are key constraint and participating constraints?	REMEMBERING	1
16	Define weak entity and strong entity sets?	REMEMBERING	1
17	Define relation, relation instance and relation schema.	REMEMBERING	1
18	Define i) super key ii) candidate key iii) primary key	REMEMBERING	1
19	Explain the use of foreign key constraint?	UNDRESTANDING	2
20	Define the terms arity and cardinality of relation?	REMEMBERING	1
21	What are domain constraints	REMEMBERING	1
22	Explain about querying relational data?	UNDRESTANDING	2
23	Define views?	REMEMBERING	1
24	Discuss how can you change the data in the table?	CREATING	6
25	List various types of attributes?	REMEMBERING	1
26	Discuss how can you alter and destroy tables?	CREATING	6
27	Explain the use of null values?	UNDRESTANDING	2

### Unit-1

#### Long Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Compare and Contrast file Systems with database system?	UNDRESTANDING	2
2	Define Data Abstraction and discuss levels of Abstraction?	REMEMBERING	1

3	Discuss about different types of Data models?	CREATING	6
4	Describe the architecture of DBMS?	CREATING	6
5	Discuss additional features of the ER-Models?	CREATING	6
6	Discuss about the Conceptual Design with the ER-Model?	CREATING	6
7	Write about views and updates on views?	REMEMBERING	1
8	Explain different types of database users and write the functions of DBA?	UNDREANDING	2
9	Explain about different types of integrity constraints?	UNDREANDING	2
10	Discuss about the logical database Design?	CREATING	6
11	Distinguish strong entity set with weak entity set? Draw an ER diagram to illustrate Weak entity set?	UNDREANDING	2
12	Explain how the integrity constraints are specified and enforces?	UNDREANDING	2
13	Explain in detail about views?	UNDREANDING	2

### Unit-2

#### Short Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Define relational database query?	REMEMBERING	1
2	Explain different types of query languages?	UNDREANDING	2
3	Explain about relational algebra?	UNDREANDING	2
4	State about SELECT operation in Relational algebra?	ANALYZE	4
5	State about PROJECT operation in Relational algebra?	ANALYZE	4
6	Explain about set operations?	UNDREANDING	2
7	Discuss the use of rename operation?	CREATING	6
8	Define join ? Explain different join operations?	REMEMBERING	1

9	Illustrate division operation?	UNDRESTDANDING	2
10	. Explain about tuple relational calculus?	UNDRESTDANDING	2
11	. Explain about Domain relational calculus?	UNDRESTDANDING	2
12	. Discuss about the expressive power of relational algebra and calculus?	CREATING	6
13	. Discuss the basic form of SQL query?	CREATING	6
14	Explain the working of union, intersection and except operations?	UNDRESTDANDING	2
15	Define nested queries?	REMEMBERING	1
16	Define correlated nested queries?	REMEMBERING	1
17	Explain Aggregate Functions?	UNDRESTDANDING	2
18	What is the use of groupby and having clauses?	REMEMBERING	1
19	Define Null Values?	REMEMBERING	1
20	Define tuple variable with its syntax?	REMEMBERING	1
21	Define outer join? Explain its types?	REMEMBERING	1
22	Explain how to create new domain?	UNDRESTDANDING	2
23	Define Assertions?	REMEMBERING	1
24	. Discuss about trigger?	CREATING	6
25	Demonstrate how to add a NOT NULL column to a table?	UNDRESTDANDING	2
26	Write a TRC query to find the names of sailors who have reserved boat103?	REMEMBERING	1
27	Write a DRC query to find the names of sailors who have reserved red boat?	REMEMBERING	1

## Unit-2

### Long Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Illustrate different operations in Relational algebra with an example?	UNDRESTDANDING	2
2	Define Join? Explain different types of	REMEMBERING	1

	joins?		
3	Discuss about Relational calculus in detail?	CREATING	6
4	Define trigger and explain its three parts? Differentiate row level and statement level triggers?	REMEMBERING	1
5	Illustrate Group by and having clauses with examples?	UNDREANDING	2
6	Discuss about Complex integrity constraints in SQL?	CREATING	6
7	Define null value? Describe the effect of null values in database?	REMEMBERING	1
8	Discuss different types of aggregate operators with examples in SQL?	CREATING	6
9	Define a nested query?	REMEMBERING	1
10	Write a nested query to find the names of sailors who have reserved both a red and green boat?	REMEMBERING	1
11	Write a nested query to find the names of sailors who have reserved all boats?	REMEMBERING	1

### Unit-3

#### Short Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Define redundancy?	REMEMBERING	1
2	Define functional dependency?	REMEMBERING	1
3	Explain the problems with Redundancy?	UNDREANDING	2
4	What is decomposition? Explain the properties of Decomposition?	REMEMBERING	1
5	Discuss normalization?	CREATING	6
6	Illustrate functional dependency with example?	UNDREANDING	2
7	Illustrate fully functional dependency with example?	UNDREANDING	2
8	Demonstrate transitive dependency? Give an example?	UNDREANDING	2

9	Define First Normal Form?	REMEMBERING	1
10	Define Second Normal Form?	REMEMBERING	1
11	Define Third Normal Form?	REMEMBERING	1
12	Explain about Loss Less Join Decomposition?	UNDRESTANDING	2
13	Describe Dependency Preserving Decomposition?	CREATING	6
14	What is multi valued Dependency?	REMEMBERING	1
15	Define Fourth Normal Form?	REMEMBERING	1
16	Define Join Dependency?	REMEMBERING	1
17	Define BCNF?	REMEMBERING	1
18	Explain Fifth Normal Form?	UNDRESTANDING	2
19	Explain about Inclusion Dependency?	UNDRESTANDING	2

### Unit-3

#### Long Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Illustrate redundancy and the problems that it can cause	UNDRESTANDING	2
2	Define decomposition and how does it address redundancy? Discuss the problems that may be caused by the use of decompositions?	REMEMBERING	1
3	Define functional dependencies. How are primary keys related to FD's?	REMEMBERING	1
4	Define normalization? Explain 1NF,2NF,3NF normal forms	REMEMBERING	1
5	Compare and contrast BCNF with 3NF?	UNDRESTANDING	2
6	Describe properties of decompositions	CREATING	6

### Unit-4

#### Short Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Define a Transaction? List the properties of transaction	REMEMBERING	1
2	Discuss different phases(states) of transaction?	CREATING	6
3	What is shadow copy technique?	REMEMBERING	1
4	List the advantages of concurrent execution?	REMEMBERING	1
5	Define Schedule? What is a serial schedule?	REMEMBERING	1
6	Discuss the Procedure to test Serializability?	CREATING	6
7	Demonstrate Conflict Serializability?	UNDREANDING	2
8	Discuss View Serializability?	CREATING	6
9	Discuss recoverable schedules?	CREATING	6
10	Discuss cascade less schedules?	CREATING	6
11	Explain the procedure to test for serializability?	UNDREANDING	2
12	Explain about different types of locks?	UNDREANDING	2
13	Define Deadlock?	REMEMBERING	1
14	Explain about locking protocols?	UNDREANDING	2
15	Define Two Phase locking protocol?	REMEMBERING	1
16	Demonstrate the implementation of Isolation?	UNDREANDING	2
17	Explain how the locks are implemented?	UNDREANDING	2
18	Explain the rules of tree protocol?	UNDREANDING	2
19	What is timestamp? Explain different timestamps used by a transaction? [L1:REMEMBERING]	REMEMBERING	1
20	Explain Thomas write rule? [L2: UNDREANDING]	UNDREANDING	2
21	What are the phases of validation based protocol?	REMEMBERING	1



22	Explain different timestamps used by validation protocol?	UNDREANDING	2
23	Define granularity?	REMEMBERING	1
24	Explain about ARIES?	UNDREANDING	2

**Unit-4**  
**Long Answer Questions-**

S.No	Question	Blooms Taxony level	Course outcome
1	Explain ACID properties and illustrate them through examples?	UNDREANDING	2
2	Discuss How do you implement Atomicity and Durability	CREATING	6
3	Illustrate Concurrent execution of transaction with examples	UNDREANDING	2
4	Discuss Serializability in detail?	CREATING	6
5	Discuss two phase locking protocol and strict two phase locking protocols? [L6: CREATING]	CREATING	6
6	Describe Times tamp based locking protocols?	CREATING	6
7	Describe Validation-based locking protocols?	CREATING	6
8	Discuss in detail Multiple Granularity?	CREATING	6
9	Explain in detail storage structure	UNDREANDING	2
10	Discuss how do you recover from failure?	CREATING	6
11	Explain Buffer Management?	UNDREANDING	2
12	Explain different types of advanced recovery techniques	UNDREANDING	2
13	Write in detail about Remote Backup systems?	REMEMBERING	1

**Unit-5**  
**Short Answer Questions-**

S.No	Question	Blooms Taxony level	Course outcome
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1	Discuss about data on External storage?	CREATING	6
2	What is indexing and what are the different kinds of indexing?	REMEMBERING	1
3	Explain Clustered Indexes?	UNDREANDING	2
4	Discuss the Primary and Secondary indexes?	REMEMBERING	1
5	Define Tree Indexing?	REMEMBERING	1
6	Explain Hash based Indexing?	UNDREANDING	2
7	Compare different file organizations?	UNDREANDING	2
8	Discuss the intuition for Tree Indexes?	CREATING	6
9	Define Indexed Sequential Access Method?	REMEMBERING	1
10	Discuss about Overflow pages and Locking considerations of ISAM?	CREATING	6
11	Discuss the Cost model of Heap files, Sorted files and Clustered files?	CREATING	6
12	Explain the structure of B+ tree?	UNDREANDING	2
13	Describe how the insert and delete operations are performed in B+ tree?	CREATING	6
14	Explain how search is performed in B+ tree?	UNDREANDING	2
15	Define static Hashing?	REMEMBERING	1
16	Explain extendible hashing?	UNDREANDING	2
17	Define linear hashing?	REMEMBERING	1
18	Differentiate between linear and extensible hashing?	UNDREANDING	2

### Unit-5

#### Long Answer Questions-

S.No	Question	Blooms Taxony level	Course outcome
1	Write in detail about hash based indexing and Tree based indexing	REMEMBERING	1

	[L1:REMEMBERING]		
2	Compare I/O costs for all file organizations	UNDREANDING	2
3	Explain in detail about ISAM	UNDREANDING	2
4	Explain about B+ tree index file?	UNDREANDING	2
5	Demonstrate searching a given element in B+ trees? Explain with example?	UNDREANDING	2
6	Illustrate insertion of an element in B+ Tree with example	UNDREANDING	2
7	Illustrate deletion of an element in B+ Tree with example	UNDREANDING	2
8	Write in detail about Static Hashing	UNDREANDING	2
9	Explain in detail about Extendible hashing	UNDREANDING	2
10	Explain in detail about Linear hashing	UNDREANDING	2
11	Compare and contrast Extendible hashing With Linear hashing	UNDREANDING	2

### Objective-Type Questions

#### JNTUH

- 1) In the relational modes, cardinality is termed as:  
 (A) Number of tuples. (B) Number of attributes.  
 (C) Number of tables. (D) Number of constraints.

**Ans: A**

- 2) Relational calculus is a  
 (A) Procedural language. (B) Non- Procedural language.  
 (C) Data definition language. (D) High level language.

**Ans: B**

- 3) The view of total database content is  
 (A) Conceptual view. (B) Internal view.  
 (C) External view. (D) Physical View.

**Ans: A**

- 4) Cartesian product in relational algebra is  
 (A) a Unary operator. (B) a Binary operator.  
 (C) a Ternary operator. (D) not Defined.

**Ans: B Cartesian product in relational algebra is a binary operator.(It requires two operands. e.g., P X Q)**

- 5) DML is provided for  
 (A) Description of logical structure of database.

- (B) Addition of new structures in the database system.
- (C) Manipulation & processing of database.
- (D) Definition of physical structure of database system.

**Ans: C DML is provided for manipulation & processing of database. Data stored in the database is processed or manipulated using data manipulation language commands as its name)**

- 6) 'AS' clause is used in SQL for
- (A) Selection operation. (B) Rename operation.
  - (C) Join operation. (D) Projection operation.

**Ans: B 'AS' clause is used in SQL for rename operation. (e.g., SELECT ENO AS EMPLOYEE\_NO FROM EMP)**

- 7) ODBC stands for
- (A) Object Database Connectivity. (B) Oral Database Connectivity.
  - (C) Oracle Database Connectivity. (D) Open Database Connectivity.

**Ans: D**

- 8) Architecture of the database can be viewed as
- (A) two levels. (B) four levels. (C) three levels. (D) one level.

**Ans: C**

In a relational model, relations are termed as

- a) Tuples. (B) Attributes (C) Tables. (D) Rows.

- 10) The database schema is written in
- (A) HLL (B) DML (C) DDL (D) DCL

**Ans: C**

- 11) In the architecture of a database system external level is the
- (A) physical level. (B) logical level. (C) conceptual level (D) view level.

**Ans: D**

- 12) An entity set that does not have sufficient attributes to form a primary key is a
- (A) strong entity set. (B) weak entity set.
  - (C) simple entity set. (D) primary entity set.

**Ans: B**

- 13) In a Hierarchical model records are organized as
- (A) Graph. (B) List. (C) Links. (D) Tree.

**Ans: D**

- 14) In an E-R diagram attributes are represented by
- (A) rectangle. (B) square. (C) ellipse. (D) triangle.

**Ans: C**

- 15) In case of entity integrity, the primary key may be
- (A) not Null (B) Null (C) both Null & not Null. (D) any value.

**Ans: A**

- 16) In tuple relational calculus  $P1 \text{ @ } P2$  is equivalent to
- (A)  $\neg P1 \cup P2$  (B)  $P1 \cup P2$  (C)  $P1 \cap P2$  (D)  $P1 \cap \neg P2$

**Ans: A In tuple relational calculus  $P1 \_ P2$  is equivalent to  $\neg P1 \cup P2$ . (The logical implication expression  $A \_ B$ , meaning if A then B, is equivalent to  $\neg A \cup B$ )**

17) The language used in application programs to request data from the DBMS is referred to as the

- (A) DML (B) DDL(C) VDL (D) SDL

**Ans: A**

18) A logical schema

- (A) is the entire database.  
(B) is a standard way of organizing information into accessible parts.  
(C) describes how data is actually stored on disk.  
(D) both (A) and (C)

**Ans: A**

19) In a relation

- (A) Ordering of rows is immaterial  
(B) No two rows are identical  
(C) (A) and (B) both are true  
(D) None of these.

**Ans: C**

20) Which of the following is correct:

- (A) a SQL query automatically eliminates duplicates.  
(B) SQL permits attribute names to be repeated in the same relation.  
(C) a SQL query will not work if there are no indexes on the relations  
(D) None of these

**Ans: D**

21) It is better to use files than a DBMS when there are

- (A) Stringent real-time requirements.  
(B) Multiple users wish to access the data.  
(C) Complex relationships among data.  
(D) All of the above.

**Ans: B**

22) The conceptual model is

- (A) dependent on hardware.  
(B) dependent on software.  
(C) dependent on both hardware and software .  
(D) independent of both hardware and software.

**Ans: D**

23) What is a relationship called when it is maintained between two entities?

- (A) Unary (B) Binary(C) Ternary (D) Quaternary

**Ans: B**

24) Which of the following operation is used if we are interested in only certain columns of a table?

- (A) PROJECTION (B) SELECTION(C) UNION (D) JOIN

**Ans: A**

25) Which of the following is a legal expression in SQL?

- (A) SELECT NULL FROM EMPLOYEE;  
(B) SELECT NAME FROM EMPLOYEE;  
(C) SELECT NAME FROM EMPLOYEE WHERE SALARY = NULL;

(D) None of the above

**Ans: B**

- 26) The users who use easy-to-use menu are called  
(A) Sophisticated end users. (B) Naïve users.  
(C) Stand-alone users. (D) Casual end users.

**Ans: B**

- 27) Which database level is closest to the users?  
(A) External (B) Internal (C) Physical (D) Conceptual

**Ans: A**

- 28) Which are the two ways in which entities can participate in a relationship?  
(A) Passive and active (B) Total and partial  
(C) Simple and Complex (D) All of the above

**Ans: B**

- 29) The result of the UNION operation between R1 and R2 is a relation that includes  
(A) all the tuples of R1  
(B) all the tuples of R2  
(C) all the tuples of R1 and R2  
(D) all the tuples of R1 and R2 which have common columns

**Ans: D**

- 30) Which of the following is a comparison operator in SQL?  
(A) = (B) LIKE (C) BETWEEN (D) All of the above

**Ans: D**

- 31) A set of possible data values is called  
(A) attribute. (B) degree. (C) tuple. (D) domain.

**Ans: D**

- 32) Which of the operations constitute a basic set of operations for manipulating relational data?  
(A) Predicate calculus (B) Relational calculus  
(C) Relational algebra (D) None of the above

**Ans: C**

- 33) Which of the following is another name for weak entity?  
(A) Child (B) Owner (C) Dominant (D) All of the above

**Ans: A**

- 34) Which of the following database object does not physically exist?  
(A) base table (B) index (C) view (D) none of the above

**Ans: C**

### **GATE**

- 35) Consider a relational table with a single record for each registered student with the following attributes:

Registration\_number: Unique registration number for each registered student  
UID: Unique identity number at the national level for each citizen  
Bank Account\_number: Unique account number at the bank. A student can have multiple accounts or join accounts. This attribute stores the primary account number.  
Name: Name of the student  
Hostel\_room: room number of the hostel  
Which of the following option is incorrect ?

- A. Bank account number is candidate key
- B. Registration Number can be a Primary Key
- C. UID is Primary Key if students are from the same country.
- D. If S is a superkey such that S UID is Null then S UID is also a super key

- 36) Consider the following schedules involving two transactions. Which one of the following statements is true? [GATE 2007]
- S1: r1(X); r1(Y); r2(X); r2(Y); w2(Y); w1(X)  
S2: r1(X); r2(X); r2(Y); w2(Y); r1(Y); w1(X)
- A) s1 is not conflict serializable and s2 is conflict serializable
  - B) both s1 and s2 are conflict serializable
  - C) s1 is conflict serializable and s2 is not conflict serializable
  - D) both s1 and s2 are not conflict serializable
- 37) Let E1 and E2 be two entities in an E/R diagram with simple single valued attributes. R1 and R2 are two relationships between E1 and E2, where R1 is one to many and R2 is many to many. R1 and R2 do not have any attributes of their own. What is the minimum number of tables required to represent this situation in the relational model? [GATE2005] A)2 B)4 C)5 D)3
- 38) The order of an internal node in a B+ tree index is the maximum number of children it can have. Suppose that a child pointer takes 6 bytes, the search field value takes 14 bytes, and the block size is 512 bytes. What is the order of the internal node? [GATE 2004] A)27 B)24 C)25 D)26

#### **Websites Addresses:**

- 1) <http://nptel.iitm.ac.in/video.php?subjectId=106106093>
- 2) <http://www.sqlcourse.com/index.html>
- 3) <http://www.tutorialspoint.com/sql/>

#### **Expert details:**

- 1) Dr. S. Srinath working in IIIT Bangalore
- 2) Prof. D. Janaki Ram working in IIT Madras

#### **Journals (National & International):**

- 1) International Journal of Intelligent Information and Database Systems  
(<http://www.inderscience.com/jhome.php?jcode=ijjids>)
- 2) The Journal of Biological Databases and Curation  
(<http://database.oxfordjournals.org/content/current>)

#### **List of topics for student's seminar s:**

- 1) Database Management System purpose and applications
- 2) Database Users and Administrators
- 3) History of Database Systems

- 4) Data Models
- 5) File System vs DBMS
- 6) Form of basic SQL query with examples
- 7) Schema Refinement
- 8) Problems caused by Redundancy
- 9) Normalization and Normal Forms
- 10) Transaction Management
- 11) Transaction States and properties
- 12) Concurrency control and execution

**Case Studies / Small Projects:**

1. Hospital Management System
2. Railway Reservation.