

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2025

B. Tech Program: Information Technology Scheme I/II/IIB/III: III

Regular/Supplementary Examination: SY Semester: III

Course Code: ITC303 & Course Name: Database Management System

Date of Exam: **02 - 12 - 2025** Duration: 02.5 Hours Max. Marks: 60

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

Qu. No.	Questions	Max. Marks	CO	BT Level
Qu-1	Solve any TWO questions out of three: (05 marks each)	10		
a)	Explain the concept of physical data independence, and its importance in database systems.		CO1	2
b)	Indices speed query processing, but it is usually a bad idea to create indices on every attribute, and every combinations of attributes, that is a potential search keys. Explain why.		CO4	2
c)	Consider a database used to record the marks that students get in different exams of different course offerings (sections). Construct an E-R diagram that models exams as entities, and uses a ternary relationship, for the database.		CO2	6
Qu-2	Solve any TWO questions out of three: (05 marks each)	10		
a)	Explain how the WHERE and HAVING clauses differ in a SELECT query, and illustrate their use with suitable examples.		CO4	3
b)	Explain with suitable example how a table with a single-attribute primary key that is in 1NF also automatically in 2NF.		CO5	3
c)	List the ACID properties. Explain the usefulness of each.		CO6	2
Qu-3	Solve any TWO questions out of three. (10 marks each)	20		
a)	Explain the functions of the query processor and the storage manager in a database management system with a suitable diagram. How do these two components cooperate to execute user queries efficiently?		CO1	2
b)	i. Explain why log records for transactions on the undo-list must be processed in reverse order, whereas redo is performed in a forward direction. ii. Explain the working of a timestamp-based concurrency control protocol with a suitable example.		CO6	2
c)	i. Explain the different unary relational algebra operations with suitable examples. ii. Discuss two ways in which the 1:M relationship between COURSE and STUDENT can be implemented.		CO3	2
Qu-4	Solve any TWO questions out of three. (10 marks each)	20		
a)	Using the INVOICE table structure shown in Table-1, draw an Entity Relationship Diagram.		CO2	3

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b)	Using the INVOICE table structure shown in Table-1, do the following: - Write the relational schema, draw its dependency diagram, and identify all dependencies, including all partial and transitive dependencies. You can assume that the table does not contain repeating groups and that an invoice number references more than one product. (Hint: This table uses a composite primary key.) - Remove all partial dependencies, write the relational schema, and draw the new dependency diagrams. Identify the normal forms for each table structure you created. - Remove all transitive dependencies, write the relational schema, and draw the new dependency diagrams. Also identify the normal forms for each table structure you created.		CO5	3
c)	Specify the following queries in SQL on the COMPANY relational database schema shown in Figure-1. - Retrieve the name and address of all employees who work for the 'Research' department. - For every project located in 'Surat', list the project number, the controlling department number, and the department manager's last name, address, and birth date. - For each employee, retrieve the employee's first and last name and the first and last name of his or her immediate supervisor. - Retrieve all employees whose address is in Mumbai, Pune. - Retrieve a list of employees and the projects they are working on, ordered by department and, within each department, ordered alphabetically by last name, then first name.		CO4	3

Table-1: INVOICE

Attribute Name	Sample Value	Sample Value	Sample Value	Sample Value	Sample Value
INV_NUM	20251347	2025347	2025347	2025348	2025349
PROD_NUM	AA-E3422QW	QD-300932X	RU-995748G	AA-E3422QW	GH-778345P
SALE_DATE	15-Jan-2025	15-Jan-2025	15-Jan-2025	15-Jan-2025	16-Jan-2025
PROD_LABEL	Rotary sander	0.25-in. drill bit	Band saw	Rotary sander	Power drill
VEND_CODE	211	211	309	211	157
VEND_NAME	NeverFail, Inc.	NeverFail, Inc.	BeGood, Inc.	NeverFail, Inc.	ToughGo, Inc.
QUANT_SOLD	1	8	1	2	1
PROD_PRICE	₹ 4204.95	₹ 289.90	₹ 3249.55	₹ 4204.95	₹ 3996.95

EMPLOYEE

Fname	Minit	Lname	<u>SSN</u>	Bdate	Address	Sex	Salary	Super_SSN	Dno
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DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_SSN	Mgr_start_date
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DEPT_LOCATIONS

<u>Dnumber</u>	<u>Dlocations</u>
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PROJECT

Pname	<u>Pnumber</u>	Plocations	Dnum
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WORKS_ON

<u>ESSN</u>	<u>Pno</u>	Hours
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DEPENDENT

<u>ESSN</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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Figure-1: Schema diagram for the COMPANY relational database schema.