(b) A relation R (X, P , C , T , G) with attributes is given. The given set of FD's are

$X \rightarrow C$

$C \rightarrow T$

$(X, P) \rightarrow G$

(i) Find out the candidate keys from the set of given FD's.

(ii) Find the canonical cover of F.

(iii) Find out in which normal form the relation is in. Convert the relation into its higher normal form such that dependency is preserved and lossless decomposition occurs. Explain.

(2 + 2 + 2) + 6 = 12

7. (a) List the Armstrong's axioms for functional dependencies. What do you understand by soundness and completeness of these axioms?

(b) (i) What is transitive dependency? Explain with an example.

(ii) What problems occur if there is transitive dependency? Explain with proper examples.

(iii) How it is corrected?

6 +(2 + 3 + 1) = 12

Group – E

8. (a) Draw the state diagram of a transaction and briefly discuss the events that causes transition from one state to another.

(b) Why concurrent execution of transactions are required?

(c) Consider two transactions T1 and T2 with following database operations:

T_1: $R_1(A)$ $W_1(A)$ $R_1(B)$ $W_1(B)$

T_2: $R_2(A)$ $W_2(A)$ $R_2(C)$ $W_2(C)$

where, $R_i(x)$ and $W_i(x)$ are read and write operations of T_i on data item x. Find out whether the following concurrent schedule S is conflict serializable or not – Justify your answer.

S = $R_1(A)$ $W_1(A)$ $R_2(A)$ $W_2(A)$ $R_1(B)$ $W_1(B)$ $R_2(C)$ $W_2(C)$.

4 + 2 + (4 + 2)= 12

9. (a) Suppose that an unordered file with 45000 records are stored on a disk with block of size 1024 bytes. Each record length of the file is of 100 bytes. A secondary index is created on the file. The index has search key of length 12 bytes and pointer field with size 5 bytes. (i) Find out the blocking factor and the number of blocks needed for the file. (ii) Find out the blocking factor and the number of the blocks needed for the index. (iii) Find out the number of block access required to search a record using the index.

(b) Construct a B+ tree with the following elements.

10, 30, 1, 3, 77, 34, 90, 67, 2, 8, 11, 89. p = 3 and p_{leaf} = 2 .

6 + 6 = 12

DBMS
(INFO 3104)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) It is an abstraction through which relationships are treated as higher level entities
(a) Generalization (b) Specialization (c) Aggregation (d) Inheritance.

(ii) According to the levels of abstraction, the schema at the intermediate level is called
(a) conceptual schema (b) physical schema
(c) subschema (d) view.

(iii) A decomposition of a relation R into R1 and R2 is lossless if
(a) common attributes between R1 and R2 is candidate key of both the decomposed relations
(b) common attributes between R1 and R2 is candidate key of atleast one of the decomposed relations.
(c) common attributes between R1 and R2 is a non key attribute of the decomposed relations
(d) common attributes between R1 and R2 is key attribute of both the decomposed relations.

(iv) If a schedule S can be transformed into a schedule S' by a series of swaps of non-conflicting database read/write instructions , then S and S' are always
(a) conflict Equivalent to each other (b) view equivalent to each other
(c) both (a) and (b) (d) none of these.

(v) Relation R=(A,B,C,D) with AB as primary key. Choose one FD such that R should be in 1NF but not in 2NF.
(a) AB -> C (b) AB -> D (c) A -> D (d) AB-> CD.

(vi) In relational algebra, ---------- is an unary operator.
(a) Project (b) Rename
(c) Natural join (d) Both (a) and (b)

(vii) A superkey set consists of {AB, A, BC, ABC}. Out of these the minimal super keys are
(a) {A, BC, AB} (b) {ABC} (c) {A, AB} (d) {A, BC}.

(viii) Isolation of the transactions is ensured by
(a) Transaction management (b) Application programmer
(c) Concurrency control (d) Recovery management.

(ix) Wait-die scheme for preventing deadlock is a
(a) pre-emptive Scheme based on time-stamp
(b) non-pre-emptive scheme
(c) preemptive Scheme
(d) non-preemptive Scheme based on timestamp.

(x) Assume transaction A holds a shared lock R. If transaction B also requests for a shared lock on R,
(a) it will result in a deadlock situation
(b) it will immediately be rejected
(c) it will immediately be granted
(d) it will be granted as soon as it is released by A.

Group – B

2. (a) In your DBMS lab, what type of DBMS architecture is used? Explain your answer with the help of a diagram.

(b) When you buy merchandise from a website, what type of DBMS architecture is used? Explain with the help of a diagram.

(c) What do you understand by physical data independence?

(d) Explain referential integrity constraint and domain integrity constraint with example.

3 + 3 + 2 + 4 = 12

3. (a) A friend is interested in keeping track of information about his album collection. He is not concerned about whether or not the albums are CDs, tapes, LPs, etc. Also, assume that he does not have any compilation albums—that is, each album has songs from a single band. For each album, he wants to store which band recorded the album, the title, the year, and the chronology (e.g. this is the 4th album for that band). He also wants to store the songs, including title, length, track number, and writer(s). Of course, if two bands record the same song, they might have different track numbers and lengths. For each band (group or individual), he also wants to store the names of all of the band members. For each band member, he needs their first and last names, and country of origin. Consider both band members and songwriters as musicians. Construct the Entity Relationship Diagram for the above problem, mentioning the cardinality and Primary keys if any.

(b) What is the difference between strong entity set and weak entity set. Explain with example.

7 + 5 = 12

Group – C

4. (a) A bank database has the following relations.
Account (account_number, branch_name, balance),
Depositor (customer_name, account_number),
Customer (customer_name, customer_street, customer_city),
Loan (loan_number, branch_name, amount),
Borrower (customer_name, loan_number),
Branch (branch_name, branch_city, assets)
Write the **relational algebra** for the following queries.
(i) Find the largest account balance in the bank.
(ii) Find the names of all customers who have a loan at the Kolkata branch.
(iii) Find all customers who have both loan and account.

(b) Why every candidate key is also a superkey. Justify with example. What are the different types of join in SQL.

6 + (4 + 2) = 12

5. (a) Consider the following relations:
(i) **Employee** (Emp_Code, Emp_Name, Desig, Manager, Date_of_Joining, Salary, Dept_Code) With Constraints: *Primary Key* is Emp_Code, *Foreign Key*: Manager references Employee(Emp_Code), Dept_Code references Department(Dept_Code).
(ii) **Department** (Dept_Code, Dept_Name, Location) With Constraints: *Primary Key* is Dept_Code.
Write the following queries in SQL:
(i) List the average salary and number of employees working in each department.
(ii) List the names of those departments where the total salary is greater than 15000.
(iii) List the names of the employees and the names of their managers under whom they are working.

(b) Write a PL/SQL code to find whether a number entered by the user is even or odd. If even then insert the number in a table named EVEN else insert it into table ODD. Both the tables has only one attribute, number. Repeat the process for all numbers in the range 3 to 100.

(2 + 2 + 2) + 6 = 12

Group – D

6. (a) Given a relation Employee{EmpID, EmpName, Dept, Salary, Course , DateCompleted} where the primary key is {EmpID, Course}, Dept is the department where employee belongs and DateCompleted is the date when an employee completed a particular training in a course. Every other field is self explanatory. Some employees have taken more than one course in their training.
(i) Is this relation in 2NF? Explain.
(ii) What nature of dependency exists? What problems can occur?
(iii) How could this be fixed?