NATIONAL INSTITUTE OF TECHNOLGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
END SEMESTER EXAMINATION, JULY – DEC 2021

B.Tech: 5th Semester

Course Name: Database Management Systems **Course Code: CS5401**

Maximum Time: 2 hours **Maximum Marks: 40**

Answer all questions & **sub questions must be answered sequentially at one place**

Q.No	Question	Marks	CO	BL
1	a) The marks of students in different exams of different course offerings (sections) get recorded in the database. i. Construct an E-R diagram that models exams as entities, and uses a ternary relationship, for the database. ii. Construct an alternative E-R diagram that uses only a binary relationship between *student* and *section*. Make sure that only one relationship exists between a particular *student* and *section* pair, yet you can represent the marks that a student gets in different exams.	6	CO2	2, 4
	b) Consider the following expressions, which use the result of a relational algebra operation as the input to another operation. For each expression, explain in words what the expression does. i. $\sigma_{year>=2020}(takes) \bowtie student$ ii. $\sigma_{year>=2020}(takes \bowtie student)$ iii. $\Pi_{id,\ name,\ course\_no}(student \bowtie takes)$	4	CO3	3
2	a) Consider the following relations in which the foreign key constraint from the *dname* attribute of *faculty* to the *department* relation. Give examples of inserts and deletes to these relations, which can cause a violation of the foreign key constraint and also give explanation regarding cause of violation. Department(dname, building, budget) Faculty(fid, name, dname, salary)	6	CO3	3
	b) Consider the following relations of employee database, where the primary keys are underlined. Give an expression in SQL for each of the following queries. Employee (ename, street, city) Works (ename, cname, salary) Company (cname, city) Manages (ename, manager_name) i. Modify the database so that Ravi now lives in Patna. ii. Give all managers of ABC bank a 10 percent raise unless the salary becomes greater than Rs500000; in such cases, give only a 5 percent raise.	4	CO3	3
3	a) List all the functional dependencies satisfied by the following relation and also list the functional dependencies that does not satisfy the relation with valid reason.	6	CO4	1, 3

A	B	C
a1	b1	c1
a1	b1	c2
a2	b1	c1
a2	b1	c3

	b) Compute the closure of the following set of functional dependencies for relation schema *r* (A, *B*, *C*, *D*, *E*), and also mention the rules for finding these closures. List also the candidate keys for *R*. $A \rightarrow BC$ $CD \rightarrow E$ $B \rightarrow D$ $E \rightarrow A$	4	CO4	1, 3
4	a) Let us consider the CUSTOMER and SALES_ORDERS relations. CUSTOMER has 15,000 tuples, SALES_ORDERS has 10,000 tuples, 30 tuples of CUSTOMER fit on one block, and 50 tuples of SALES_ORDERS fit on one block. Estimate the number of block transfers and seeks required for each of the following join strategies for CUSTOMER ⋈ SALES_ORDERS. i. Nested-loop join ii. Block nested-loop join	4	CO5	2,3,5
	b) Consider the following relational-algebra expression, for the query "Find the names of all instructors in the CSE department together with the course title of all the courses that the instructors teach." $\Pi_{name,\ title}(\sigma_{dept\_name="CSE"}(instructor \bowtie (teaches \bowtie \Pi_{course\ id,\ title}(course))))$ Construct the initial expression tree and transformed expression tree of above relational-algebra expression. Afterwards, rewrite the relational-algebra expression which is equivalent to our original algebra expression, but which generates smaller intermediate relations.	6	CO5	2,3,5

Wish you all the best