

UG- F-2001-BCA

2023

Full Marks : 70

Time : 3 hours

Answer from both the Groups as directed.

*The figures in the right-hand margin
indicate marks.*

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

GROUP—A

Answer any four questions of the following :

10 × 4

- 1. Prove that the identity element in a group is Unique.**
- 2. Define ring and show that the set $R = \{a + b\sqrt{2} : a, b \in Q\}$ is a ring under the usual addition and multiplication as binary compositions.**

3. If S is a non-empty subset of a vector space V , then prove that its linear span $L(S)$ is the smallest subspace of V containing S .
4. Let T be a linear operator defined on \mathbb{R}^2 and given by
- $$T(x, y) = (2x + 3y, 4x - 5y)$$
- Find the matrix of T relative to the basis $B = \{(1, 2), (2, 5)\}$.
5. Find the eigenvalue and eigenvectors of the matrix

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

6. Solve the system of linear equations

$$2x - y + 3z = 9$$

$$x + 3y - 2z = 1$$

$$5x - 3y + z = 2$$

(3)

7. Find the equation of the sphere through the following points $(0, 0, 0)$, $(0, 1, -1)$, $(-1, 2, 0)$, $(1, 2, 3)$.

8. Prove that the lines :

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4} \quad \text{and}$$

$$\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5} \quad \text{are coplanar.}$$

GROUP—B

Answer *all* questions of the following : 3×10

9. Define subgroup of a group.

10. Prove that in a ring R

$$a(-b) = -(ab)$$

11. Write a necessary and sufficient condition for a subset of a vector space to be a subspace.

12. Define basis and dimension of a vector space.

13. Define the inverse of an element in a group.

14. Define linear independence of vectors.

15. State whether the system of equations has unique solution or not

$$x + y + z = 0$$

$$2x + 5y - z = 9$$

16. Determine the relation between Cartesian and Polar spherical coordinates of a point.

17. Define cosets and state Lagrange's theorem.

18. State the condition under which an integral domain is a field.

Robert Sharma

UG- F-2002-BCA

2023

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Answer from **both** the Sections as directed.

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SECTION-A

(Long Answer Type Questions)

Answer any *four* questions 10 × 4

1. Describe phosphorous cycle and its global budget.
2. Why environmental sciences are called as multidisciplinary in nature ?
3. Describe the phenomenon of greenhouses-effect ? And characteristics of its gases ?

(Turn Over)

4. Describe various types of pollutants which cause water pollution.
5. What do you mean by term ecosystem ? Write about the different components of ecosystem and its importance.
6. Describe about different types of ecological pyramid in ecosystem.
7. Describe the structure and composition of atmosphere. And describe role of ozone in stratosphere for life.
8. Explain biogeochemical cycle. Explain and draw diagram of nitrogen cycle.

SECTION-B

(Short Answer Type Questions)

Answer *all* questions

3 × 10

9. (a) Describe food chain and their types.
(b) Rain water harvesting

(3)

- ~~(c)~~ Sulphurous smog
- ~~(d)~~ Biological Oxygen Demand
- ~~(e)~~ Global warming
- ~~(f)~~ Ozone depletion
- ~~(g)~~ Acid rain
- ~~(h)~~ Primary and secondary air pollutant
- ~~(i)~~ Waste water treatment process
- ~~(j)~~ Population explosion

Rohit Sharma

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SECTION-A

Answer any *four* questions 10 × 4

1. What is DBMS ? Discuss its functions and applications. What are the advantages of DBMS over File System ?
2. Draw ER diagram for Hospital Management System (Use DOCTOR, PATIENT, HOSPITAL AND MEDICAL_RECORD Entity). Identify Primary Key and Foreign Key.

(Turn Over)



3. What is deadlock ? Explain deadlock detection and recovery scheme.

4. What is relational algebra ? Discuss basic set operation and relational operation.

5. Consider the following tables:

Employee (Emp_no, Name, Emp_city)

Company (Emp_no, Company_name, Salary)

(a) Write an SQL query to create above two tables using the concept of primary and foreign key.

(b) Write an SQL query to insert relevant values in the above tables.

(c) Write a SQL query to display Employee name and company name.

(d) Write a SQL query to display employee name, employee city, company name and salary of all the employees whose salary > 10000 .

(e) Write a query to display all the employees working in 'XYZ' company.

6. What is Data Model in DBMS and what are its types ? Explain clearly the function, advantage and disadvantage of hierarchical database model.
7. Which normal form is based on the concept of full functional dependency ? Explain the same with example.
8. Explain the basic constraints that can be specified in SQL as part of table creation with example.

SECTION—B

All questions are compulsory. 3 × 10

9. What is multivalued attribute of an entity? Give example to explain.
10. Give example of following relationships:
 - (a) One-to-one
 - (b) One-to-Many
 - (c) Many-to-Many

(4)

11. What is data base administrator ?

12. What is candidate key ?

13. Define specialization and generalization.

14. Define query processor.

15. Enlist DDL and DML commands.

16. What is a view ?

17. Define ACID Property.

18. Name any three components of database.

2 Rohit Sharma

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SECTION—A

Answer any *four* questions.

10 × 4

1. Define OOPS. What are the major features of OOPS ? Differentiate between C and C++ programming language.

2. Write a program to declare a class employee consisting of data members, empno, empname and empsalary. Write the member function accept () to accept and

(Turn Over)

display () to display the details of employees. WAP to store the details of 5 employees and display the details of employee who earns maximum salary.

3. Define loop and its types. Also differentiate between while loop and do while loop. Write a program to print the array elements in reverse order.

4. What are constructors and destructors ? Also define constructor overloading. Explain all with suitable example.

5. What are the differences between static binding & late binding ? Explain dynamic binding with a suitable example.

6. Define operator overloading. Write a program in C++ to overload binary operator '+' to add two time class object.

7. What do you mean by generic programming ? Explain class template with suitable example.

8. Explain the steps involved in reading and writing a file in a C++. List any five file manipulation library functions.

SECTION—B

Answer *all* the questions. 3 × 10

9. List any five string functions.
10. Define identifiers.
- ~~11.~~ Differentiate between virtual and pure virtual function.
- ~~12.~~ Differentiate between function overloading and function overriding.
- ~~13.~~ What is static member function ?
- ~~14.~~ Write a C++ program to find the maximum among three numbers.

15. Define multiple inheritance.

16. What is the difference between private and protected access specifier ?

17. Write a C++ program to convert the temperature from Fahrenheit to Celsius.

18. What is an exception ?

Rohit Sharma

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SECTION—A

Answer any *four* questions.  10 x 4

1. What is Boolean algebra ? State important laws of Boolean algebra. Using Boolean laws, reduce the expression to minimum number of literals

$$F = A + \underline{A'}B + \underline{A'}B'C + A'BC'D$$

2. What is demultiplexer ? Design 1 X 8 Demultiplexer using two 1 X 4 Demultiplexer

(Turn Over)

(2)

3. Define pair, quad, octet in K-Map. Reduce the following function using four variable k-map and implement the simplified function using basic gates. $F(A, B, C, D) = \sum (1, 5, 6, 7, 11, 12, 13, 15)$

4. What is an Encoder? Draw the truth table and circuit diagram of 8-to-3 Encoder.

5. Explain canonical and standard form by giving examples. Express the following boolean expression in SOP and POS forms-

$$F = X + Y'Z$$

6. What are counters? Explain how synchronous counter differs from and asynchronous counters.

7. What are universal gates? Realise all basic gates using universal gates.

8. What is flip flop? Draw logic diagram, graphical symbol and characteristics table for J-K flip flop.



All questions are compulsory. 3×10

9. Subtract using 2s complement. $(101)_2 - (10110)_2$

10. Draw the circuit diagram of the logic expression $Y = (A + B)(A' + C)(B + D)$ using basic gates.

11. What are latches ?

12. What do you understand by Don't Care condition ?

13. Write down the 1's and 2's complement of the following numbers.

(a) 1100110

(b) 1000000

(c) 1010101

14. Define truth table.

15. What are combinational circuits ?

16. Draw the XNOR gate and write its truth table.

17. Perform the following operation

(a) $(744)_8 + (266)_8$

(b) $(744)_8 - (266)_8$

18. State and prove DeMorgan's law.