

- N.B.** (1) All questions are compulsory.
(2) Each question carries 10 marks.
(3) Internal choices are there in each question.
(4) Figures to the right indicates full marks.

1. Attempt any Two :

- (a) State and prove Demorgan's law of Sets. 5
(b) Check whether set of Natural numbers with the operation $a*b = a + b - 3$ forms a Group or not. 5
(c) State Tower of Hanoi Problem and derive recurrence relation for it and hence solve the recurrence relation. 5

2. (a) Find the number between 1 and 200 which are divisible by 2 or 3. 6
(b) Show that if any five numbers from 1 to 8 are chosen then two of them will add up to 9. 4

OR

- (c) Check whether statement $(p \rightarrow q) \longleftrightarrow (\sim p \vee q)$ is Tautology or not. 4

3. (a) Prove that if R is any Equivalence relation on set S then R induces partition of S. 6
(b) Relation R on the set $A = \{1, 2, 3, 4\}$ is defined by xRy iff $x \leq y$. Find domain & Range of R. 4

OR

- (c) Check whether Relation R on the set $A = \{1, 2, 3, 4\}$ defined by xRy iff $x + y$ is divisible by 3 is equivalence or not. 4

4. (a) Find the number of Bijective functions from n-set to m-set. 6
(b) Show that the mapping $f(x) = 2x + 7$ from Real numbers to itself is Bijective. 4

OR

- (c) In how many ways can we distribute 6 mangoes (identical) and 5 bananas (identical) among 2 children ? 4

5. (a) Define following with examples : 6
(i) Connected graph (ii) Tree (iii) Regular graph
(b) Find all Possible Sub graphs of K_3 . 4

OR

- (c) If a graph has 2 vertices of degree 3 & x vertices of degree 4 and total number of edges 20 find x. 4

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6. (a) Define following with examples : 6
 (i) Abelian group (ii) Cyclic group (iii) Field

- (b) Prove that set of Gaussian Integers is an Integral Domain. 4

OR

- (c) Prove that the set of integers with addition modulo 4 forms a group. 4

7. (a) Solve the following recurrence relation with the given initial conditions 6

$$a_{n+2} = -4a_{n+1} + 5a_n \text{ for } n \geq 0, a_0 = 2, a_1 = 8$$

- (b) Find the solution by using an iterative approach for 4

$$a_n = a_{n-1} + 1, a_0 = 3$$

OR

- (c) Solve : $a_n = a_{n-2}$ for $n \geq 2, a_0 = 5, a_1 = 1$. 4

8. (a) Prove that every prime order Group is Cyclic. 6

- (b) Derive a formula for number of edges in a complete graph on n vertices. 4

OR

- (c) Determine the coefficient of x^3 in generating function $(1-x)^{-5}$. 4

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UN-7994

(3 Hours)

[Total Marks : 100

N.B. (1) All questions are compulsory.

(2) Figures to the right indicate full marks to the subquestion.

(3) From question 2 to 7, subquestion (a) is compulsory and attempt any One from (b) and (c).

1. Attempt any One of the following : 10
- (a) If the characteristic equation of a recurrence relation $a_n = r_1 a_{n-1} + r_2 a_{n-2}$ has two distinct roots s_1 and s_2 . Then prove that $a_n = A(s_1)^n + B(s_2)^n$ for arbitrary constants A & B.
- (b) How many integral solutions does $x_1 + x_2 = x_3 + x_4 = 17$ has $1 \leq x_1 \leq 3$, $2 \leq x_2 \leq 4$, $3 \leq x_3 \leq 5$, $4 \leq x_4 \leq 6$. 10
2. (a) Find the truth values of following : 8
- (i) $(r \rightarrow q) \leftrightarrow (p \vee r)$ (ii) $(p \rightarrow q) \rightarrow r$
- (b) Find the number of integers between 1 to 2000 that are not divisible by 4, 3 or 6. 7
- (c) Prove for any three sets P, Q & R, $P \Delta (Q \cap R) \equiv (P \Delta Q) \cap (P \Delta R)$ 7
3. (a) Define an Equivalence relation & prove that the Relation R on the set $A = \mathbb{N}$ defined by xRy iff $x - y$ is divisible by 4 is an equivalence relation. 8
- (b) Relation R on the set $A = \{1, 2, 3, 4\}$ is defined by xRy iff $x + y$ is odd. Find the Transitive closure of R. 7
- (c) If $A = \{1, 4, 6\}$ and $B = \{p, q\}$. Find $A \times B$, $B \times A$ and check whether $A \times B = B \times A$ or not. 7
4. (a) Show that in any group of six people there are either three mutual friends or else three mutual strangers. 8
- (b) How many automobile license plates can be made if each plate contains two different letters followed by 4 different digits ? 7
- (c) Prove that number of permutations on n-symbol is $n!$. 7
5. (a) State and prove Handshaking lemma for Graphs. 8
- (b) Write a note on isomorphic graphs. 7
- (c) Define Planar graph and check whether the following graphs are Planar or Not. 7
- (i) $K_{3,3}$ (ii) Q_4

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6. (a) Prove that every infinite Cyclic Group has exactly 2 generators. 8
- (b) Check whether set of Natural numbers with the Operation $a*b = a + b + 3$ forms a Group or not. 7
- (c) Define Integral Domain and Prove that set of Gaussian Integers is an Integral Domain. 7
7. (a) State Tower of Hanoi Problem and derive recurrence relation for it and hence solve the recurrence relation. 8
- (b) Determine the coefficient of x^5 in generating function $(1 - 2x)^{-8}$. 7
- (c) Solve the following recurrence relation with the given initial conditions 7
 $a_n = 6a_{n-1} + 8a_{n-2}$ for $n \geq 2$, $a_0 = 4$, $a_1 = 10$
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Object Oriented Programming

(3 Hours) *with c++* [Total Marks : 80

- N.B. :** (1) All questions are compulsory.
(2) Figures to the right indicate full marks.

1. Attempt the following questions (Solve Any Two) :—
 - (a) What are the various applications of Object Oriented programming. 5
 - (b) Describe the concept of classes and objects in oop languages. 5
 - (c) Write a short note on Encapsulation and Data abstraction. 5

2. Attempt the following questions (Solve Any Two) :—
 - (a) Write a short note on copy constructor with example. 5
 - (b) What is destructor? Explain with an example. 5
 - (c) Design a class static Demo to show the implementation of static variable and static function. 5

3. Attempt the following questions (Solve Any Two) :—
 - (a) What is operator overloading? Write any 4 rules to overload operator. 5
 - (b) Explain the term pointer with example. 5
 - (c) Write a C++ program for overloading assignment operators. 5

4. Attempt the following questions (Solve Any Two) :—
 - (a) Write a short note on public, private and protected access specifiers. 5
 - (b) What is friend class and friend function? 5
 - (c) Write a C++ program for overloading subscript operators. 5

5. Attempt the following questions (Solve Any Two) :—
 - (a) Write a short note on virtual destructors. 5
 - (b) Explain the concept of method overriding with suitable example. 5
 - (c) Explain the concept of command line argument with an example. 5

6. Attempt the following questions (Solve Any Two) :—
 - (a) Write a C++ program to count the number of occurrences of vowels in an input string. 5
 - (b) Write the use of following functions :-
 - (i) get () (ii) put() (iii) getline() (iv) read() (v) write(). 5
 - (c) Write a short note on istream and ostream classes. 5

7. Attempt the following questions. (Solve Any Two) :—
 - (a) Differentiate between Function overloading and function template 5
 - (b) Write a short note on container and its types. 5
 - (c) Explain Class template with suitable example. 5

8. Attempt the following questions. (Solve Any Two) :—
 - (a) Explain the different forms of inheritance. 5
 - (b) Write a short note on iterator classes. 5
 - (c) Explain the terms vector and stack. 5

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- N.B. :** (1) All questions are compulsory.
 (2) Figures to the right indicate full marks.

1. Attempt the following questions (Solve Any Two) :—
 - (a) What is oop? Explain with its characteristics. 5
 - (b) Write a difference in between POP and OOP. 5
 - (c) Write a C++ program with a class to check a number is Armstrong or not. 5
2. Attempt the following questions (Solve Any Three) :—
 - (a) Explain the different methods of defining member functions in C++. 5
 - (b) Write a short note on Encapsulation and Polymorphism. 5
 - (c) Differentiate between class and structure. 5
 - (d) Explain the term inheritance with its different types. 5
3. Attempt the following questions (Solve Any Three) :—
 - (a) What is constructor ? Explain any two types of constructor. 5
 - (b) Explain Destructor with a suitable program. 5
 - (c) Explain static data member and static member function with example. 5
 - (d) Write a C++ program with a class to calculate an area of rectangle. 5
4. Attempt the following questions (Solve Any Three) :—
 - (a) What is pointer ? Explain the use of 'this pointer' with example. 5
 - (b) Write a short note on operator overloading. 5
 - (c) What is friend class and friend function ? 5
 - (d) Write a C++ program for overloading arithmetic operators. 5
5. Attempt the following questions (Solve Any Three) :—
 - (a) Explain the concept of method overriding with suitable example. 5
 - (b) Write a short note on abstract base class. 5
 - (c) Define virtual function. Explain the rules used for it. 5
 - (d) Explain the different types of file modes. 5
6. Attempt the following questions (Solve Any Three) :—
 - (a) Define the terms : - Stream, Input Stream and Output Stream. 5
 - (b) Explain the following manipulators of ios
 Showpos , noshowpos , uppercase, nouppercase . 5
 - (c) Write a short note on assignment and append operators. 5
 - (d) How are exceptions handled in classes. 5
7. Attempt the following questions (Solve Any Three) :—
 - (a) Differentiate between vector and stack. 5
 - (b) Write a short note on container and its types. 5
 - (c) Explain function template with example. 5
 - (d) Write a C++ program to store the details of student object into a file.
 Read the following details from the file (Data members: Rollno, name, Address). 5

Modern Operating Systems

(3 Hours)

[Total Marks : 80

N.B. : (1) All questions from question No. 1 to 8 are compulsory.
(2) Figures to the right indicate full marks.

1. Attempt any two (5 marks each) :— 10
 - (a) State the various classes of an operating system.
 - (b) Write a note on Clustered Systems.
 - (c) State the functions of an assembler.

2. Attempt any two (5 marks each) :— 10
 - (a) State different operating system services
 - (b) Describe different system calls
 - (c) What are the differences between layered approach and microkernel approach ?

3. Attempt any two (5 marks each) :— 10
 - (a) Define Process and explain different states of process with diagram.
 - (b) Explain different process scheduling algorithm.
 - (c) Write notes on Inter Process Communication.

4. Attempt any two (5 marks each) :— 10
 - (a) What is a linker ? Explain with the help of a diagram.
 - (b) Write a short note on Virtual Machines
 - (c) Write notes on Semaphores.

5. Attempt any two (5 marks each) :— 10
 - (a) Write notes on Virtual Memory.
 - (b) Explain different Page replacement algorithm.
 - (c) What is segmentation ? Explain.

6. Attempt any two (5 marks each) :— 10
 - (a) Explain the concept of File structure.
 - (b) Write notes on free Space Management.
 - (c) Write notes on RAID.

7. Attempt any two (5 marks each) :— 10
 - (a) State some characteristics of I/O devices.
 - (b) Explairt in brief the Security Problems.
 - (c) Write short notes on : (a) Access Matrix (b) Hydra.

8. Attempt any two (5 marks each) :— 10
 - (a) Write notes on RPC.
 - (b) What is Deadlock ? Explain deadlock prevention, detection and recovery.
 - (c) Write notes on WORM.

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Con. 286-UN-7914-19.**2****(3 Hours)****[Total Marks : 100**

- N.B. :** (1) All questions from question No. 1 to 7 are **compulsory**.
 (2) **Figures to the right indicate full marks.**

1. Attempt **both** the questions :— **10**
 - (a) Write notes on assembler, compiler and interpreter.
 - (b) Write a short note on Design and implementation of an Operating System.

 2. Attempt any **three (5 marks each)** :— **15**
 - (a) State the various classes of an operating system.
 - (b) Write a note on Clustered Systems.
 - (c) State the functions of an assembler.
 - (d) What is a linker ? Explain with the help of a diagram.

 3. Attempt any **three (5 marks each)** :— **15**
 - (a) State different operating system services.
 - (b) Describe different system calls.
 - (c) What are the differences between layered approach and microkernel approach ?
 - (d) Write a short note on Virtual Machines.

 4. Attempt any **three (5 marks each)** :— **15**
 - (a) Define Process and explain different states of process with diagram.
 - (b) Explain different process scheduling algorithm.
 - (c) Write notes on Inter Process Communication.
 - (d) Write notes on Semaphores.

 5. Attempt any **three (5 marks each)** :— **15**
 - (a) Write notes on Virtual Memory.
 - (b) Explain different Page replacement algorithm.
 - (c) What is segmentation ? Explain.
 - (d) Write notes on RPC.

 6. Attempt any **three (5 marks each)** :— **15**
 - (a) Explain the concept of File structure.
 - (b) Write notes on Free Space Management.
 - (c) Write notes on RAID.
 - (d) What is Deadlock ? Explain deadlock prevention, detection and recovery.

 7. Attempt any **three (5 marks each)** :— **15**
 - (a) State some characteristics of I/O devices.
 - (b) Explain in brief the Security Problems.
 - (c) Write short notes on : (a) Access Matrix (b) Hydra.
 - (d) Write notes on WORM.
-

Advanced SQL

(3 Hours)

[Total Marks : 80

1. Attempt any two :-

- (a) List and Explain the different types of constraints with examples ? 5
- (b) What is a join ? Explain the various categories of joins that can be used to join two tables ? 5
- (c) Write a short note on indexes. 5

2. Attempt any two :-

- (a) What are SET operators ? List and explain the different types of SET operators. 5
- (b) What is a privilege ? Explain the different types of privileges ? 5
- (c) What is a scalar subquery ? Explain with suitable example. 5

3. Attempt any two :-

- (a) Why is % TYPE attribute used ? 5
- (b) What is a cursor ? Discuss the different attributes of a cursor ? 5
- (c) What is transaction ? Explain COMMIT, ROLLBACK and SAVEPOINT in transaction. 5

4. Attempt any two :-

- (a) Create table DEPT with the following columns and constraints. 5

Column Name	Data type	Size	Constraint
DEPTNO	NUMBER	2	PRIMARY KEY
DNAME	VARCHAR2	10	UNIQUE + NOT NULL
LOCATION	VARCHAR2	10	UNIQUE + NOT NULL

- (b) What is a hierarchical query ? Illustrate with the help of an example. 5
- (c) Explain the different types of scalar data types used in PL/SQL. 5

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5. Attempt any two :—

- (a) Explain Searched CASE statement in PL/SQL with Help of Example. 5
- (b) Write a short note on PL/SQL Records and its types. 5
- (c) Explain For UPDATE Clause and WHERE CURRENT Clause. 5

6. Attempt any two :—

- (a) What is a Stored Procedure. 5
- (b) Write short note on Function PARAMETERS. 5
- (c) Write short note on Data Dictionary and PL/SQL Source Code. 5

7. Attempt any two :—

- (a) What is Native Dynamic SQL ? 5
- (b) Define Triggers, Explain the syntax of creating triggers in PL/SQL. 5
- (c) How to view, Alter and Remove Triggers ? Explain with examples. 5

8. Attempt any two :—

- (a) Write short note on SQLCODE and SQLERRM functions. 5
- (b) Write short note on PROCEDURE PARAMETERS. 5
- (c) Distinguish between BEFORE and AFTER Triggers. 5

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(3 Hours)

[Total Marks : 100

1. Attempt the following :—

- (a) What are aggregate functions ? Explain in detail. 5
- (b) What is a synonym ? Why should you use a synonym ? 5

2. Attempt any three :—

- (a) Explain the commands used to alter table. 5
- (b) Differentiate between the WHERE clause and HAVING clause ? 5
- (c) What is view ? What are the benefits of using views. 5
- (d) Create table EMPLOYEE with the following columns and constraints. 5

Column Name	Data type	Size	Constraint
EMPNO	CHAR	4	PRIMARY KEY
ENAME	VARCHAR2	10	NOT NULL
JOB	VARCHAR2	10	
MGR	CHAR	4	
HIREDATE	TIMESTAMP		NOT NULL
GENDER	CHAR	1	'M' OR 'F' ONLY
SAL	NUMBER	8.2	DEFAULT 0
COMM	NUMBER	8.2	DEFAULT 0
DEPTNO	NUMBER	2	FOREIGN KEY REFERRING TO DEPTNO of DEPT table

3. Attempt any three :—

- (a) Explain the GRANT command in detail with examples ? 5
- (b) Explain the ROLLUP and CUBE operator with examples ? 5
- (c) Explain multiple column subqueries with suitable examples ? 5
- (d) What is a hierarchical query ? Illustrate with the help of an example. 5

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4. Attempt any **three** :—

- (a) What is an identifier ? What are the rules for naming them. 5
- (b) Write the various categories of operators used in PL/SQL. 5
- (c) Explain the concept of implicit cursor in PL/SQL. 5
- (d) Explain the different types of scalar data types used in PL/SQL. 5

5. Attempt any **three** :—

- (a) Explain IF-THEN-ELSE Statement with help of example. 5
- (b) Explain Index By Tables with help of Example. 5
- (c) How to Insert and Update with PL/SQL Records. 5
- (d) Explain in detail use of RAISE_APPLICATION_ERROR (). 5

6. Attempt any **three** :—

- (a) Explain Difference between anonymous blocks and sub programs in PL/SQL. 5
- (b) Explain the Difference between Procedures & Functions. 5
- (c) How to overload Subprograms in PL/SQL. 5
- (d) Write a PL/SQL block of code for a procedure which displays the message HELLO WORLD. 5

7. Attempt any **three** :—

- (a) Write a Simple example for Multiple-Row Query Using Native Dynamic SQL. 5
- (b) How to create DML statement Triggers ? 5
- (c) Distinguish between BEFORE and AFTER Triggers. 5
- (d) Explain the creation of Database Event Trigger with example. 5

Computer Graphics

(3 Hours)

[Total Marks : 80

N.B. :- (1) All questions are compulsory.

1. Attempt any two :—
 - (a) What are the applications of Computer Graphics ? 5
 - (b) Write a Short note on Cathode Ray Tubes. 5
 - (c) Explain Digital Differential Analyzer line drawing algorithm. 5

2. Attempt any two :—
 - (a) Describe Midpoint Circle drawing algorithm. 5
 - (b) What is Transformation Matrix ? 5
 - (c) Write short note on Identity Transformation. 5

3. Attempt any two :—
 - (a) Explain the method of rotation about an arbitrary point. 5
 - (b) Write short note on homogeneous coordinates system. 5
 - (c) Describe the concept of 2D - Shear Transformation. 5

4. Attempt any two :—
 - (a) Write short note on 2D - Scaling. 5
 - (b) Explain the concept of World Coordinates and Viewing Coordinates. 5
 - (c) Explain the method of Projection. 5

5. Attempt any two :—
 - (a) Write a short note on Two-Dimensional Clipping. 5
 - (b) Describe the concept of Three-Dimensional Morphing 5
 - (c) Explain the procedure of Text Clipping. 5

6. Attempt any two :—
 - (a) What is mean by Inside-Outside test ? 5
 - (b) Explain Seed Fill Algorithm. 5
 - (c) Write short note on Priority Algorithm. 5

7. Attempt any two :—
 - (a) Write a short note on Thresholding and Dithering. 5
 - (b) Explain the method of Parametric Curve Design. 5
 - (c) What is mean by Fractals ? List down its applications. 5

8. Attempt any two :—
 - (a) Write short note on Painter's Algorithm and Z-Buffer algorithm. 5
 - (b) Explain any two Shading techniques. 5
 - (c) Write short note on Color Models. 5

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Con. 284-UN-7822-19.**2****(3 Hours)****[Total Marks : 100****N.B. : (1) All questions are compulsory.**

1. Attempt the following :—
 - (a) What are the applications of Computer Graphics? 5
 - (b) Write a Short note on Cathode Ray Tubes. 5

2. Attempt any three :—
 - (a) Explain Digital Differential Analyzer line drawing algorithm. 5
 - (b) Describe Midpoint Circle drawing algorithm. 5
 - (c) What is Transformation Matrix ? 5
 - (d) Write short note on Identity Transformation. 5

3. Attempt any three :—
 - (a) Explain the method of rotation about an arbitrary point. 5
 - (b) Write short note on homogeneous coordinates system. 5
 - (c) Describe the concept of 2D - Shear Transformation. 5
 - (d) Write short note on 2D - Scaling. 5

4. Attempt any three :—
 - (a) Explain the concept of World Coordinates and Viewing Coordinates. 5
 - (b) Explain the method of Projection. 5
 - (c) Write a short note on Two-Dimensional Clipping. 5
 - (d) Explain the concept of Point Clipping. 5

5. Attempt any three :—
 - (a) Explain the procedure of Text Clipping. 5
 - (b) What is mean by Inside-Outside test ? 5
 - (c) Explain Seed Fill Algorithm. 5
 - (d) Write short note on Priority Algorithm. 5

6. Attempt any three :—
 - (a) Write a short note on Thresholding and Dithering. 5
 - (b) Explain the method of Parametric Curve Design. 5
 - (c) What is mean by Fractals ? List down its applications. 5
 - (d) Explain any two surface design methods. 5

7. Attempt any three :—
 - (a) Write short note on Painter's Algorithm and Z-Buffer algorithm. 5
 - (b) Explain any two Shading techniques. 5
 - (c) Write short note on Color Models. 5
 - (d) Describe the concept of Three-Dimensional Morphing. 5

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 S.Y. B.Sc (IT)
 (Sem-III)