Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

2nd Year 1st semester B.Sc. Engineering Final Examination, 2023

Course Code: ICT-2103 Course Title: Digital Logic Design

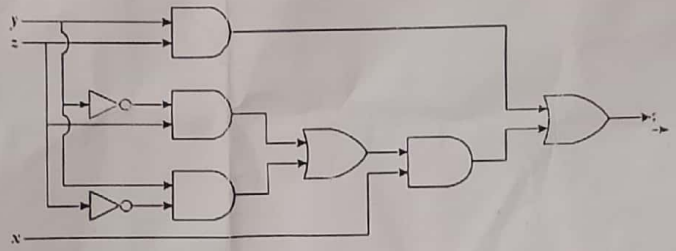
Full Marks: 70 Time: 3 Hours

[Answer Any 5 (Five) Questions]

1. a) Convert the hexadecimal number E3FA to binary. 3
   b) Find the 10's complement of 246700. 3
   c) Determine BCD addition of 184 and 577. 3
   d) Perform the multiplication using Booth's algorithm where multiplicand=3 and multiplier=-5. 5

2. a) What is the largest binary number that can be expressed with 7 bits? What are the equivalent decimal and hexadecimal numbers of the largest binary number? 4
   b) Convert (10110110)2 to Gray code and Excess 3 code. 3
   c) Prove that x+x=x 3
   d) State and Explain the DeMorgan's Theorem. 4

3. a) What are the advantages of binary code? 2
   b) Find the Boolean expression for the following circuit 4



   c) Construct a circuit that represent the following input-output table. 4

x	y	Output
1	1	1
1	0	0
0	1	0
0	0	1

   d) Design the circuit by Using NAND gates F= BC'+ DE 4

4. a) Express the Boolean function F=A+ B'C as a sum of minterms. 4
   b) Compare sequential circuits and combinational circuits. 3
   c) Explain briefly the Karnaugh map or K-Map method? 4
   d) Write the steps for the design of combinational circuit. 3

5. a) Simplify the following Boolean expression using K-map and implement using NAND gates: 6
   $F(W, X, Y, Z) = XZW + WXY + WYZ + WXZ.$
   b) Design a BCD to Excess -3 Code Converter Circuit: 8

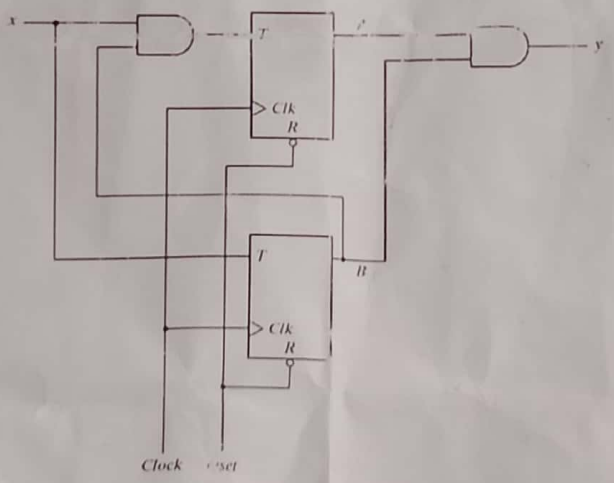
(BCD) 8421	Excess-3
0000	0011
0001	0100
0010	0101
0011	0110
0100	0111
0101	1000
0110	1001
0111	1010
1000	1011
1001	1100

6. a) Write the difference between PROM, PLA and PAL? 3
   b) Implement F(A, B, C, D) = ∑ m(0, 1, 5, 6, 8, 10, 12, 15) using 8 : 1 multiplexer 4
   c) Implement the following functions using PLA 7

$Y_1 = \sum m(0, 1, 7)$, $Y_2 = \sum m(0, 3, 6, 7)$ and $Y_3 = \sum m(0, 1, 3, 5, 7)$

7. a) Design a seven segment display which display from 0 to 9. 7
   b) Design a synchronous counter with counting sequence 0, 3, 5, 7, 6, 0 using J-K flip-flop. 7

8. a) What is parity bit? Design a parity generation and checking circuit where original message is a 3 bit message. 7
   c) Analyze a clocked sequential circuit in the following figure with T Flip-Flop. 7



Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

2nd Year 1st Semester B.Sc.(Engg.) Final Examination 2023

Course Title: Object Oriented Programming **Course Code:** ICT-2105

Marks: 70 **Time:** 3 Hours

Answer any five questions. Illustrate where necessary

1. a) What is object-oriented programming (OOP)? Briefly describe the basic feature of OOP. 3

   b) Discuss the following program line by line and understand the unique features that constitute the program: 4

```
class test{
public static void main( String args[ ] ){
System.out.println("Java is better than C++"); } }
```

   c) Write down the output for the following block of code. 4

```
public static void main( String args[ ] ){
 int m=36, n=3, x=0;
 x= ++m + n-- +2;
m++; n++;
System.out.println("x = "+x+ "m= "+ m++ +"n= "+ ++n);
System.out.println("m= "+ m-- + "n= "+ n++);
m=--m+n++;
System.out.println("m= "+ m++ +"n= "+ n);
System.out.println("m= "+ -- m +"n= "+ ++n); }
```

   d) What do you mean by JVM? Distinguish between **compiler** and **interpreter**? 3

2. a) What is conditional operator? Briefly explain the scope of variables. 2

   b) Write a program that will read the value of x and evaluate the following function Using "conditional operator". 4

$$Y = \begin{cases} 15 & \text{for } x>0 \\ 0 & \text{for } x=0 \\ -10 & \text{for } x<0 \end{cases}$$

   c) Write a program to compute the sum of the digits of a given integer number and display that number in reverse order as another number. For example, if num=1234, then sum=10 & display 4321 as another number. 5

   d) Write short notes on i) methods overloading & ii) methods overriding. 3

3. a) What do you mean by **classes** and **objects**? How can you create an object from a class, explain with an example? 4

   b) Briefly explain the passing parameters to a constructor with an example. 4

   c) What is constructor? What are its special properties? 2

   d) Write a program to determine the sum of the following series for a given value of n. 1+1+2+3+5+8+13+..... +n. Where the value of n should be inputted from keyboard. 4

4. a) Write a program to read the integer values from a file and save them another file after sorting 6

   b) How can you convert i) primitive numbers to object numbers ii) Numeric strings to primitive numbers? 4

   c) For a class called Fraction that has two data members, an ***int number*** and an ***int denom*** (for the numerator and denominator), write the following Java code: Write a constructor that accepts values for the numerator and denominator as arguments. 4

5. a) What is an Applet? How do Applets differ from application programs? 3

   b) What is JDBC? Write down the steps of How JDBC work? Explain briefly, How JDBC connect to a database? 5

   c) How do you get the IP address of a machine from its Hostname? How can you find who is accessing your server? 4

   d) How can you create a Server Socket? 2

6. a) In Java, methods can be inherited. What does that mean? 2

   b) Write a class, call it **GradesCount,** to read a list of grades from the keyboard (integer numbers in the range 0 to 100). Prompt the user with "Please enter a grade between 0 to 100 or -1 to quit:" each time before reading the next integer. Store each grade in a A, B, C, D or F vector as follows: 90 to 100 = A, 80 to 89 = B, 70 to 79 = C, 60 to 69 = D, and 0 to 59 =F. 5

c) What is the difference between function "overriding" and "overloading". Explain clearly with simple code example. 4

d) What will be the output of the program? 3

```
Public class If1
{
      static Boolean b;
      public static void main( String [ ] args )
      {
            short hand = 42;
            if ( hand < 50 && !b )
                        hand++;
             if ( hand > 50 ) ;
             else if ( hand > 40 )
             {
                  hand += 7;
                  hand++;
              }
              else
                     --hand;
              System.out.println(hand);
          }
}
```

7. a) What is a package? Explain the usage of Java packages. 2

b) Consider the following line segment of a Java program. What does it mean using throws keyword in the file 3

```
static void amount (int a) throws ArithmeticException
{
  .....
  .....
}
```

c) Consider the following method: 3

```
public static void mystery ( string [ ] arr ) {
          for ( int i=1; i<arr.length; i++) {
               arr [i] = arr[i-1] + arr [i];
          }}
```

What is the approximate run time of the mystery method in terms of the length of the input array?

d) What is the output of this program? 3

```
class overload {
    int x;
    int y;
    void add (int a) {
        x = a + 1; }
    void add (int a, int b) {
         x = a + 2; } 8
    }
 class overload_methods {
      public static void main ( String args [ ] )
        {   overload obj = new overload( );
            Int a = 0 ;
            obj.add(6,7);
            System.out.println(obj.x);
         }                              }
```

e) What is the output of this program? 3

```
package pkg;
   class output {
     public static void main ( string args [ ] )
         { StringBuffer s1 = new StringBuffer("Hello");
           s1.setCharAt(1, x);
           System.out.println(s1);
         }      }
```

8. a) Write a method that returns a String that contains the letters of the input String parameter in sorted order. 4

b) Write a Java program to create your own Exception to check weather a number is i) Prime or not ii) Even or odd. 3

c) What will be the output of the following Java code? 3

```
class MyThreads extends Thread
    {
      public static void main ( String args [ ] )
            {
                MyThread t = new MyThread ( );
                t.start ( );
                System.out.print ("one. ");
                t.start ( );
                System.out.print ("two. ");
             }
          public void run ( )
             {
                System.out.print("Thread ");
             }
    }
```

d) What will be the output of the following Java code? 4

```
class Testtry  {
public static void main ( String args [ ] ) {
      int a = 0;
      String name[ ] = {"Rahim", "Karim", "Shuvo"};
      while (a < 4)  {
            try  {
                  System.out.println ( name [a] );
                  a++;
                 } catch (Exception e ) {
                  System.out.println ( "Nothing" ); }
                finally {
                  System.out.println ( "Must Execute" );
                if ( a < 3 ) ;
                else {
                  System.out.println ( "Wrong");
                  break; }
                      }
                   }                    }
               }
```

Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

2nd year 1st Semester B. Sc (Engg.) Final Examination-2023

Course Title: Statistics — Course Code: ICT 2111

Full Marks: 70 — Time: 3 hour

Answer any **five** from the following questions

1. (a) Define Statistics. Discuss the role of statistics in engineering. 5
   (b) What is variable? Discuss different types of variable with examples. 4
   (c) Discuss various scales of measurements with suitable examples. 5

2. (a) A series of values with a common ratio r as follows a, ar, ar^2, ar^3, ..., ar^{n-1}. Find arithmetic mean (AM), geometric mean (GM), and harmonic mean (HM) of the series and show that $AM \times HM = GM^2$. 3
   (b) For two-positive non-zero quantities, prove that $A.M \geq G.M \geq H.M$. 4
   (c) The following distribution refers to the amount of annual income tax (in thousand taka) paid by manager of different firms. 7

Annual tax paid	5-10	10-15	15-20	20-25	25-30	30-35	35-40
No. of firms	5	8	10	15	9	6	2

Calculate Arithmetic mean, median and mode.

3. (a) Define dispersion. What are the different measurements of dispersion? Distinguish between absolute and relative measures of dispersion. 5
   (b) Find the variance and coefficient of variation for first n natural numbers. 4
   (c) The grade point average (GPA) in different semesters of two students are shown below: 5

Students	GPA in semesters							
	1	2	3	4	5	6	7	8
A	2.5	2.5	3.0	3.5	3.5	4.0	3.5	3.5
B	2.5	3.0	4.0	4.0	4.0	2.0	2.5	4.0

Which students would you consider better throughout the course of studies?

4. (a) Define skewness? What are the different types of skewness? Explain them with the help of diagram. 5
   (b) What is meant by moments? Write down different types of moment. 3
   (c) In a firm, there are five employees. The numbers of days absent by these employees for the last year are 24, 27, 30, 31 and 33. Calculate the first four central moments. 6

5. (a) Define the following terms: Experiment, Random experiment, Sample space and Probability of an event. 4
   (b) Define conditional probability. In a class of 120 students, 60 are studying English, 50 are studying Frence and 20 are studying both English and Frence. If a student is selected at random from this class, what is the probability that he is studying English if it is given that he is studying Frence? 5
   (c) State the Bayes theorem. In a course 65% students are female. The probability that a female student passes the course is .8 and the probability that a male student passes the course is .75. A student number 2575 is selected at random from this class and is found to be passed. What is the probability that the student number 2575 is a female student? 5

6. (a) Define correlation. Write down the properties correlation coefficient. 4
   (b) What do you understand by regression analysis? State the purpose of regression analysis. 4
   (c) The following table gives the ages and blood pressure of 8 women: 6

Age in years: x	56	40	35	46	49	42	70	62
Blood pressure: y	147	124	117	127	145	140	155	158

i) Calculate correlation coefficient.

ii) Find the fitted regression line of blood pressure on age.

Estimate the value of blood pressure when age is 48 years.

7. (a) Define discrete and continuous random variable. 2

(b) Define probability mass function with properties. Let X be a random variable with probability function defined by $f(-2)=\frac{1}{10}$, $f(0)=\frac{2}{10}$, $f(4)=\frac{4}{10}$ *and* $f(11)=\frac{3}{10}$. 5

Find i) $P[-2 \le X < 4]$ ii) $P[X > 0]$ iii) $P[X \le 4]$

(c) What is meant by Binomial distribution? In a community, the probability that a newly born child will be boy is $\frac{2}{5}$. Among the 4 newly born children are selected in that community, what is the probability that i) all the four boys ii) At least two boys iii) No boys iv) Exactly one e) at most two boys. 7

8. (a) What do you mean by a statistical hypothesis? Write down the steps involved in testing a hypothesis. 4

(b) Define (i) Null hypothesis, (ii) Critical region, (iii) Acceptance region, (iv) level of significance. 4

(c) A bulb manufacturing company claims that the average longevity of their bulb is 3.65 years with standard deviation 0.16 years. A random sample of 36 bulbs gave a mean longevity of 3.45 years. Does the sample mean justify the claim of the manufacturer? Use a 5% level of significance. 6

$\frac{a+ar+ar^2+ar^3}{q}$

$= \frac{a(a\frac{1}{r}+r+r^2+r^3)}{q}$

$a \times ar \times ar^2 \times ar^3$

$= a^4 r^6$

$= \frac{a(1+r+r^2+r^3)}{q}$

$=$

$\frac{1}{\frac{1}{a}+\frac{1}{ar}+\frac{1}{ar^2}+\frac{1}{ar^3}} \times \frac{1}{a^4 r}$

$= (a \times ar \times ar^2 \times ar^3)^{\frac{1}{4}}$

$= a^{\frac{1}{4}} \times ar^{\frac{1}{4}} \times a^{\frac{2}{4}} r^{\frac{6}{4}}$

Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

2nd year 1st semester B.Sc. (Engg.) Final Examination,2023

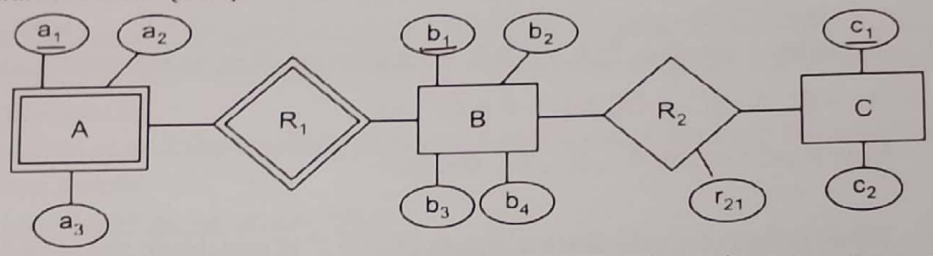
Course Title: Database Management System
Time: 3 hours

Course Code: ICT-2107
Full Marks: 70

[Answer Any Five Questions]

1. a) Define an *Entity* and *attribute*. Describe different types of mapping cardinalities with appropriate example and diagram. 5

   b) Define *superkey* and *candidate* key. Convert the following *E-R* diagram into a relational database (the primary keys are underlined): 4



   c) Consider an entity-Relationship diagram of a manufacturing company which information about the projects is listed below: 5

   I. Project includes project id, p-name, start-date, end-date.
   II. Employee includes emp id, name, age, address.
   III. Supplier includes s id, sname, saddress.
   IV. Warehouse includes W-id, address, capacity.
   V. Parts include part-id, part-name

   Now construct an E-R diagram which records information about the projects it has on hand, the parts used in projects, the suppliers who supply the parts, the warehouses in which those parts are stored, and the employees who work on these projects.

2. a) What do you know about *Relational Algebra?* How does the *select* and *project* operation performed in *Relational Algebra?* 3

   b) Consider the following relational tables and write down the appropriate *Relational Algebra* expression for the following queries. 6

   employee (ID, person_name, street, city)
   works (person_name, company name, salary)
   company (company name, city)

   I. Find the name of each employee who lives in city "Miami".
   II. Find the ID, name, and city of residence of each employee who works for "BigBank".
   III. Find the ID, name, street address, and city of residence of each employee who works for "BigBank" and earns more than $10000.

   c) Define *Fully functional* and *Partial Functional* dependency. Consider a relation R(A,B,C,D,E, F ,G, H) with the functional dependencies- 5

   $CH \rightarrow G$ & $A \rightarrow BC$ & $B \rightarrow CFH$ & $E \rightarrow A$ & $F \rightarrow EG$

   Now Find the all possible candidate keys using the following dependencies.

3. a) What is Normalization? "If database not normalize properly then insert, update, and delete anomalies occurs"- do you agree? Explain your answer. 5

b) Consider the following relational table given below and normalize the table up to 3NF with proper explanation. 6

StudentID	Student Name	Address	HouseName	HouseColor	Subject	Subject Cost	Grac
1959433X	Mary Watson	10 charles street	Bob	Red	English Math Info tech	$50 $50 $100	B A B+

c) Consider a relation R(A,B,C,D,E, F ,G) with the functional dependencies- 3

$A \rightarrow BC$ & $BC \rightarrow DE$ & $D \rightarrow F$ & $CF \rightarrow G$

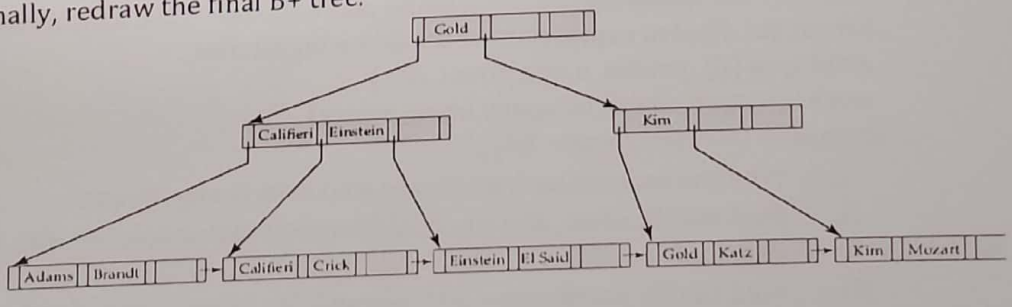
Now Find out the A+ , B+ , C+, D+, BC+

4. a) What is Boyce-Codd Normal Form (BCNF)? Write down the necessary conditions to make the decomposition lossless. 4

b) What is indexing? Construct the B+ tree with the instructor's name given in the table below where the pointer value is 4. 6

10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	80000
33456	Gold	Physics	87000
45565	Katz	Comp. Sci.	75000
58583	Califieri	History	60000
76543	Singh	Finance	80000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

c) Consider the B^+ tree showing below and delete the value "Gold" from the B+ tree. Finally, redraw the final B+ tree. 4



5. a) Draw and explain the *storage Hierarchy* in terms of operation *speed, cost per bit,* and *access time.* 4

b) What is schedule of a transaction? A serial schedule can also be executed in a concurrent schedule approach- do you agree? Explain your answer with relative diagram and examples. 5

c) What is MTTF and *Mean time to data loss*? Consider a mirrored pair disks of *RAID* system where *MTTF* of individual disk is 100,000 hours and *mean time to repair* of a disk is 10 hours. So, what is the value of *Mean time to data loss* for a *RAID* system? 5

6. a) Consider the following set F of functional dependencies on the relation schema r. 3

r (A, B, C, D, E, F)

$A \rightarrow BCD$

$BC \rightarrow DE$

$B \rightarrow D$

$D \rightarrow A$

You are required to:

I. Compute a canonical cover for the above set of functional dependencies F; give each step of your derivation with an explanation.

II. Compute a 3NF decomposition of r based on the canonical cover.

III. Compute a BCNF decomposition of r using the original set of functional dependencies.

b) Explain the syntax and the working procedure of the two following SQLs on the schema given below 5

Employee (employee_name, street, city)
Works (employee_name, company_name, salary)
Company (company_name, city)
Manages (employee_name, manager_name)

```
(I)
create function AVG_SALARY (cname varchar (15))
    returns integer
    declare result integer;
      select avg(salary) into result
      from works
      where works.company_name = cname
    return result;
end

(II)
select company_name from works where
AVG_SALARY (company_name) > AVG_SALARY ("First Bank Corporation")
```

7. a) Consider the following schema 6

Employee (NationalID, FirstName, BasicSalary, MedicalAllownce, HouseRent,);

You are required to:

Create a Trigger for each row to calculate and set the value of *MedicalAllownce and HouseRent* while inserting value of other columns. Please note that *MedicalAllownce is equals to 15% of BasicSalary while HouseRent is 50% of BasicSalary*

b) Suppose user *A*, who has all authorizations on a relation *r*, grants select on relation *r* to public with grant option. Suppose user *B* then grants selection *r* to *A*. Does this cause a cycle in the authorization graph? Explain why. 4

c) Explain the following SQL structures: 4

grant <privilege list> on <relation name or view name> to <user/role list>;

8. Design a database for an automobile company to provide to its dealers to assist them in maintaining customer records and dealer inventory and to assist sales staff in ordering cars. Please note that:

- Each vehicle is identified by a vehicle identification number (VIN).
- Each individual vehicle is a particular model of a particular brand offered by the company (e.g., the XF is a model of the car brand Jaguar of Tata Motors).
- Each model can be offered with a variety of options, but an individual car may have only some (or none) of the available options.
- The database needs to store information about models, brands, and options, as well as information about individual dealers, customers, and cars.

Your design should include: 6

I. An E-R diagram, 4

II. A set of relational schemas (derived from E-R diagram) 4

III. A list of constraints, including primary-key and foreign-key constraints

Mawlana Bhashani Science and Technology University

Department of Information and Communicating Technology

2nd Year 1st Semester B.Sc. Engineering final Examination-2023

Course Title: Differential Equations and Vector Calculus Course Code: ICT-2109
Time: 3 Hours Marks: 70

Answer any **five** questions from the following:

1. (a) Define ordinary differential equation with examples. Construct a differential equation for the family of curves $y = e^x(A\cos x + B\sin x)$; where A and B are arbitrary constant. Also identify it. 05
   (b) Define initial value problem and boundary value problem with example. Solve the initial value problem: $xsiny\,dx + (x^2+1)cosy\,dy = 0; y(1) = \frac{\pi}{2}$. 05
   (c) The population of Tangail doubles in 20 years. Assuming that the rate of increase is proportional to the number of inhabitants, find the number of years, in which it would treble itself. 04

2. (a) Find the general solutions of the following differential equations: 04
   i) $y'' + 7y' + 12y = 0$
   ii) $y'' + 2y' + 2y = 0$
   (b) Solve the following differential equation by the method of undetermined coefficients: 05
   $(D^2+4)y = xe^{2x}$
   (c) Use method of variation parameter solves the second order differential equation 05
   $y'' + y = \tan x$.

3. (a) Define partial differential equation with examples. Form the partial differential equation by eliminating arbitrary constants a and b from the equation $az + b = a^2x + y$. 04
   (b) Write down Charpit's auxiliary equation. Find the complete integral of $q = -xp + p^2$. 05
   (c) Obtain the solution of wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ by using the method of separation of variables. 05

4. (a) What do you mean by semi-linear and quasi-linear partial differential equations? 02
   (b) Formulate a partial differential equation by eliminating the arbitrary function φ from the equation $\varphi(x+y+z,\ x^2+y^2-z^2) = 0$. Examine whether the partial differential equation is linear or non-linear. Also, find its order and degree. 06
   (c) Find the integral surface of $x^2p + y^2q + z^2 = 0$ which passes through the hyperbola $xy = x + y,\ z = 1$. 06

5. (a) What do you mean by linearly dependent and linearly independent set of vectors? Suppose a, b and c are non-coplanar vectors. Determine whether the following vectors are linearly dependent or independent: $\bar{r}_1 = 2a - 3b + c$, $\bar{r}_2 = 3a - 5b + 2c$ and $\bar{r}_3 = 4a - 5b + c$. 07
   (b) Find the work done in moving an object along a vector $\vec{r} = 3i + 2j - 5k$, if the applied the force is $\vec{F} = 2i - j - k$. 03
   (c) Find the projection of the vector $\bar{A} = 4i - 3j + k$ on the line passing through the points $(2,\ 3,\ -1)$ and $(-2,\ -4,\ 3)$. 04

6. (a) What do you mean by divergence? Discuss about the physical meaning of divergence. 03
   (b) Define directional derivative. Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at $(2,-1,-2)$ in the direction of $2i - 3j + 6k$. 05
   (c) Find an equation for the tangent plane to the surface $xz^2 + x^2y = z - 1$ at the point $(1,-3,2)$. 06

7. (a) What do you mean by a line integral? Find the work done in moving a particle once around a circle C in the xy plane, if the circle has centre at the origin and radius 3 and if the force field is given by $\vec{F} = (2x - y + z)i + (x + y - z^2)j + (3x - 2y + 4z)k$. 06
   (b) Define conservative force field. Show that $\vec{F} = (2xy + z^3)i + x^2j + 3xz^2k$ is a conservative force field. 04
   (c) Find the work done in moving a particle in the force field $\bar{F} = 3x^2i + (2xz - y)j + zk$ along the straight line from $(0,0,0)$ to $(2,1,3)$. 04

8. (a) State and prove green's theorem. 07
   (b) Verify the green's theorem in the plane for $\oint (xy + y^2)dx + x^2dy$, where c is the closed curved of the region bounded by $y = x$ and $y = x^2$. 07

Course Title: Programming with Java | Course Code: ICT -2103

Marks: 20 | Time: 20 minutes

1. What do you mean by **classes** and **objects**?
2. What is the main difference between **Is-a** Vs. **Has-a** relationship?
3. How do you find out the current IP address from your machine?
4. How are this() and super() used with constructors?
5. Write any four names of Common Java Exception with their cause of Exception.
6. Write a program to determine the sum of the following series for a given value of X & n.
   $1+X+X^2+X^3+ \ldots\ldots\ldots\ldots\ldots\ldots+X^n$
7. How do you add a **class** or an **interface** to a package? Write with an example.
8. Why do you need a random access file? What is StreamTokenizer & StringTokenizer?