

## Writing Task

You should spend about 40 minutes on this task.

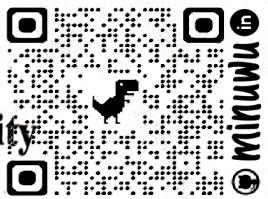
**Write about the following topic:**

An increasing number of people are now using the internet to meet new people and socialize. Some people think this has brought people closer together while others think people are becoming more isolated.

**Discuss both sides and give your opinion.**

Give reasons for your answer and include any relevant examples from your own knowledge or experience.

**Write at least 250 words.**



# Rangamati Science and Technology University

Department of Computer Science and Engineering

1<sup>st</sup> Year 2<sup>nd</sup> Semester BSc (Engg.) Final Examination-2020

Session: 2019-2020

Course Title: Discrete Mathematics;

Course Code: CSE-1201

Time-3Hours

Total Marks-60

- NB: 1. Answer any FOUR (4) questions out of SIX (6) questions.  
2. Figures in the right margin indicate marks (15\*4=60).  
3. All parts of a question must be answered serially.

- 1 (a) Define propositions. Let p and q be the propositions. 4

p: Maria learns discrete mathematics.

q: Maria will find a good job.

Write these following propositions using p and q and logical connectives.

- If Maria learns discrete mathematics, then she will find a good job.
- Maria learns discrete mathematics and finds a good job.
- Maria learns discrete mathematics if only if she will find a good job.

- (b) What is a contradiction? Let p, q be the propositions. 4

p: I bought a lottery ticket this week.

q: I won the million-dollar jackpot on Friday.

Express each of these following propositions as an English sentence.

i.  $\neg p \wedge q$

ii.  $p \vee \neg q$

iii.  $p \leftrightarrow q$

- (c) Construct a truth table for each of these compound propositions. 3

i.  $(p \vee q) \rightarrow (p \wedge q)$

ii.  $(p \rightarrow q) \rightarrow (q \rightarrow p)$

- (d) Determine whether the following compound propositions are tautologies or not. 4

$(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$

ii.  $((p \vee q) \wedge \neg p) \rightarrow q$

- 2 (a) What is bit string? Show that the hypotheses "It is not sunny this afternoon and it is colder than yesterday," "We will go swimming only if it is sunny," "If we do not go swimming only if it is sunny," "If we do not go swimming, then we will take a canoe trip," and "If we take a canoe trip, then we will be home by sunset" lead to the conclusion "We will be home by sunset." 5

- (b) Show that the following argument is valid. If today is Tuesday, I have a test in Mathematics or Economics-If my Economics Professor is sick, I will not have a test in Economics. Today is Tuesday and my Economics Professor is sick. Therefore I have a test in Mathematics. 4

(c) State the converse, contrapositive, and inverse of each of these conditional statements:

- i) I go to the beach whenever it is a sunny summer day.
- ii) If it snows tonight, then I will stay at home.

3 (a) State the Chinese remainder theorem. Solve the following systems of congruence by using the Chinese remainder theorem.

$$x \equiv 2 \pmod{3}$$

$$x \equiv 4 \pmod{5}$$

$$x \equiv 5 \pmod{7}$$

(b)

$$\text{Let } A = \begin{vmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{vmatrix} \text{ and } B = \begin{vmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix}$$

Find

i.  $A \vee B$ .      ii.  $A \wedge B$       iii.  $A \oplus B$

(c) Write down the theorem of the pigeonhole principle. Use mathematical induction to show that

$$1+2+2^2+\dots+2^n = 2^{n+1}-1 ; \text{ for all nonnegative integer } n.$$

3

2+3

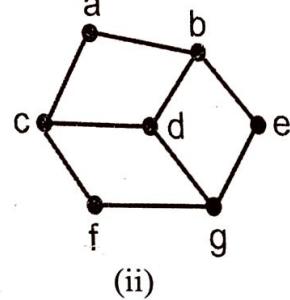
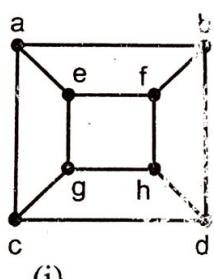
=5

(d) How many students must be in the discrete math class to guarantee that at least two students receive the same grade on the final exam if the exam is graded on a scale from 0 to 54 points?

2

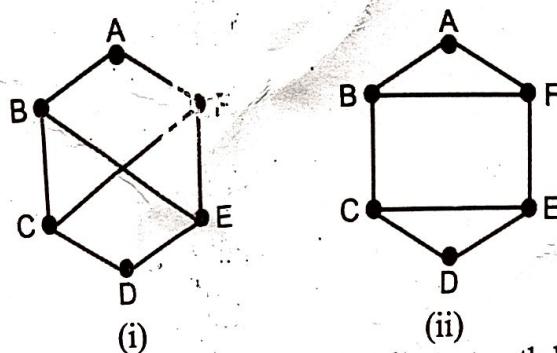
4 (a) Determine whether the following graphs are bipartite or not.

5



2

- (b) State the Handshaking theorem. Determine whether the given pair of graphs are isomorphic or not. 5



- (c) Use Dijkstra's algorithm to find the length of the shortest path between the vertices a and z in the weighted graph displayed in Figure -2.

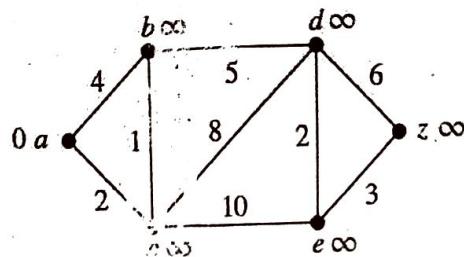
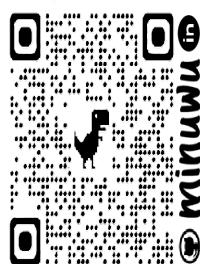
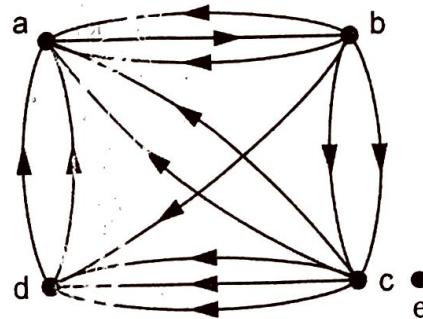


Figure-2.

- 5 (a) Find the in-degree and out-degree of each vertex in the following graph with directed edges.



- (b) Using Prim's algorithm to find a minimum spanning tree for the following given weighted graph (Figure-3).

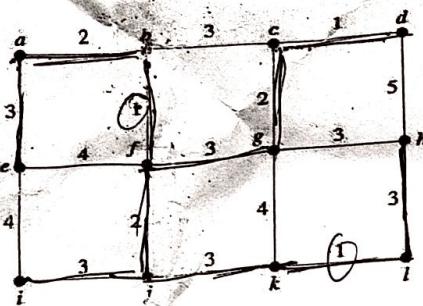
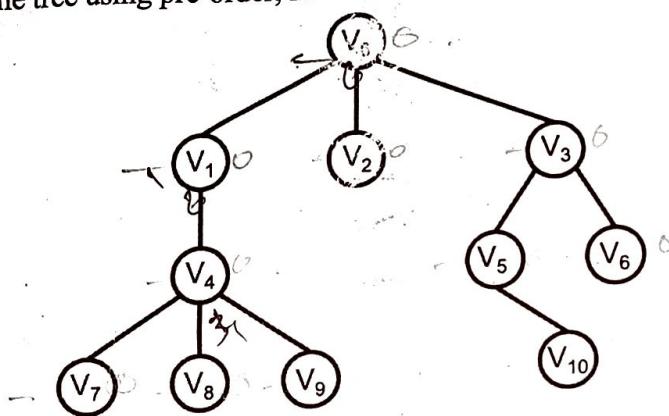
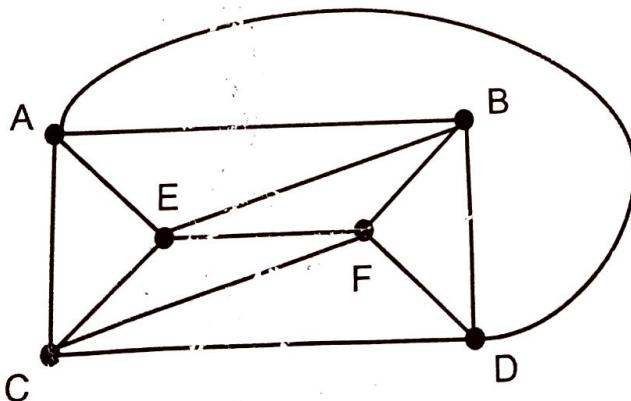


Figure-3

- (c) Visit the tree using pre-order, in-order, and post-order tree traversal algorithms.



- (d) Define the chromatic number. Find the chromatic number of the following graph.



6

2



- 6 (a) To find a spanning tree using Breadth First-Search and Depth First-Search for the graph shown in figure-4.

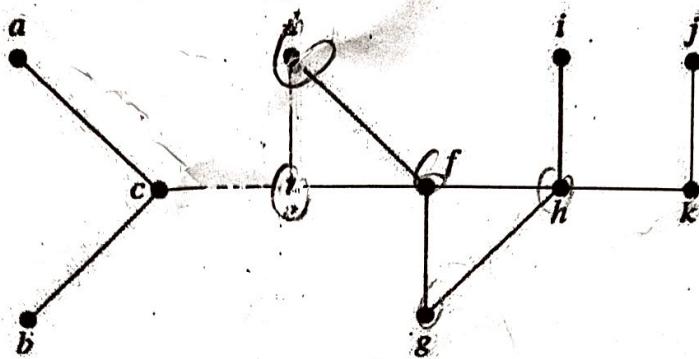
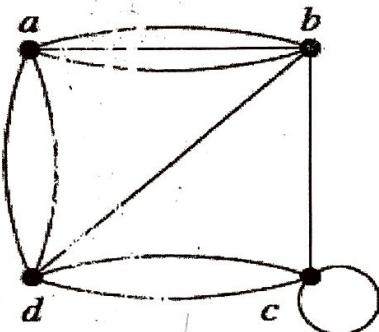


Figure-4

- (b) Using the following pseudograph to represent an adjacency matrix. How many edges does a full binary tree with 100 internal vertices have? 1+2 =3



- (c) Determine whether each of these sets is the power set of a set. Determine the cardinality of each set. 4

i.  $\emptyset$       ii.  $\{\emptyset, a\}$       iii.  $\{\emptyset, a, \{\emptyset, a\}\}$       iv.  $\{\emptyset, a, b, \{a, b\}\}$

- (d) Define inverse relation. Find  $R^{-1}$  if  $R = \{(1,2), (2,5), (2,2), (x,y)\}$  3



# Rangamati Science and Technology University

## Department of Computer Science and Engineering

1<sup>st</sup> Year 2<sup>nd</sup> Semester B.Sc. (Engg.) Final Exam-2020

Course Code: CSE-1204 Session: 2019-2020

Course Title: Digital Logic Design

Time: 3 Hours

Marks: 60

- NB: 1. Answer any FOUR (4) questions out of SIX (6) questions.  
 2. Figures in the right margin indicate marks ( $15 \times 4 = 60$ ).  
 3. All parts of a question must be answered separately.

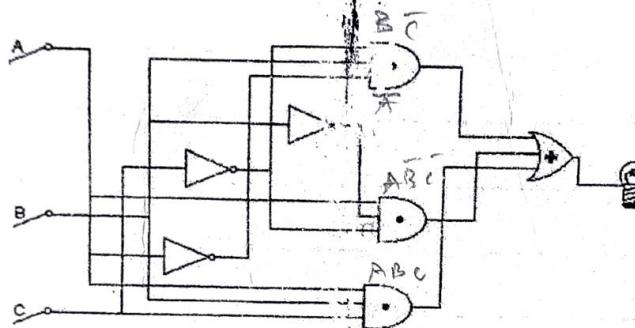
1. (a) Define Universal gate? Explain the formation of AND, OR, and NOT gate using universal gates. 5

- (b) Do the following conversion: 5

$$\text{i. } (465.32)_8 = (?)_{10}$$

$$\text{ii. } (365.672)_{10} = (?)_{16}$$

- (c) From the following circuit, find the output expression and simplify that logical equation and then re-draw the circuit. 5



2. (a) Reduce the following Boolean expression to two literals: 5  
 $ABC'D + A'BD + ABCD$

And draw logic diagrams of the circuit to implement the original and simplified expressions.

- (b) Simplifying the following Boolean Function A with the don't care conditions C using Karnaugh map. 5

$$A(w,x,y,z) = \sum(1,3,7,11,15,5) \quad \text{and} \quad C(w,x,y,z) = \sum(2,5,10)$$

- (c) Simplify the following expression and draw the circuit: 5

$$(AB + \overline{A}\overline{B})(A + B)$$

3. (a) State De Morgan's theorem. Find the complement of the function  $F_1 = x'y'z' + x'y'z$  and  $F_2 = x(y'z' + yz)$  applying De Morgan's theorem. 5

- (b) Construct a 4 to 16 decoder using 2 to 4 binary decoder and show the truth table. 5

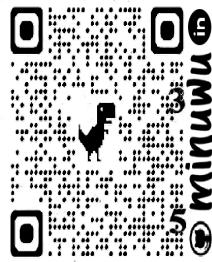
- (c) Design a Block diagram of 32\*5 Encoder and also show the Timing diagram. 5

4. (a) Draw a logic diagram using only two input NOR gates to implement the following function: 5

$$F(A, B, C, D) = (A \oplus B)'(C \oplus D)$$

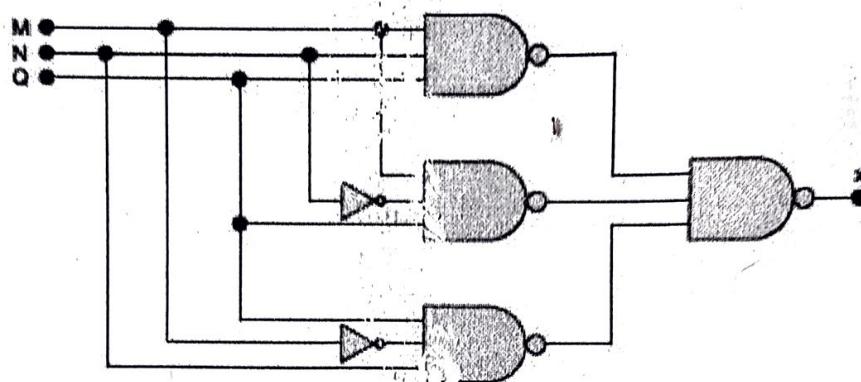
- (b) Illustrate the logic diagram of SR latch constructed with two cross-coupled NOR gates. Also show the function table. 5

- (c) How may you construct Full adder using 4:1 MUX or 8:1 MUX? 5



5. (a) Show the basic configuration of three PLDs.

(b)



- i. Simplify the circuit of figure using Boolean algebra.
- ii. Change each gate in Problem to a NOR gate, and simplify the circuit using Boolean algebra.

(c) i. Construct  $16 \times 1$  mux using five  $4 \times 1$  only. 5

ii. Implement full-adder circuit with multiplexer.

(d) Prove that  $f_1 = m_0 + m_2 + m_5 + m_7 = M_1 \cdot M_3 \cdot M_4 \cdot M_6$ . 2

6. (a) Define positive edge triggered. Design **MOD 10** an asynchronous binary counter and its timing diagram for one cycle. 5

(b) How could you use J-K flip flop to build a D flip flop and show the truth table of D-ff. 5

(c) Differentiate between
 

- i. Combinational logic circuit and Sequential logic circuit.
- ii. RAM and ROM

5



## Rangamati Science and Technology University

### Department of Computer Science and Engineering

1<sup>st</sup> Year 2<sup>nd</sup> Semester B.Sc. (Engg.) Final Exam-2020

Course Code: CSE-1202; Session: 2019-2020

Course Title: Object Oriented Programming Language

Time: 3 Hours

Marks: 60

- NB: 1. Answer any FOUR (4) questions out of SIX (6) questions.  
2. Figures in the right margin indicate marks (15\*4=60).  
3. All parts of a question must be answered serially.

1. (a) What is object-oriented programming? How is it differ from the procedure-oriented programming? 02  
(b) What is JVM? Can java run on any machine? What is need to run Java on a computer? 1+1+3 =05  
(c) How do you define a class? How do you create an object? Describe the relationship between an object and its defining class. 02  
(d) What is a keyword? List some Java keywords? Is Java case sensitive? What is the case for java keywords? 03  
(e) What are syntax errors, runtime error, and logical errors? Give examples of these type errors. 03
2. (a) Body Mass Index (BMI) is a measure of health based on height and weight. It can be calculated by taking your weight in kilograms and dividing it by the square of your height in meters. The interpretation of BMI for 20 years or older as follows: 05

BMI	Interpretation
$BMI < 18.5$	Underweight
$18.5 \leq BMI < 25.0$	Normal
$25.0 \leq BMI < 30.0$	Overweight
$30.0 \leq BMI$	Obese

Write a program that prompts the user to enter a weight in pounds and height in inches and displays the BMI. [ 1 pound = 0.4536 kilograms and 1 inch = 0.0254 meters ]

- (b) Define infinite conditions for the loop. Describe infinite states that may occur for various looping statements used in the Java OOP programming language with appropriate examples. 05  
(c) What is the output of the following code? 03

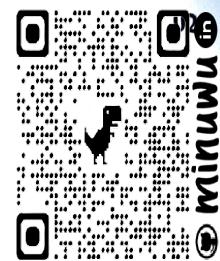
```
1 public class Test {  
2     public static void main(String[] args) {  
3         int list[] = {1, 2, 3, 4, 5, 6};  
4         for (int i = 1; i < list.length; i++)  
5             list[i] = list[i - 1];  
6         for (int i = 0; i < list.length; i++)  
7             System.out.print(list[i] + " ");  
8     }  
9 }  
10 }
```

- (d) Find out the VALID and INVALID: 02
- |               |                  |
|---------------|------------------|
| i) 1_uits     | v) it1sp; a;y    |
| ii) @tutorial | vi) total Number |
| iii) Number1  | vii) RD tems     |
| vi) Else      | viii) inv ilid   |

3. (a) What are the benefits of using a method? How do you define a method? How do you invoke a method? 04

- (b) Identify and correct the errors in the following program:

```
public class Test {  
    public static method1(int n, m) {  
        n += m;  
        method2(3.4);  
    }  
  
    public static int method2(int n) {  
        if (n > 0) return 1;  
        else if (n == 0) return 0;  
        else if (n < 0) return -1;  
    }  
}
```



- (c) What is the keyword break for? What is the keyword continue for? Will the following program terminate? If so, give the output. 04

```
int balance = 10;  
while (true) {  
    if (balance < 9)  
        break;  
    balance = balance - 9;  
}  
  
System.out.println("Balance is "  
+ balance);
```

(a)

```
int balance = 10;  
while (true) {  
    if (balance < 9)  
        continue;  
    balance = balance - 9;  
}  
  
System.out.println("Balance is "  
+ balance);
```

(b)

- (d) Explain the difference between method overloading and method overriding with an appropriate example. 05

4. (a) How do you declare and create an array? How do you access elements of an array? What happens when your program attempts to access an array element with an invalid index? 05

- (b) In the following code, radius is private in the Circle class, and myCircle is an object of the Circle class. Does the highlighted code cause any problems? If so, explain why. 05

```
public class Circle {  
    private double radius = 1;  
  
    /** Find the area of this circle */  
    public double getArea() {  
        return radius * radius * Math.PI;  
    }  
  
    public static void main(String[] args) {  
        Circle myCircle = new Circle();  
        System.out.println("Radius is " + myCircle.radius);  
    }  
}
```

- (c) Let s1 be "Welcome" and s2 be "welcome". Write the code for the following statements: 05

"Replace all occurrences of the character e with E in s1 and assign the new string to s2."

5. (a) Write a method to add two matrices. The header of the method is as follows: 05

```
public static double[][] addMatrix(double[][] a, double[][] b)
```

- (b) What is the output of the following program?

```
public class Test {
    private static int i = 0;
    private static int j = 0;

    public static void main(String[] args) {
        int i = 2;
        int k = 3;

        {
            int j = 3;
            System.out.println("i + j is " + i + j);
        }

        k = i + j;
        System.out.println("k is " + k);
        System.out.println("j is " + j);
    }
}
```

05

- (c) If a method in a subclass has the same signature as a method in its superclass with a different return type, will this be a problem? Explain with an example.

03

- (d) What is the benefit of using the `@Override` annotation?

02

6. (a) How do you catch an exception? Describe with a proper example program. Suppose that statement2 causes an exception in the following statement:

```
try {
    statement1;
    statement2;
    statement3;
}
catch (Exception1 ex1) {
}
finally {
    statement4;
}
statement5;
```

If no exception occurs, will statement4 be executed, and will statement5 be executed?

03

- (b) “Abstract classes may or may not have abstract methods”- explain this statement with appropriate example and explanation.

03

- (c) What is single and multiple inheritance? Does java support multiple inheritance?

04

- (d) Describe Java swing vs AWT components. What is GUI container classes and GUI helper classes? Explain with example.

03

- (e) Write the function of cookies in a Java program.



# Rangamati Science and Technology University

Department of Computer Science and Engineering

1<sup>st</sup> Year 2<sup>nd</sup> Semester B.Sc. (Engg.) Final Examination, 2020

Session: 2019-2020

Course Title: Chemistry

Course code: CHEM-1207

Full Marks: 60

Time: 3 Hours

## Instructions:

- i. Answer any 4 (four) questions out of six questions.
- ii. Figures in the right margin indicate marks.
- iii. All parts of a question must be answered serially.

1.	a) What is Charles' gas law? Give example.	2.5
	b) What are ideal gases? How does an ideal gas differ from a real gas?	2+5=7
	c) A sample of neon gas at 1.20 atm compresses from 0.250 L to 0.125 L. If the temperature remains constant, what is the final pressure?	2.5
	d) What is Avogadro's law? Give a graphical representation of Avogadro's law	1+2=3
2.	a) Define chemical bond. How many types of chemical bonds are recognized?	1+1=2
	b) Define ionic bond with example. Describe the conditions for formation of ionic bond.	2+4=6
	c) What are the characteristics of covalent compounds? Explain coordinate covalent bond with example.	2+3=5
	d) What are the conditions for formation of hydrogen bonding?	2
3.	a) Explain Bronsted-Lowry concept of acids and bases with example.	4
	b) What do you understand by ionization of water? Explain with example.	4
	c) What is a pH meter? Describe a pH meter with figure.	1+3=4
	d) Explain acid-base indicators with example.	3
4.	a) Explain three states of matter with figures.	4.5
	b) What are the properties of plasma state of matter. Where plasmas are found?	2.5+1 =3.5
	c) Describe phase changes of matter with the term of phase change and heat movement during phase change.	3
	d) Describe Boyle's gas law with example. Give a graphical representation of Boyle's gas law.	2+2=4
5.	a) Explain the postulates of Bohr theory.	5
	b) What do you understand by Aufbau Principle? Why the four quantum numbers are needed to specify the position of an electron in an atom? Explain in briefly.	1+4
	c) What are the scopes of Chemistry in studying Computer Science and Engineering? Explain with examples.	4



6. a) "Oxidation is always accompanied by a reduction in a chemical reaction"- 3  
discuss the significance of this statement with example.
- b) Establish the equation  $C_P - C_V = R$  with regard to the 1<sup>st</sup> law of thermodynamics. 5
- c) What will happen if you increase the temperature of a chemical reaction by 10°C from 20°C to 30°C? Explain with the help of Arrhenius equation. 3
- d) Discuss the law of mass action and equilibrium constant ( $K_c$  and  $K_p$ ) for a chemical reaction. 4



**Rangamati Science and Technology University**  
**Department of Computer Science and Engineering**  
 1<sup>st</sup> Year 2<sup>nd</sup> Semester B.Sc. (Engg.) Final Exam-2020  
**Course Code:** MATH-1206; **Session:** 2019-2020  
**Course Title:** Matrices, Vector Analysis and Geometry



**Time: 3 Hours**

**Marks: 60**

- NB: 1. Answer any FOUR (4) questions out of SIX (6) questions.  
 2. Figures in the right margin indicate marks ( $15 \times 4 = 60$ ).  
 3. All parts of a question must be answered serially.

1. (a) Define null matrix, adjoint matrix, scalar matrix, symmetric matrix and skew symmetric matrix. 5  
 (b) Find the inverse matrix of the given matrix using row canonical form: 6  

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$$
  
 (c) Solve the system of linear equations using Matrix method. 4  

$$\begin{aligned} 3x-y+5z &= 1 \\ 2y-4z &= 2 \\ 6x-y+3z &= 0 \end{aligned}$$
2. (a) Determine the given matrix is invertible or not:  $B = \begin{bmatrix} 5 & 10 \\ 3 & 6 \end{bmatrix}$  and find the  $B^{-1}$ . 3  
 (b) What do you mean by Rank of a matrix? Find the rank of the matrices where they are in normal form:  $A = \begin{bmatrix} 1 & -1 & 2 & 0 \\ 1 & 1 & 1 & 1 \\ -1 & -3 & 0 & -2 \end{bmatrix}$  7  
 (c) If  $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ , then find  $A^{-1}$ . 6
3. (a) Find a unit vector perpendicular to both vector **A** and vector **B** where:  $\bar{A}=6\bar{i}+22\bar{j}-5\bar{k}$ ,  $\bar{B}=\bar{i}+6\bar{j}-2\bar{k}$ . 4  
 (b) Determine the value of  $a$  so that  $\bar{A}=2\bar{i}-a\bar{j}-\bar{k}$  and  $\bar{B}=4\bar{i}-2\bar{j}-2\bar{k}$  are perpendicular. 2  
 (c) Prove that,  $\frac{d}{dt} \left[ (\bar{a} \times \frac{d}{dt} \bar{b}) \right] - \frac{d}{dt} \left[ (\bar{b} \times \frac{d}{dt} \bar{a}) \right] = \frac{d}{dt} \bar{b} \times \bar{a} - \frac{d}{dt} \bar{a} \times \bar{b}$  5  
 (d) Show that  $\bar{A} = (6xy + z^3)\bar{i} - (3x^2 - z)\bar{j} - (3xz^2 - y)\bar{k}$  is irrational. Find  $\phi$  such that  $A = \nabla \phi$ . 4
4. (a) What is the basic difference between Divergence and Curl. Find the gradient and unit normal to the surface  $x^2y+2xz=4$  at the point  $(2, -2, 3)$ . 4  
 (b) Prove that the curl of the gradient of **A** is zero. 3  
 (c) If  $u=x+y+z$ ,  $v=x^2+y^2+z^2$ ,  $w=xy+yz+zx$ , then prove that  $(\text{grad } u) \cdot ((\text{grad } v) \times (\text{grad } w))=0$  4  
 (d) Show that  $\nabla r^n = nr^{n-2} \bar{r}$  4

5. (a) Write down the summarized formulas of conics. 5
- (b) Suppose a force field is given by  $(2x-2y+z)\vec{i} + (3x+y-2z^2)\vec{j} + (2x-2y+4z)\vec{k}$ . Find the work done in moving a particle once around a circle C in the xy-plane with its center at the origin and a radius of 5. 5
- (c) Prove the equation to the line and intersecting the plane  $4x+4y-5z=12$  and  $8x+12y-13=32$  can be written as  $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z}{4}$  5
6. (a) Find the equation of plane through the points  $(2,2,1)$  and  $(9,3,5)$  and perpendicular to the plane  $2x+6y+6z=9$ . 3
- (b) What is shortest distance of two lines. Show that the shortest distance between two lines  $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$  and  $\frac{x-2}{2} = \frac{y-4}{3} = \frac{z-5}{5}$  is  $1/\sqrt{6}$  6
- (c) Find the centre and radius of the sphere whose equations is  $x^2+y^2+z^2-2x-4y-6z=0$ . Show that the intersections of the sphere and plane  $x+2y+2z-20=0$  is circle whose centre is at the point  $(2,4,5)$  and radius  $\sqrt{7}$ . 6

