MID-SEMESTER EXAMINATION, MAY-2023
CALCULUS - B (MTH-2101)

Programme: B. Tech **Semester : 2nd**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Determine the distances, volume, equations of spheres, lines, and planes using vector operations in space.	L3	1. a, b, c, 2. a, b, c, 3. a	2,2,2 2,2,2 2
Compute the length of a curve, curvature, tangent, and normal vectors.	L3	3. b, c, 4. a, b, c	2,2 2,2,2
Determine limit, derivatives, directional derivatives, maxima/minima, and Jacobian of a function of two or several variables.	L3	5. a, b, c.	2,2,2

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1.	(a)	Determine the distance from (3,7, -5) to the xy - plane.	2
	(b)	Determine the equation of the sphere with center (2, -6,4) and radius 5 and also examine the plane obtained by the intersection of the sphere and zx -plane.	2
	(c)	If $A(0,4,3)$ $B(0,0,0)$, and $C(3,0,4)$ are three points defined in x, y, z coordinate system, then compute the vector perpendicular to both $\overrightarrow{AB}$ and $\overrightarrow{AC}$.	2

2.	(a)	Determine whether the two vectors $\langle 4,6\rangle$ and $\langle -3,2\rangle$ are orthogonal, parallel, or neither.	2
	(b)	Determine the parametric and symmetric equations for the line through the origin and the point (1,2,3).	2
	(c)	Calculate the volume of the parallelopiped formed by the vectors $\vec{a}=\langle 6,3,-1\rangle, \vec{b}=\langle 0,1,2\rangle$ and $\vec{c}=\langle 4,-2,5\rangle$.	2
3.	(a)	Construct a vector equation and parametric equations for the line segment that joins $P(1,2,3)$, and $Q(1,-3,1)$.	2
	(b)	Determine the parametric equations for the tangent line to the curve $x=e^t, y=te^t, z=te^{t^2}$ at the point $(1,0,0)$.	2
	(c)	Compute the length of the curve $\vec{r}(t)=\left\langle 12t, 8t^{\frac{3}{2}}, 3t^2 \right\rangle, 0\le t\le 1$.	2
4.	(a)	Determine the equation of the normal plane of the curve $x=2\sin 3t, y=t, z=2\cos 3t$ at the point $P(0,\pi,-2)$.	2
	(b)	Determine the velocity and position vectors of a particle that has the acceleration $\vec{a}(t)=\langle 1,2,0\rangle$ and has the initial velocity and position vectors $\vec{v}(0)=\langle 0,0,1\rangle$ and $\vec{r}(0)=\langle 1,0,0\rangle$ respectively.	2

	(c)	A gun has muzzle speed $150m/s$. Compute the two angles of elevation that can be used to hit a target $800m$ away.	2
5.	(a)	Determine $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if z is defined implicitly as a function of x and y by the equation $x^2-y^2+z^2-2z=4$.	2
	(b)	Let $f(x,y)=y^x$. Determine $\frac{\partial^2 f}{\partial x \partial y}$ at $x=2, y=1$.	2
	(c)	If $u=\sqrt{r^2+s^2}$, $r=y+x\cos t, s=x+y\sin t$; then determine the partial derivatives $\frac{\partial u}{\partial x}, \frac{\partial u}{\partial y}, \frac{\partial u}{\partial t}$ when $x=1, y=2, t=0$.	2
		End of Questions	

MID-SEMESTER EXAMINATION, MAY-2023
INTRODUCTORY GRAPH THEORY (CSE 1004)

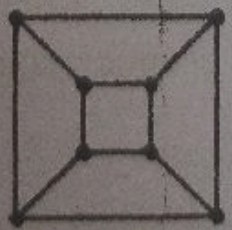
Programme:B.Tech(CSE & CSIT) **Semester: 2nd**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
CO-1: Define the fundamental concepts of graphs and apply them to study graph isomorphisms, Eulerian graphs, graphic sequences and digraphs.	L3, L3, L4, L3, L3, L3 L3, L3, L4	1(a),1(b), 1(c),2(a), 2(b),2(c) 3(a),3(b), 3(c)	2,2, 2,2, 2,2 2,2, 2
CO-2: Define trees, spanning trees and study its various concepts and apply the Kruskal's algorithm to find the minimum spanning tree and Dijkstra's algorithm to find the shortest path of a connected weighted graphs.	L3, L3, L3, L3, L3, L3	4(a),4(b), 4(c),5(a), 5(b),5(c)	2,2, 2,2, 2,2

*Bloom's taxonomy levels: Remembering (L1), Understanding (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

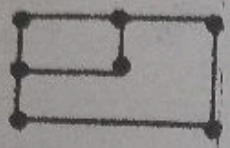
Answer all questions. Each question carries equal mark.

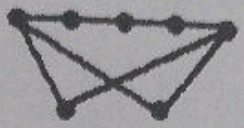
1. (a) Determine whether the graph given below decomposes into copies of P_4. 2



(b) Show that every graph has an even number of vertices of odd degree. 2

(c) Analyze the given pair of graphs and determine whether they are isomorphic or not. 2





2. (a) Determine the maximum number of edges in a bipartite graph with 12 vertices. 2

(b) If G is an undirected graph with n vertices and 25 edges such that each vertex of G has degree atleast 3, then determine the maximum possible value of n. 2

(c) Prove or disprove: Every Eulerian simple graph with an even number of vertices has an even number of edges. 2

3. (a) Show that every graph with n vertices and k edges has at least $n-k$ components. 2

(b) Show that if there is an n-vertex tournament with indegree equal to outdegree at every vertex then n is odd. 2

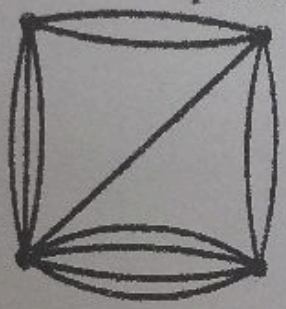
(c) Analyze and determine whether the sequence $5,5,4,3,2,2,2,1$ is a graphic sequence or not. If yes, draw the graph. 2

4. (a) Show that if G is an n-vertex connected graph with $n-1$ edges then G has no cycles. 2

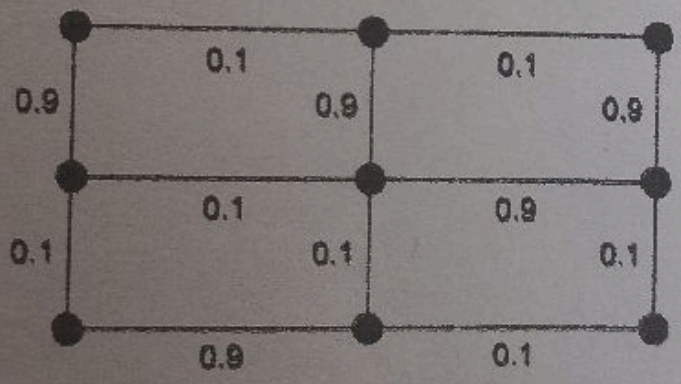
(b) If T is a tree with 10 vertices, then determine the sum of the degrees of all the vertices in T. 2

(c) Let T be a tree with average degree a. In terms of a, determine $n(T)$. 2

5. (a) Determine the number of spanning trees of the given graph by the matrix tree computation method. 2



(b) Consider the given undirected graph with edge weights as shown. 2



Determine the number of minimum weight spanning trees of the above graph and draw them.

(c) Show that the graph G is a tree if and only if G is connected and every edge is a cut-edge. 2

End of Questions

MID-SEMESTER EXAMINATION, May-2023

University Physics:Electricity & Magnetism (PHY2001)

Programme: B.Tech **Semester:2nd**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
CO-1: Able to comprehend Laws of electricity and magnetism Electromagnetic waves, active components of dc and ac circuits.	L_1, L_2	1(a), 2(a), 3(a), 4(a),5(a)	10
CO-2: Able to apply theoretical concepts and laws of electricity & magnetism to solve problems related to circuits analysis, electromagnetic theory and relevant engineering applications.	L_2, L_3	1(b), 2(b), 3(b), 4(b),5(b)	10
CO-3: Able to apply the fundamental laws of electromagnetism to give appropriate solutions to complex problems, design experiments and circuits, design small electrical equipments related to day to day life.	L_2, L_3	1(c), 2(c), 3(c), 4(c),5(c)	10

*Bloom's taxonomy levels: Remembering (L1), Understanding (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1.	(a)	Find the electric field at a point on the axis of a uniformly charged ring of radius 'a' at a distance '*x*' from its centre.	2
	(b)	Two equal positive charges $q_1 = q_2 = 2\mu C$ are located at x = 0, y = 0.3m and x=0, y= – 0.3m, respectively. What are the magnitude and direction of the total electric force that q_1 and q_2 exert on a third charge $Q = 4\mu C$ located at x = 0.4m, y = 0.	2
	(c)	Evaluate the ratio of electrostatic force and gravitational force of attraction between an electron and proton pair where mass of electron $m_e = 9.1\times10^{-31} kg$ and mass of proton $m_p = 1.67\times10^{-27} kg$. ($G = 6.67\times10^{-11}\frac{N.m^2}{kg^2}$).	2

2.	(a)	Derive an expression for the electric field due to a uniformly charged non conducting sphere of radius R at a distance r from the centre of the sphere, where $r < R$.	2
	(b)	A point charge of -2.00 μC is located in the center of a spherical cavity of radius 6.50 cm inside an insulating charged solid. The charge density in the solid is $\rho = 7.35 \times 10^{-4}$ C/m^3. Calculate the electric field inside the solid at a distance of 9.50 cm from the center of the cavity.	2
	(c)	An amount of charge 'Q' is placed on an irregularly shaped conductor. Can it be possible to calculate the electric field at an arbitrary position outside the conductor applying the Gauss law if the shape and size of the conductor is known? Justify your answer.	2
3.	(a)	A solid conducting sphere of radius R has a total charge Q. Find the electric potential everywhere, both inside and outside the surface.	2
	(b)	A total electric charge of 3.5 nC is distributed uniformly over the surface of a metal sphere of radius 24 cm. Find the value of potential at the following distances from the centre of the sphere; (i) 48 cm and (ii) 12 cm.	2
	(c)	Graphically, show how the electric field and electric potential due to a charged conducting sphere vary with the distance 'r' from its centre.	2
4.	(a)	Derive the expression for energy stored in a capacitor with the space between the plates being vacuum. If a dielectric is inserted in between the plates keeping the charge on each plate constant, how will the stored energy be affected?	2
	(b)	The plates of a parallel plate capacitor in vacuum are 5 mm apart and $2m^2$ in area. A 10 KV potential difference is applied across the capacitor. Compute (i) Charge on each plate (ii) Magnitudes of the electric field between the plates.	2
	(c)	You want to connect a 4 μF capacitor and an 8 μF capacitor. In which type of connection will the 4 μF capacitor have a greater amount of energy than that of 8 μF capacitor? Justify your answer.	2
5.	(a)	Express Ohm's Law in terms of electric field and current density. Hence derive the relation between potential difference across a conductor and the current flowing through it.	2

	(b)	Evaluate and rank the magnitude of the current from the highest to lowest value in the following circuits. (i) 1.4 Ω connected to 1.5 V battery with internal resistance r = 0.10 Ω (ii) 1.8 Ω connected to 4V battery having terminal voltage of 3.6V but with an unknown internal resistance. (iii) An unknown resistor connected to a 12V battery that has an internal resistance of 0.2 Ω and terminal voltage of 11V.	2
	(c)	A radio receiver operating at 6 V draws a current of 0.1 A. How much electrical energy will it consume in 2 hours?	2
		End of Questions	

MID-SEMESTER EXAMINATION, May-2023
DATA STRUCTURE AND ALGORITHMS (CSE 2001)

Programme: B.Tech/BCA/MCA/MSc/M.Tech **Semester:2nd**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Able to state and explain the basic programming syntax, semantics, building blocks.	L1	4(a,c) 5(b)	6
Able to develop java programs using the programming constructs like conditional statements, looping, arrays, methods and structures.	L2	2(a,b,c) 3(a,b,c) 4(b) 5(a)	16
Able to analyze, debug and test the programs and correctly predict their outputs.	L3	1(a,b,c) ,5(c)	8

*Bloom's taxonomy levels: Remembering (L1), Understanding (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) Find output of the given code snippet. 2

```
class p2
{
        static int x=-55;
        public static void main(String args[])
        {
          p2 obj1=new p2();
          obj1.x=obj1.x*2-66;
          System.out.println(obj1.x);
          p2 obj2=new p2();
          obj2.x=obj2.x+66;
          System.out.println(obj1.x+" "+obj2.x);
        }
        static
        {
              System.out.println(x);
        }
}
```

(b) Find Error or output of the below given code. If error then re-write the correct code. 2

```
public class p2
{
        public static final int x=4;
        public static void main(String[] args)
        {
         int a=10,b=5;
         switch(a<b?a:b-1)
         {
          case 5:
               System.out.println("Wow");
               break;
          case 3:
               System.out.println("Its working");
               break;
          case x:
               System.out.println("Ooh...");
               break;
          default:
               System.out.println("Fine...");
        }
   }
}
```

(c) Find Error or output of the below given code. If error then re-write the correct code. 2

```
abstract class Bank
{
    private String bankName;
    Bank(String bankName)
    {
        this.bankName=bankName;
    }
    public String getBankName()
    {
      return "Your bank is:"+bankName;
    }
}
class p2 extends Bank
{
        p2()
        {
          super("SBI");
          super("AXIS");
```

```
    }
    public static void main(String args[])
    {
      Bank bank=new p2();

System.out.println(bank.getBankName());
    }
}
```

2. (a) Define a class called Complex with instance variables real, imag and instance methods display() and add(). Initialize the two complex number by using parameterized constructor. Write a Java program to add two complex number. The prototype of add method is: *public Complex add(Complex, Complex).* 2

(b) Write a Java program to declare a Class named as Person which contains name and age as instance members and Person (name,age) and displayStudent () as constructor and instance methods. A derived class Employee is created from the class Person. The derived class contains eid, dept, salary as instance members. Use proper constructor to initialize Employee details. The displayDetails () is to print the employee details. 2

(c) For the Question no. 3(a) Create an array of objects of the Employee class and display the details of 50 employees. 2

3. (a) Define an interface StaffInterface (void displayStaff(), void giveBonus(double amount)). Define an abstact class Staff (Fname, Lname, salary). 2

(b) Use Question no. 4(a) and define a concrete class Supervisor(bonous) subclass of staff and define the interface methods. Use proper constructor in the class hierarchy. Ensure bonous amount should not be zero, handle it using exception handling. Create an array of interface references and populate the supervisor objects. 2

(c) Initialize an array with name of the Animals. Identify the 2 exceptions that may be generated and write the exception handler in Java. 2

4. (a) Why multiple inheritance is not supported in java. Explain with proper examples. 2

(b) Write a java program to print an array of different type using single Generic method. The signature of printArray method is given below.
public static <T> void printArray(T a[])

(c) What is auto boxing and unboxing explain with proper examples. 2

5. (a) Write a java program to read dsa_mark from keyboard. If the dsa_mark>100 then throw an user defined Exception "MarkException" with a customized message "Mark can't be greater than 0". 2

(b) What is the use of finally block in Exception Handling. Explain with proper examples. 2

(c) For the below given code snippet which line having error. Identify the error. Correct the error and re-write the code. 2

```
abstract class Bank
{
        private abstract void withdraw();//Line
1
        abstract void deposit();
        public void balance();//Line 2
}
class office extends Bank
{
        void deposit()//Line 4
        {

        }
}
```

End of Questions