

MID-SEMESTER EXAMINATION, MARCH-2020
INTRODUCTORY GRAPH THEORY (CSE 1004)

Programme: B.Tech(CSE & CSIT)
Full Marks: 30

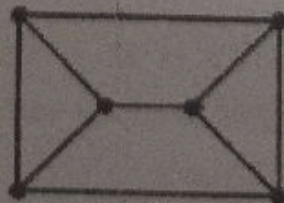
Semester: 2nd
Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Define the fundamental concepts of graphs and apply them to study graph isomorphisms, Eulerian graphs, graphic sequences and digraphs.	L3, L3, L3, L3, L3, L3 L3, L3, L3	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
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

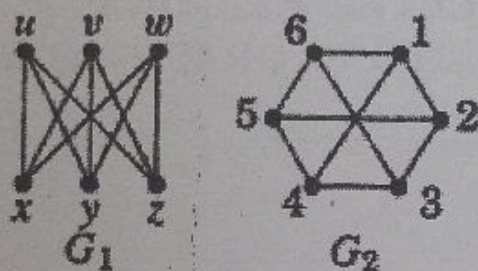
*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) Define decomposition of a graph and determine whether the graph given below decomposes into copies of P_4 . 2



- (b) Determine whether the given pair of graphs G_1 and G_2 are isomorphic or not. 2

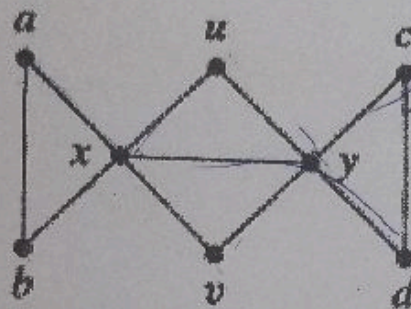


- (c) Prove that the complement of a simple disconnected graph must be connected. 2
2. (a) Prove that every $u-v$ walk in a simple undirected graph contains a $u-v$ path. 2
- (b) Define cut-vertex and cut-edge of a graph and determine the cut-vertices and cut-edges of the given graph by suitably naming the vertices. 2

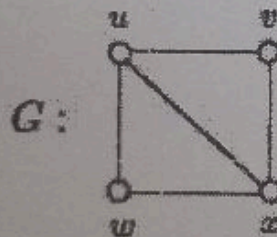


- (c) Prove or disprove: Every Eulerian simple graph with an even number of vertices has an even number of edges. 2
3. (a) Prove that every graph has an even number of vertices of odd degree. 2
- (b) Determine whether the sequence 5, 5, 4, 4, 2, 2, 1, 1 is a graphic sequence or not. 2
- (c) Prove that if there is an n -vertex tournament with indegree equal to outdegree at every vertex then n is odd. 2

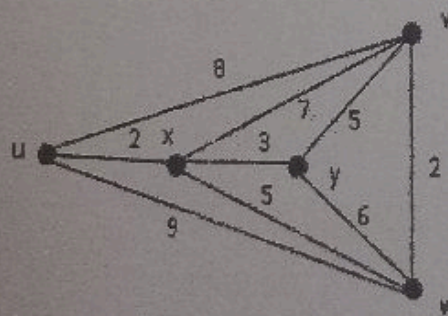
4. (a) Prove that if G is an n -vertex connected graph with no cycles then G has $n-1$ edges. 2
- (b) Find the eccentricities of each vertex of the given graph and hence find the diameter and radius of the graph. 2



- (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 graph G by contraction of edges or recurrence method. 2



- (b) Define minimum spanning tree and find the minimum spanning tree of the given weighted graph by Kruskal's algorithm. 2



- (c) Prove that if a graph is loopless and has exactly one spanning tree then it is a tree. 2

End of Questions

Mid-Semester Examination, March-2020

Data Structure and Algorithms(CSE 2001)

Programme: B.Tech.(All Branch)

Semester: 2nd

Full marks: 30

Time: 2 hours

Subject Learning Outcome	*Taxonomy Level	Question Number	Total Marks
Ability to state and explain the basic programming syntax, semantics, building blocks .	L1	2(b,c)	4
Ability to develop java applications using the programming tools like conditional statements,looping, arrays, methods and structure.	L2, L3	1c, 2a, 3(a,b), 4(a,b,c), 5(a,c)	18
Ability to analyze, debug and test the programs and correctly predict their output.	L4	1(a,b), 3c, 5b	8
Ability to differentiate behaviors of different data structures and their memory representation.			
Ability to choose the appropriate data structures that efficiently model the problem of interest.			
Ability to apply advanced programming technique for developing solution of different problems.			

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

Answer all questions. All questions carry equal marks. All bits of each question carry equal marks.

The figures in the right side indicate marks.

1. (a) Find the output or error of the given code.If error then re-write the code so that it will give output.

[2]

```
class Test
{
    static int i;
    double d;
}
```



```
class check
{
    public static void main(String args[])
    {
        Test t1=new Test();
        t1.i++ ;
        t1.d++;
        System.out.println(t1.i);
        System.out.println(t1.d);
        Test t3=t1;
        t3.i=t3.i++;
        t3.d=t3.i+t3.d+7.325;
        System.out.println(t1.i);
        System.out.println(t1.d);
        System.out.println(t3.i);
        System.out.println(t3.d);
    }
}
```

- (b) Find the output or error of the given code. If error then re-write the code so that it will give output. [2]

```
interface check
{
    int a;
    void print()
    {
        System.out.println("hello");
    }
}

class test
{
    public static void main(String args[])
    {
        check cl=new check();
        System.out.println(cl.a);
    }
}
```



```
        System.out.println(c1.print());  
    }  
}
```

- (c) Define a class called Complex with instance variables real, imag and instance methods display() and add(). Initialize the two complex number by using parametrized constructor. Write a Java program to add two complex number. The prototype of add method is:
public Complex add(Complex, Complex) [2]
2. (a) Write a Java program to declare a Class named as Student which contains rollno, name and course as instance variables and Student (rollno,name,course) and displayStudent () as constructor and instance methods. A derived class Exam is created from the class Student . The derived class contains mark1, mark2, mark3 as instance variables representing the marks of three subjects and inputMarks () and displayResult () as instance methods. [2]
- (b) For the *Question no. 2(a)* Create an array of objects of the Exam class and display the result of 5 students. [2]
- (c) Define Interface in Java. How the interface is differentiated from abstract class explain with proper examples. [2]
3. (a) Define an interface EmpInterface (void displayEmp(), void giveBonus(double amount)). Define an abstract class Employee (empID, Fname, Lname, salary). [2]
- (b) Use Question no:3(a) and define a concrete class Manager (bonus) subclass of Employee and define the interface methods. Perform the followings: Define the appropriate constructor in class hierarchy Ensure the bonus amount should not be negative and zero using exception handling. Create an array of interface reference variables and populate with manager objects. [2]
- (c) Initialize an array with name of the students. Identify 2 exceptions that may be generated & write exceptional handler in Java. [2]
4. (a) Write a Java program to read withdraw balance from keyboard. Treat withdraw balance <100 as withdrawException(user defined). The Exception should print "Invalid amount". [2]

- (b) Write a java program using Generics to swap two generic variable of same type. Show the swap with different data type. [2]
- (c) Write a java method using Generics to search of an element in an array of any type. The signature of search method is given below.
public static <T>int search(T[] array, T item) [2]
5. (a) Write a recursive method in Java to find the nth Fibonacci number. [2]
- (b) Draw the recursive trace for Question no 5(a). Let the number n=6. [2]
- (c) Write a recursive method in Java to find the binary equivalent of a positive decimal integer. [2]

MID-SEMESTER EXAMINATION, MARCH-2020 **CALCULUS-II (MTH-2001)**

Programme: B.Tech.

Full Marks: 30

Semester: 2nd

Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Use the knowledge of three dimensions and vectors to describe the region, lines, planes and surfaces.	L1, L1, L1	1 (a)(b)(c)	2 X 9=18
	L1, L1, L5	2 (a)(b)(c)	
	L1, L1, L3	3 (a)(b)(c)	
Compute the length of the curve, curvature, tangent, normal vector and tangent plane.	L1, L1, L1	4 (a)(b)(c)	2 X 3=6
Apply the concept of function of several variables to find the limit, continuity and partial derivatives.	L1, L1, L1	5 (a)(b)(c)	2 X 3=6

*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) Find the region of \mathbb{R}^3 represented by the inequality $x^2 + y^2 + z^2 \leq 2z$. [2]
- (b) Find the center and radius of the sphere $2x^2 + 2y^2 + 2z^2 = 8x - 24z + 1$. [2]
- (c) Find the direction cosines and direction angles of the vector $\vec{a} = 6\hat{i} + 3\hat{j} - 2\hat{k}$. [2]

2. (a) Find a vector that has the same direction as the vector $\vec{a} = -2\hat{i} + 4\hat{j} + 2\hat{k}$ but has length 6. [2]

(b) Find a nonzero vector \vec{v} that is orthogonal to the plane through the vertices [2]

$P(1,0,1)$, $Q(-2,1,3)$ and $R(4,2,5)$.

(c) Find the area of the parallelogram with vertices [2]

$A(-2,1)$, $B(0,4)$, $C(4,2)$ and $D(2, -1)$.

3. (a) Find the angle between the planes $2x - 3y + 4z = 5$ and $x + 6y + 4z = 3$. [2]

(b) Find an equation of the plane through the point $(4,0,-3)$ and with normal vector $\langle 0,1,2 \rangle$. [2]

(c) Sketch the region bounded by the surfaces [2]

$z = \sqrt{x^2 + y^2}$ and $x^2 + y^2 = 1$ for $1 \leq z \leq 2$

4. (a) Find the domain of the vector function $\vec{r}(t) = \langle \sqrt{4-t^2}, e^{-3t}, \ln(t+1) \rangle$. [2]

(b) A projectile is fired with muzzle speed 150 m/s and angle of elevation 45 degree from a position 10m above ground level. Find, where does the projectile hit the ground? [2]

(c) Find the length of the curve $\vec{r}(t) = \sqrt{2}t\hat{i} + e^t\hat{j} + e^{-t}\hat{k}$, $0 \leq t \leq 1$. [2]

5. (a) Find the domain and range of the function $f(x, y) = \cos(x + 2y)$.

(b) Find the limit if it exists $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 y^3}{2x^2 + y^2}$.

(c) Find the first partial derivatives of the

function $f(x, y) = \frac{x}{(x + y)^2}$.

End of Questions

MID-SEMESTER EXAMINATION, MARCH-2020
University Physics: Electricity and Magnetism (PHY 2001)

Programme: B. Tech
 Full Marks: 30

Semester: 2nd
 Time: 2 Hours

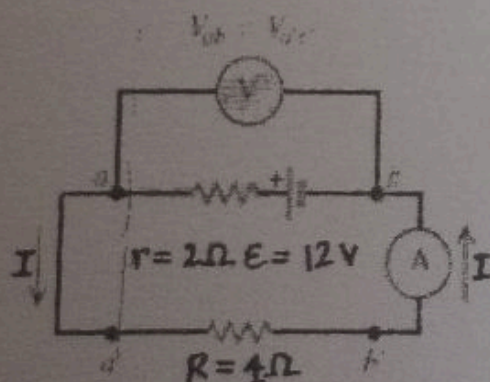
Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
UPEM/ a, e	L ₁ , L ₂ , L ₃	1	6
UPEM/ a, e, g	L ₁ , L ₂ , L ₃	2	6
UPEM/ a, e, g	L ₁ , L ₂ , L ₃	3	6
UPEM/ a, e	L ₁ , L ₂ , L ₃	4	6
UPEM/ a, e, g	L ₁ , L ₂ , L ₃	5	6

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

Answer all questions. Each question carries equal mark.

- Derive the expression for torque on an electric dipole in a uniform external electric field.
 - An electric dipole is in a uniform electric field of magnitude 5×10^5 N/C. The charges on the dipole are $\pm 1.6 \times 10^{-19}$ C each and are separated by 0.125 nm. Find the magnitude of electric dipole moment, potential energy and torque on the dipole if it makes an angle 145° with the direction of electric field.
 - Discuss the equilibrium condition of an electric dipole when it is placed in a region of uniform electric field E, with the electric dipole moment P.
- Find the electric field due to a uniformly charged non conducting sphere at a distance 'r' from the centre of the sphere.
 - A solid metal sphere with radius 0.45 m carries a net charge of 0.25 nC. Find the magnitude of the electric field at a point 0.1 m outside the surface of the sphere.
 - 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.

3. (a) Electric charge 'Q' is distributed uniformly around a thin ring of radius 'a'. Find the electric potential at a point 'P' on the ring axis at a distance 'x' from the centre of the ring. 2
- (b) A small particle has charge $-5\mu\text{C}$ and mass $2.00 \times 10^{-4} \text{ kg}$. It moves from point A, where the electric potential is $V_A = +200 \text{ V}$, to point B, where the electric potential is $V_B = +800 \text{ V}$. The electric force is the only force acting on the particle. The particle has speed 5.00 m/s at point A. What is its speed at point B? 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) Find the capacitance of a parallel plate capacitor with its two plates each of area 'A' at a distance 'd' from each other. What change in its capacity do you expect if a dielectric is inserted between the plates? 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 (a) the capacitance; (b) the charge on each plate; and (c) the magnitude of the electric field between the plates. 2
- (c) You want to connect a $4 \mu\text{F}$ capacitor and an $8 \mu\text{F}$ capacitor. In which type of connection will the $4 \mu\text{F}$ capacitor have a greater amount of energy than that of $8 \mu\text{F}$ capacitor? Justify your answer. 2
5. (a) Derive the expression for current density in a conducting wire in terms of drift velocity of moving charges. 2
- (b) A copper wire of diameter 1 mm carries a current of 1.75 A to a 200-W lamp. The free electron density in the wire is $8.5 \times 10^{28} \text{ m}^{-3}$. Find (i) the current density; and (ii) the drift velocity. 2
- (c) 2



What are the voltmeter and ammeter readings in the above given circuits?