University of Asia Pacific

Department of Basic Sciences and Humanities

Mid-Semester Examination Fall-2022

Program: B. Sc. in CSE

Course Title: Math III: Multivariable Calculus Course No. MTH 201 Credit: 3.0

Time: 1.00 Hour Full Marks: 60

There are **FOUR** Questions. **Answer THREE questions including Q-1 and Q-2.**

1. a. Find parametric equations of the tangent line to the curve whose parametric equations are $x = t^3$, $y = t^4 - t^2$, $z = -5t^2$ at $t = 2$. **[10]**

   b. Suppose that a particle moves through 3-space so that its position vector at time t is $\vec{r}(t) = t\hat{i} + t^2\hat{j} + t^3\hat{k}$ **[10]**

   (i) Find the scalar tangential and normal components of acceleration at $t = 1$

   (ii) Find the vector tangential and normal components of acceleration at $t = 1$.

2. a. A moving particle starts at an initial position $\vec{r}(0) = \hat{i}$ with initial velocity $\vec{v}(0) = \hat{i} - \hat{j} + \hat{k}$. Its acceleration is $\vec{a}(t) = 4t\,\hat{i} + 6t\,\hat{j} + \hat{k}$. Find its position and velocity at time t. **[10]**

   b. Define arc length and hence find the arc length of the curve **[10]**

$$\vec{r}(t) = e^t \cos t\,\hat{i} + e^t \sin t\hat{j} + e^t\hat{k} \text{ for } 0 \le t \le \frac{\pi}{2}.$$

3. a. Find the curvature of the vector function $\vec{r}(t) = a\cos t\hat{i} + a\sin t\hat{j} + ct\,\hat{k}$ at $t = 0$. **[10]**

   b. Test the continuity of $f(x, y)$ at $(x, y) = (0, 0)$ where **[10]**

$$f(x,y) = \begin{cases} \dfrac{\sin(x^2 + y^2)}{(x^2 + y^2)} & when\ (x,y) \neq (0,0) \\ 1 & when\ (x,y) = (0,0) \end{cases}$$

OR

4. a. What do you know about gradient, divergence and curl? Find the directional derivatives of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction $2\hat{i} - 3\hat{j} + 6\hat{k}$. **[12]**

   b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$. **[8]**

University of Asia Pacific

Department of Computer Science and Engineering

Mid Semester Examination Fall - 2022

Program: B. Sc. Engineering (2nd Year / 1st Semester)

Course Title: Electrical & Electronic Engineering II Course No: EEE221 Credits: 4.00

Time: 1.00 Hour. Full Marks: 60

[There are **Four** Questions. Answer any **Three** including **question 1 and 2**. Figures in the right margin indicate marks.]

1. Explain the reasons for choosing NPN transistor over PNP transistor and NMOS over PMOS for implementing different logic functions. Construct the following logic function using DTL and CMOS design techniques. [4+8+8]

$$F = (\bar{A} + B + C\bar{D})$$

2. a. Draw the equivalent circuits for short shunt and long shunt compound generator. Explain the open circuit characteristics of a DC shunt generator. [5+5]

   b. A shunt generator delivers a load current of 50A at 500 V and has armature and shunt filed resistance of 0.05 Ω and 250 Ω respectively. Calculate the generated voltage and the armature current. [10]

3. a. What are the losses involved in a DC machine? How can these losses be minimized? [5+5]

   b. A DC motor takes an armature current of 100A at 450V. The armature circuit resistance is 2.5Ω. The machine has 6-poles and the armature is wave-connected with 850 conductors. The flux per pole is 0.05Wb. Calculate (i) the speed, (ii) the gross torque developed by the armature. [5+5]

OR

4. a. What is armature reaction? What are the effects of armature reaction? How it can be minimized? [5+5]

   b. A four-pole generator, having wave-wound armature winding has 51 slots, each slot containing 20 conductors. What will be the voltage generated in the machine when driven at 1500 rpm assuming the flux per pole to be 7.0 mWb? [10]

University of Asia Pacific

Department of Basic Sciences and Humanities

Mid-Semester Examination Fall -2022

Program: B. Sc. in CSE

Course Title: Probability & Statistics Course No. MTH 203 Credit: 3.0

Time: 1 Hour Full Marks: 60

There are **FOUR** Questions. **Answer THREE questions including Q-1 and Q-2.**

1. **a.** If a student of the CSE department has the following results during his/her under graduation, Calculate his/her CGPA. **[10]**

Level	**1-1**	**1-2**	**2-1**	**2-2**	**3-1**	**3-2**	**4-1**	**4-2**
GPA	3.21	3.50	3.76	3.65	3.45	3.60	3.95	3.82
Credit	19.00	19.50	20.50	19.50	21.50	21.00	21.50	19.50

b. Calculate the mode age from the following data showing the distribution of internet browsing per week. **[10]**

Age (years) of users	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Hours (per week)	10	38	35	32	33	15	4

2. Calculate the mean by step deviation method from the following table giving the age distribution of 542 members. **[20]**

Age in years	20–30	30–40	40–50	50–60	60–70	70-80	80-90
No. of members	3	61	132	153	140	51	2

Also find the standard deviation and hence find the variance by using empirical relations.

3. **a.** For a group of 200 candidates, the mean and standard deviation of scores were found to be 40 and 15 respectively. Later on it was discovered that the scores 43 and 35 were misread as 34 and 53 respectively. Find the corrected mean and standard deviation corresponding to the corrected figures. **[8]**

[12]

b. Calculate the coefficient of variation (CV) and Karl Pearson's coefficient of skewness from the following data:

Marks less than:	20	40	60	80	100
No. of students	18	40	70	90	100

OR

4. a. Establish the following relations between the central moments and moments about an arbitrary origin. **[8]**

i) $\mu_2 = \mu_2' - (\mu_1')^2$ ii) $\mu_3 = \mu_3' - 3\mu_2'\mu_1' + 2(\mu_1')^3$

b. Calculate the regression equation of (i) y on x and (ii) x on y from the following data. Also estimate (iii) y when $x = 30$, (iv) x when $y = 25$. **[12]**

x:	10	12	13	17	18
y:	5	6	7	9	13

University of Asia Pacific

Department of Computer Science and Engineering

Mid-Semester Examination Fall-2022

Program: B.Sc. in CSE

Course Title: Object Oriented Programming I: Java Course No. CSE 203 Credit:3

Time: 1.00 Hour. Full Mark: 60

There are **Three** Questions. **Answer all three questions.**

1. a. Define a class named "**Electronics**". Please add the followings inside the class: **[12] CO3**

   i. Declare 3 instance variables: ***name, color, batteryPercentage.***
   ii. Create a parameterized **constructor** with 3 parameters to initialize the instance variables.
   iii. Please add the following methods:
      a) public String getName()
         - Inside the method, return the name of the **Electronics**.
      b) public void running*(int time)*
         - Inside the method, decrease the ***batteryPercentage*** by ***time*** amount. Here ***batteryPercentage*** is the attribute/instance variable and ***time*** is the parameter of this method.
      c) public void showCharging()
         - Inside the method, show "Charging is needed." if the ***batteryPercentage*** falls below 20%, else show "No charging is needed."

   b. Define a class named "**Cellphone**" and declare the **main** method inside the class. **[8] CO3**
   Inside the **main** method, please do the following:
   i. Create an object with "**Electronics**" class with ***name*** as "iPhone", ***color*** as "Black" and ***batteryPercentage*** as "45%". Store the reference of the object to ***myPhone*** variable.
   ii. Call the **running**() method using ***myPhone*** variable and pass the last 2 digits of your id as the value of the ***time*** parameter.
   iii. Call the **showCharging**() method using ***myPhone*** variable and show the output.

2. a. Write short notes on any two of the following: **[10] CO1**

   i. Java Life Cycle
   ii. JRE and JDK
   iii. Data Types and Casting

b. Write a Java program that will take 3 integers as user input and print the sum of the maximum and minimum number. [10] CO2

3. Identify the **errors** in the code below and fix the errors. You **are not allowed to delete** any line of code. You can **only add new line** or edit existing line. [8] CO4

```
package mid;

public class Test {

	public static void main(String[] args) {
		int num1, int #num2;
		num1 = 9.5;
		System.out.println("%f", num1);
		if(num1 % 2)
			System.out.println(#num2);
	}
}
```

OR

```
package mid;

public class Patient {
  public String name, gender;
  private int age;

  public Patient(String n,int a,String g)
  {
	this.name = n;
	this.age = a;
	this.gender = g;
  }

  public int getAge() {
	return age;
  }

  public void display(){
 System.out.print(name+":"+age+":"+gender);
  }
}
```

```
package mid.error;

public class TestError {

public static void main(String[] a) {

 Patient pat = new Patient("Abir", 20);

 System.out.println(pat.name);
 System.out.println(pat.age);
 System.out.println(pat.gender);

 }
}
```

b. What will be **output** of the code below? Explain your steps in details. [12] CO4

```
package mid;
public class TestOutput {
	public static void main(String[] args) {
		int[] array1 = new int[]{1,3,5,7,9};
		int[] array2 = new int[] {2,3,6,7,5,9};

		int len = array1.length;
		if(array2.length<len)
			len = array2.length;

		int result=0;

		for(int i= 0; i<len; i++) {
			if (array1[i]>array2[i])
				result += array1[i];
			else
				result += array2[i];
		}

		System.out.println("Result:"+ result);
	}
}
```

OR

```
public class Patient {
	String name, gender;
	private int age;

 public Patient(String n,int a,String g) {
	this.name = n;
	this.age = a;
	this.gender = g;
 }

 public void grow(int year) {
	age += year;
 }

 public void visitDoctor(String symptom) {
	display();
	System.out.println("Visiting a doctor
with following symptom:");
	System.out.println(symptom);
 }

 public void display() {
	System.out.println(name+":" + age +
":" + gender);
 }
}
```

```
public class TestPatient {

 public static void main(String[] args) {
   Patient pat=new Patient("Hasin",22,"M");
   pat.display();

   fun(pat);
   pat.visitDoctor("Fever and Cough");
 }

 public static void fun(Patient p) {
   p.grow(3);
   p.name = "Md. " + p.name;

   p = new Patient("Abrar", 19, "M");
   p.grow(1);
 }

}
```

University of Asia Pacific

Department of Computer Science and Engineering

Mid-Semester Examination Fall-2022

Program: B.Sc. in CSE

Course Title: Data Structures **Course No.** CSE 205 **Credit:** 3.0

Time: 1.00 Hour **Full Mark:** 60

There are **Four** Questions. **Answer three questions including Q-1 and Q-2.**

1. At U. A. High School, each student can be identified using a unique number. All the students possess superpowers (for example, danger sensing, floating, etc.) and their powers tend to enhance through academic training. The authority keeps track of the power enhancement using a score against each student.

a. How can the authority organize the information of the students using a data structure? Illustrate your opinion with the necessary pseudocodes/codes. **[10]**

b. Recently a student, whose ID is 18, needed some corrections in his power score. Previously his power score was 1, currently, it is 7. How did the authority update the power score of the student in the record? Illustrate your answer using necessary diagrams and pseudocodes/codes. **[10]**

2. a. Compare Linear Search, Binary Search and Interpolation Search. **[10]**

b. Suppose you have been given a sorted binary array which contains only 0 and 1 as its element. Your task is to count the number of '1's in this array using any of the search techniques mentioned above. Write down the algorithm for this problem. Show the iterations with necessary diagrams. **[10]**

3. Construct a stack of size 5 and then show the following operations with necessary iterations and diagrams: **[2x10]**

i. isEmpty
ii. PUSH: 5
iii. PUSH: 3
iv. POP
v. isFull
vi. PUSH: 7
vii. POP
viii. POP
ix. isEmpty
x. PUSH: -1

OR

4. Construct a queue of size 5 and then show the following operations with necessary iterations and diagrams: **[2x10]**

i. isEmpty
ii. ENQUEUE: 5
iii. ENQUEUE: 3
iv. DEQUEUE
v. isFull
vi. ENQUEUE: 7
vii. DEQUEUE
viii. DEQUEUE
ix. isEmpty
x. ENQUEUE: -1