MID-SEMESTER EXAMINATION, February-2023
DISCRETE MATHEMATICS (CSE 1002)

Programme:B.Tech **Semester:1st**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Able to analyze and apply rules of logic to distinguish between valid and invalid arguments and use them to prove mathematical statements.	L1, L3, L3, L2, L2, L3	1(a),1(b), 1(c),2(a), 2(b),2(c)	2, 2, 2, 2, 2, 2,
Able to understand sets, their various operations and use them to analyze functions and its various concepts as well as study sequences and summations.	L3, L3, L3	3(a),3(b), 3(c)	2, 2, 2
Able to analyze the searching and sorting algorithms and use the growth of functions to study the time complexity of algorithms as well as apply some of the important concepts of number theory to divisibility and modular arithmetic, integer representation of algorithms, congruences and cryptography.	L2, 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), Applying (L3), Analysing (L4), Evaluating (L5), Creating (L6)

Answer all questions. Each question carries equal mark.

1. (a) State the converse, contrapositive and inverse of the given conditional statement. 2
'I go to the beach whenever it is a sunny summer day.'

(b) Determine whether $(p \to r) \vee (q \to r)$ and $(p \wedge q) \to r$ are logically equivalent or not. 2

(c) Use a proof by contradiction to prove that if n is an integer and $3n+2$ is even, then n is even. 2

2. (a) Translate the following statement into a logical expression using predicates, quantifiers and logical connectives. 2

'Atleast one of your friends is perfect.'

(b) Translate the following logical expression into English, where the domain for each variable consists of all real numbers. 2

$$\forall x \forall y \exists z (xy = z)$$

(c) Use rules of inference to show that the hypotheses *'Randy works hard.' 'If Randy works hard, then he is a dull boy.'* and *'If Randy is a dull boy, then he will not get the job.'* imply the conclusion *'Randy will not get the job.'* 2

3. (a) Show that if A and B are sets, then $A \cap (B - A) = \phi$. 2

(b) Determine whether the function $f : Z \times Z \to Z$ is onto if 2

$$f(m,n) = m + n + 1.$$

(c) Evaluate $\sum_{i=0}^{2} \sum_{j=0}^{3} i^2 j^3$. 2

4. (a) Convert $(135AB)_{16}$ to binary notation. 2

(b) Use the binary search algorithm to search for 9 in the sequence 2

$$1,3,4,5,6,8,9,11$$

(c) Determine whether $3x^2 + 8x \log x$ is $O(x^2)$. 2

5. (a) Express the greatest common divisor of 124 and 323 as the linear combination of these integers. 2

(b) Solve the congruence $2x \equiv 7 (\text{mod} 17)$. 2

(c) Define Carmichael number and determine whether 1729 is a Carmichael number or not. 2

End of Questions

MID-SEMESTER EXAMINATION, FEBRUARY-2023
CALCULUS-A (MTH - 1101)

Semester: 1st Semester
Full marks: 30

Branch: ALL
Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Use limit laws to evaluate the limit of a function and demonstrate the existence of limit and continuity of functions .	L1,L1,L3	1.a,b,c	2,2,2
Compute slope of tangent lines and derivatives by different techniques of functions and solve various physical and Engineering problems .	L1,L3,L3 L1,L1,L3	2.a,b,c 3.a,b,c	2,2,2 2,2,2
Discuss the Mean Value Theorems and study maximum and minimum values of a function as well as apply L' Hospital's rule to evaluate limits of functions and sketch curves of functions	L3,L3,L3	4.a,b,c	2,2,2
Compute indefinite integrals using techniques of integration and apply it to physical and Engineering problems	L1,L1	5.a,b	2,2
Apply the concept of integration to find volume, work done, surface area and average value of an integral and study numerical integration using different methods.	L1	5.c	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 infinite limit $\lim_{x\to 3^+} \frac{2x}{x-3}$	2
(b)	Evaluate: $\lim_{x\to -1} \frac{x^2-4x}{x^2-3x-4}$	2
(c)	Use the ε, δ definition of limit to prove: $\lim_{x\to 2}(\frac{x}{2}+3)=2$.	2
2.(a)	Use the definition continuity to show that the function $f(x)=\left(x+2x^3\right)^4$ is continuous at a = -1 .	2
(b)	Find the horizontal and vertical asymptotes of the function $y=\frac{2x+1}{x-2}$	2
(c)	Find equation of tangent line and normal line to the curve $y=\sec x$ at $\left(\frac{\pi}{3},2\right)$	2
3.(a)	Find $\frac{d^{35}}{dx^{35}}(x\sin x)$.	2
(b)	At what point in the 1st quadrant is the tangent line to the folium $x^3+y^3=6xy$ horizontal?	2
(c)	Find the domain and differentiate the function $f(x)=\sqrt{2+\ln x}$.	2
4 (a)	When a cold drink is taken from a refrigerator, its temperature is 5^0 C. After 25 mins, in a 20^0 C room its temperature has increased to 10^0 C. What is the temperature of the drink after 50 mins? When will its temperature be 15^0 C?	2

(b)	Find the local maximum and minimum values of $f(x)=\sin x+\cos x\ ;0\le x\le 2\pi$	2
(c)	Compute $\lim_{x\to 1}\frac{\ln x}{x-1}$ using L'Hospital's rule.	2
5.(a)	If $f(x)=\int_0^{\sin x}\sqrt{1+t^2}\,dt$ and $g(y)=\int_3^{y} f(x)dx$, find $g''(\frac{\pi}{6})$.	2
(b)	Find the area of the region bounded by curves $y=5x-x^2$ and $y=x$.	2
(c)	Find the approximate value of $\sqrt[100]{100}$ by Newton Raphson method correct up to 2 decimal places using $x_0=1.2$.	2

End of the question

MID SEMESTER EXAMINATION, FEBRUARY-2023
University Physics: Mechanics (PHY 1001)

Programme: B. Tech **Semester: 1st**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
UPM/ a, e	L_1, L_2, L_3	1	6
UPM/ a, e	L_1, L_2, L_3	2	6
UPM/ a, e, g	L_1, L_2, L_3	3	6
UPM/ a, e	L_1, L_2, L_3	4	6
UPM/ a, e	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 an equal mark.

1. (a) Is the vector $(\hat{\imath} + \hat{\jmath} + \hat{\mathbf{k}})$ a unit vector? Can a unit vector have any components with magnitude greater than unity? Justify your answer in each case. 2

   (b) A motorcyclist heading east through a small town accelerates at 4 m/s^2 after he leaves the city limits. At time $t = 0$, he is 5.0 m east of the city-limits signpost, moving east at 15 m/s. Find his position and velocity at $t = 2\ s$. 2

   (c) A stone is thrown up vertically upward with a velocity of 20 m/s. Find out the instances at which the magnitudes of its, (i) momentum and (ii) kinetic energy will be half of its initial value ($g = 9.8\ m/s^2$). 2

2. (a) Derive an expression for radial acceleration for a particle performing uniform circular motion. 2

(b) Two particles are thrown up simultaneously with a velocity of 30 m/s, one thrown vertically and another at 45^0 with respect to the horizontal. Find out the distance between them at $t = 1.5$s. 2

(c) Passengers on a carnival ride move at constant speed in a horizontal circle of radius 5.0 m, making a complete circle in 4.0 s. What is their acceleration? 2

3. (a) A passenger on a carnival Ferris wheel moves in a vertical circle of radius R with constant speed v. The seat remains upright during the motion. Find expressions for the force the seat exerts on the passenger at the top of the circle and at the bottom. 2

(b) Suppose an astronaut landed on a planet where g = 19.6 m/s^2. Compared to earth, would it be easier, harder, or just as easy for her to walk around? Would it be easier, harder, or just as easy for her to catch a ball that is moving horizontally at 12 m/s. 2

(c) A crate with mass 32.5 kg initially at rest on a warehouse floor is acted on by a net horizontal force of 140 N. (a) What acceleration is produced? (b) How far does the crate travel in 10.0 s? 2

4. (a) Derive Work-Energy Theorem for a particle moving along a straight line enacted by a constant force. 2

(b) You throw a 20-N rock vertically into the air from ground level. You observe that when it is 15.0 m above the ground, it is travelling at 25 m/s upward. Use the work–energy theorem to find (a) the rock's speed just as it left the ground and (b) its maximum height. 2

(c) A 50.0-kg marathon runner runs up the stairs to the top of Chicago's 443 m tall Willis Tower, the tallest building in the United States. To lift her to the top in 15.0 minutes, what must be her average power output? 2

5 (a) A puck with coordinates x and y slides on a level, frictionless air hockey table. It is acted on by a conservative force described by the potential-energy function $(x, y) = \frac{1}{2}k(x^2 + y^2)$. Find a vector expression for the force acting on the puck and find an expression for the magnitude of the force. 2

(b) A truck of mass 10 tones travels up on an inclined terrain of angle 15° to the horizontal at a constant speed of 36 km/h. If the resistance per kg of the truck is 0.025 N, determine the power of the engine of the truck (g = 10 m/s^2). 2

(c) A glider with mass $m = 0.200\,kg$ sits on a frictionless horizontal air track, connected to a spring with force constant $k = 5.00\,N/m$. You pull on the glider, stretching the spring 0.100 m, and release it from rest. The glider moves back toward its equilibrium position. What is its x-velocity when $x = 0.08\,m$? 2

MID-SEMESTER EXAMINATION, February-2023
INTRODUCTION TO COMPUTER PROGRAMMING
(CSE 1001)

Programme: B.Tech **Semester: 1st**
Full Marks: 30 **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Ability to state and explain the basic Java programming syntax, semantics and building blocks.	L1	2(a,b, c),4(b ,c)	10
Ability to design, write, debug and test the correctness of programs.	L2, L4	1(a,b, c)	6
Ability to develop Java programs using programming constructs like conditional statements, looping, arrays, methods and class.	L2, L3	3(a,b, c), 4(a),5 (c)	10
Ability to solve computational problem(s) using programming constructs.	L3	5 (a,b)	4

Bloom's taxonomy levels: Remembering (L1), Understanding (L2), Applying (L3), Analysing (L4), Evaluating (L5), Creating (L6)

Answer all questions. Each question carries equal mark.

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

```
int a=5+7-6*8/2%10;
int b=a+2-9%6/3+(-7);
System.out.println(a+" "+b);
boolean p=(++a > 61 &&  --b < 13);
System.out.println(p);
System.out.println(b>>5);
```

(b) Find the output of the given code snippet. Eliminate typographic error. 2

```
int z=-4;
int k=z++ + ++z + ++z;
System.out.println(z+"  "+k);
int t=--k + k++ + z++;
int p=t++ -(t%5) + (p=t);
System.out.println(z+ " "+k+" "+t+" "+p);
```

(c) Find the output of the given code snippet. Eliminate typographic error. 2

```
int a=Integer.MAX_VALUE;
System.out.println(a+9);
System.out.println(-a-8);
System.out.println(a*3);
System.out.println(a>>24);
```

2. (a) Write the java statements to take two number from command line arguments and print true if anyone is divisible by other or not. If not divisible print false. 2

Sample output:

```
Enter two number: 10  5
10 is divisible by 5: true
Enter two number: 7  4
7 is not divisible by 4 and 4 is not divisible by 7
so: false
```

(b) Write the java statements that display the following table. Cast floating-point numbers into integers. 2

A	B	pow(A,B)
3	1	3
5	2	25
7	3	147
9	4	6561

(c) The total number of students in a class are 90 out of which 45 are boys. If 50% of the total students secured grade 'O' out of which 20 are boys, then write a program to calculate the total number of girls getting grade 'O'. 2

3. (a) Write a java program to calculate the monthly electricity bill. The tariff is given as follows: 2

Price per unit	Unit range
Rs.3/-	First 50 units
Rs. 4.80/-	Next 50-200 units
Rs. 5.80/-	Next 200-400 units
Rs.6.20/-	Above 400 units

(b) For the above *Question no 3(a)*, write the java statements with a choice if the consumer wants to pay bill online. Consumer who pays their bill online will get a discount of 3%. 2

Sample output:

```
No. of units consumed: 867
Do you want to pay online(y/n): y
Total amount:4925.4
Discount:147.762
```

```
Amount payable: 4777.638
```

(c) Write the java statements to create a simple calculator using switch case. The simple calculator calculates only addition (+), subtraction (-), multiplication (*) and division (/). 2

Sample output:

```
Enter two operands: 6   3
Enter an operator: +
The addition of 6 and 3 is 9
```

4. (a) Write a java program to print sum of all even numbers and the product of all odd numbers from 1 to n, where n is inputted through the keyboard. 2

(b) Draw a flow diagram for the *Question no. 4(a)*. 2

(c) Write the execution pattern for the *Question no. 4(a)* for n=10. 2

5. (a) Write the java statements to take an integer input from the user and print the input by removing all zeroes. 2

Example: *Input n=20406 then Output=246*

(b) Write the java statements to check whether a number can be expressed as sum of two prime numbers or not. 2

Sample output:

```
Enter a number :16
16 can be written as 3+13
16 can be written as 5+11
```

(c) Write the java statements using for loop the print the given pattern. 2

```
1  2  3  4  5
6  7  8  9
10 11 12
13 14
15
```

End of Questions