

Total No. of Questions : 5]

SEAT No. :

PD3791

[Total No. of Pages : 2

[6489]-101

F.Y. M.Sc. (Industrial Mathematics with Computer Applications)

MATHEMATICS

IMT - 501 - MJ : Linear Algebra

(2023 Pattern) (Semester - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt any three questions from 2 to 5.
- 3) Figures to the right indicate full marks.
- 4) Use of non - programmable scientific calculators is allowed.

Q1) Attempt any Five of the following.

[5×1=5]

- a) Define nullspace and nullity of matrix.
- b) If the Eigen values of matrix A of size 2×2 are 2, 3 then what are the eigen values of A^T .
- c) Define Orthonormal basis.
- d) Define SVD.
- e) Give the formula for condition number of matrix A.
- f) Find the inverse of A where $A = \begin{bmatrix} 1 & 2 \\ -1 & 0 \end{bmatrix}$.
- g) Check whether vectors $u = (4, 2)$ and $v = (-1, 2)$ are orthogonal or not?

Q2) a) Determine the solution space of the system.

[5]

$$x - 2y + 3z = 0$$

$$2x - 4y + 6z = 0$$

$$3x - 6y + 9z = 0$$

- b) Find the value of 'k' for which the vector, $u = (1, -2, k)$ in R^3 in linear combination of the vectors $v = (3, 0, -2)$ and $w = (2, -1, -5)$? [5]

P.T.O.

Q3) a) Let $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$ be linear transformation defined by [5]

$T(x, y) = (y, -5x + 13y, -7x + 16y)$, Find the matrix T with respect to basis $B_1 = \{(3, 1), (5, 2)\}$ for $\mathbb{R}^2$ and $B_2 = \{(1, 0, -1), (-1, 2, 2), (0, 1, 2)\}$ for $\mathbb{R}^3$.

b) Determine whether $u = (1, 2, 3)$, $v = (1, 0, 1)$, $w = (-1, 0, 0)$ are linearly independent. If not then Justify. [5]

Q4) a) Determine the kernel of S where, $S(x, y, z) = (x - y, y, x + y, 7z)$. [5]

b) If vector space V is the set of all real valued continuous function over $\mathbb{R}$, then show that W of solutions of differential equations

$3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 2y = 0$ is a subspace of V . [5]

Q5) a) Construct an orthonormal basis $\mathbb{R}^3$ over $\mathbb{R}$ with standard inner product given the basis $B = \{(1, 0, 1), (1, 0, -1), (0, 3, 4)\}$. [5]

b) Find all Eigen values and Eigen vectors of $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$. [5]



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SEAT No. :

PD3792

[6489]-102

[Total No. of Pages : 2

F.Y. M.Sc. (Industrial Mathematics with Computer Applications)

MATHEMATICS

IMT-503-MJ : Discrete Mathematical Structure

(2023 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Question No. 1 is compulsory.*
- 2) *Attempt any three questions from 2 to 5.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable scientific calculator is allowed.*

Q1) Attempt any five of the following :

[5×1=5]

- a) How many one-one functions are there from a set with 5 elements to a set with 7 elements?
- b) Define:
 - i) Euler Graphs
 - ii) Hamiltonian Graphs.
- c) Suppose that the roots of the characteristic equation of a linear homogeneous recurrence relation are 2, 2, 2, 5, 5 and 9. What is the form of the general solution?
- d) How many bit strings are there of length 6 or less, not counting the empty string?
- e) Draw an undirected graph with the following adjacency matrix.

$$\begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 0 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

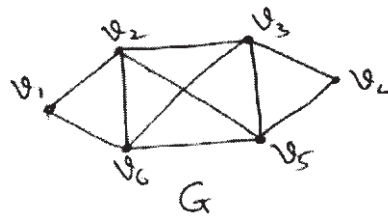
- f) Write the negation of the following statement, $\forall x, x \geq 2x$.
- g) Find the number of edges in $K_{5,8}$ graph.

Q2) a) How many positive integers between 100 and 999 inclusive are: **[5]**

- i) are divisible by 3 or 4?
- ii) are divisible by 3 and 4?
- iii) are not divisible by either 3 or 4?
- b) Show that the premises “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, 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]**

P.T.O.

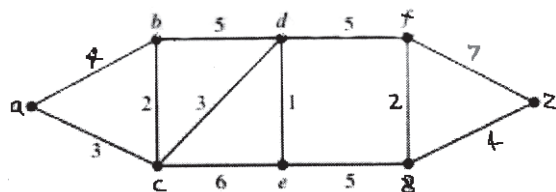
- Q3) a)** Determine whether the following graph is Eulerian. If yes, find an Euler line in it. [5]



- b) How many bit strings of length 10 either begin with three 0s or end with two 0s? [5]

- Q4) a)** How many ways are there to put four different employees into three indistinguishable offices, when each office can contain any number of employees? [5]

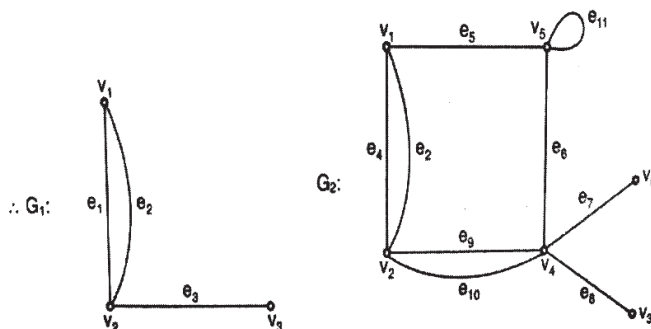
- b) Use Dijkstra's algorithm to find shortest path between 'a' and 'z' in the weighted graph given below. [5]



- Q5) a)** Find the solution to the recurrence relation. [5]

$$a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3} \text{ with } a_0 = 1, a_1 = -2, a_2 = -1.$$

- b) Find the union of the following graphs. [5]



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SEAT No. :

PD3793

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[6489]-103

**First Year M.Sc. (Industrial Mathematics with Computer Applications)
MATHEMATICS**

**IMT - 504 MJ :Object Oriented Programming Using C++
(2023 Pattern) (Semester-I)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Answer any 3 questions from Q2 to Q5.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable scientific calculators is allowed.*

Q1) Attempt any FIVE of the following :

[5×1=5]

- a) What is inheritance?
- b) How to define user defined function?
- c) What is data binding?
- d) Define Class
- e) List different access specifiers in CPP?
- f) Write syntax of switch statement.
- g) What is friend function in C++?

Q2) a) Explain virtual base class with suitable diagram.

[5]

b) Explain array of object in C++ with example.

[5]

Q3) a) Explain function overloading with example.

[5]

b) Differentiate between structure and classes.

[5]

Q4) a) Explain the object oriented concept in CPP.

[5]

b) Explain hybrid Inheritance with example.

[5]

Q5) a) Explain Abstract class with example.

[5]

b) Explain any two Classes for file stream operations.

[5]



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SEAT No. :

PD3794

[Total No. of Pages : 2

[6489]-104

M.Sc. - I (Industrial Mathematics with Computer Application)

IMT-505-MJ : DATABASE MANAGEMENT SYSTEM

(2023 Pattern) (Semester - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any three questions from 2 to 5.*
- 3) *Figures to the right indicate full marks.*

Q1) Solve any FIVE from the following.

[5×1=5]

- a) List any two applications of NoSQL database.
- b) What is NoSQL?
- c) What is the primary key?
- d) List two advantages of DBMS.
- e) Write a syntax of If-else in PL/SQL.
- f) Define Aggregation.
- g) What is the use of the commit command?

Q2) Attempt the following.

[2×5=10]

- a) Explain PL SQL Block in detail.
- b) What is mean by RDBMS? Explain its advantages and disadvantages.

Q3) Attempt the following.

[2×5=10]

- a) Explain the fundamental operations in Relational Algebra.
- b) Explain the types of SQL joins in detail.

P.T.O.

Q4) Attempt the following.

[2×5=10]

- a) Write a syntax of select, update and insert commands in SQL with example.
- b) What is DDL Command? Explain any two DDL commands with example.

Q5) Attempt the following.

[2×5=10]

- a) Explain various key features of NoSQL
- b) Consider following database:

Student (sno, sname, sclass, saddr)

Teacher (tno, tname, qualification, experience)

Relationship between Student and Teacher is many to many with descriptive attribute subject.

Create a trigger for following:

Write a trigger which restrict the sno less than or equal to zero. Display appropriate message.



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SEAT No. :

PD3795

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[6489]-105

First Year M.Sc. (I.M.C.A.)

STATISTICS

**IMT-510(A)MJ: Statistical Methods
(2023 Pattern) (Semester - I)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any THREE questions from 2 to 5.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable scientific calculator is allowed.*

Q1) Attempt any five of the following.

[5×1=5]

- a) Define the term attribute with illustration.
- b) State any two demerits of median.
- c) State the equation of linear multiple regression model of X_2 on X_1 and X_3 .
- d) State any two properties of correlation coefficient.
- e) State the utility of coefficient of variation.
- f) For a bivariate data the two regression coefficients are $b_{xy} = 2$ and $b_{yx} = 0.8$. Obtain correlation coefficient between X and Y.
- g) State the probability mass function of Geometric distribution.

Q2) Attempt each of the following:

[2×5=10]

- a) What is dispersion? Compare between the relative and absolute measures of dispersion.
- b) Explain the concept of Target Population, and Sample. Explain how you will use these terms in any project survey.

Q3) Attempt each of the following:

[2×5=10]

- a) What is kurtosis? Explain the different types of kurtosis with sketches.
- b) Define coefficient of determination. Also explain its significance in the linear regression models with example.

P.T.O.

Q4) Attempt each of the following:

[2×5=10]

- a) Explain the concept of multiple correlation coefficient. Also state equation of multiple correlation coefficient of X_1 on X_2 and X_3 and explain its significance in the multiple regression model.
- b) Marks obtained by 10 students in the subject of Mathematics (X) and Statistics (Y) is below:

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

Obtain the Rank correlation coefficient and interpret it.

Q5) Attempt each of the following:

[2×5=10]

- a) Define an Exponential distribution. State its mean and variance. Also discuss its real life situations.
- b) The incidence of occupational disease in an industry is such that a worker has 20% chance of suffering from it. Find the probability that, out of 12 workers selected at random
- i) Two or more will suffer from the disease.
- ii) At most three will suffer from the disease.



Total No. of Questions : 5]

SEAT No. :

PD3796

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[6489]-106

M.Sc. - I (IMCA)

IMT-510(B)MJ: NUMERICAL ANALYSIS

(2023 Pattern) (Semester - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt any THREE questions from 2 to 5.
- 3) Figures to the right indicate full marks.
- 4) Use of non-programmable scientific calculators is allowed.

Q1) Solve any FIVE of the following.

[5]

- a) Find $\Delta(x^3)$ for $h=1$.
 - b) Is the matrix $A = \begin{bmatrix} 1 & 0 \\ 0 & 3 \end{bmatrix}$ diagonalizable? Justify your answer.
 - c) Find the root of the equation $x^3 - 5x + 1 = 0$ by using Newton Raphson method. Take $x_0 = 0.5$. (Perform two iterations)
 - d) Find the relative error if $x = 3.141592$ and $x' = 3.14$.
 - e) Find the Jacobian matrix for the functions $f(x, y) = x^2 + 1$ and $g(x, y) = x^2y^2$ at a point $(1, 2)$
 - f) Construct the backward difference table for the following data
- | | | | | |
|-----|---|---|---|----|
| x | 1 | 2 | 3 | 4 |
| y | 1 | 3 | 8 | 20 |
- g) Define dominant Eigen value of a matrix.

Q2) a) Let $g(x)$ and $g'(x)$ be continuous on a balanced interval $(a, b) = (p - \delta, p + \delta)$ that contains the unique fixed point P and that the starting value P_0 is chosen in this interval. If $|g'(x)| \leq K < 1, \forall x \in [a, b]$, then prove that the sequence defined by $P_n = g(P_{n-1}), n \geq 1$ converges to P . [5]

- b) Find the inverse of a matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$. [5]

P.T.O.

Q3) a) Show that the rate of convergence of Newton Raphson method is two.[5]

b) Show that the matrix $A = \begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$ is diagonalizable. [5]

Q4) a) Construct the forward difference table. Hence find $y(0.5)$ using Newton's forward difference formula for the data [5]

x	-2	-1	0	1	2	3
y	15	5	1	3	11	25

b) Find the Approximate value of $I = \int_0^1 \frac{1}{1+x} dx$ using Trapezoidal Rule. Take $h = 0.25$. [5]

Q5) a) Determine the dominant eigen value of a matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ by power method. [5]

b) For the initial value problem $y' = \frac{x}{y}, y(0) = 1$, compute $y(0.2), y(0.4)$ and $y(0.6)$ using Euler method. (Take $h = 0.2$). [5]



Total No. of Questions : 5]

SEAT No. :

PD3797

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[6489]-108

First Year M.Sc. (I.M.C.A.)

IMT-507-RM : RESEARCH METHODOLOGY

(2023 Pattern) (Semester - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any three questions from 2 to 5.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Non-Programmable Scientific Calculator is allowed.*

Q1) Multiple Choice Questions :

[5]

- a) What is the primary goal of a pilot study in research?
 - i) To collect data from the entire sample
 - ii) To test and refine the research instruments and procedures
 - iii) To analyze the research findings
 - iv) To publish the initial research results
- b) Which of the following best describes the term “research methodology”?
 - i) The subject of a research study
 - ii) The process and techniques used to conduct research
 - iii) The findings and conclusions of a research study
 - iv) The literature review in a research paper
- c) Which of the following is a primary data collection method in qualitative research?
 - i) Experiments
 - ii) Surveys
 - iii) Content analysis
 - iv) In-depth interviews
- d) When conducting research, what is the term for a sample that accurately represents the characteristics of the population from which it is drawn?
 - i) Biased sample
 - ii) Convenience sample
 - iii) Random sample
 - iv) Stratified sample
- e) What is the purpose of a literature review in the research process?
 - i) To present the research findings
 - ii) To summarize the research methodology
 - iii) To identify and analyze existing research on the topic
 - iv) To propose a new research topic

P.T.O.

- Q2)** a) Define Research Questions. [5]
b) Define Data Collection. [5]
- Q3)** a) Write a note on Publication of Research Paper. [5]
b) Write a note on Mathematical Software used in Research. [5]
- Q4)** a) Write a Note on Review of Paper. [5]
b) Define Components of Research Paper. [5]
- Q5)** a) Define Review of Literature. [5]
b) Write a note on Qualitative Data Analysis. [5]



Total No. of Questions : 7]

SEAT No. :

PD3798

[6489]-201

[Total No. of Pages : 3

First Year M.Sc. (I.M.C.A.)

MATHEMATICS

IMT-551-MJ : Foundation of Analysis
(2023 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt any five questions from Q.2 to Q.7.
- 3) Figures to the right indicates full marks.
- 4) Scientific calculators and statistical tables are allowed.

Q1) Solve any five of the following.

[5×2=10]

- a) Find the closure of the set $A = \left\{ \frac{1}{n} \mid n \in \mathbb{N} \right\}$.
- b) Let f be defined by $f(x) = \begin{cases} x \sin \frac{1}{x} & ; \quad x \neq 0 \\ 0 & ; \quad x = 0. \end{cases}$ Check whether f is differentiable or not.
- c) Find the limit superior and limit inferior of the sequence $S_n = (-1)^n$.
- d) Is the function $f(x) = \sin x$ Riemann integrable on $[0, 1]$? Justify.
- e) Check the convergence of the series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}$.
- f) Find the radius of convergence of the power series $\sum_{n=0}^{\infty} \frac{z^n}{n}$.
- g) Define perfect set. Give an example of a perfect set in $\mathbb{R}$.

P.T.O.

Q2) a) Show that open balls in a metric space are convex. [7]

b) Let f be a real differentiable function on $[a, b]$ and $f'(a) < \lambda < f'(b)$. Show that there is a point $x \in (a, b)$ such that $f'(x) = \lambda$. [5]

Q3) a) Show that $f \in \mathcal{R}(\alpha)$ on $[a, b]$ if and only if for every $\varepsilon > 0$ there exists a partition P such that $U(P, f, \alpha) - L(P, f, \alpha) < \varepsilon$. [7]

b) Let $f_n(x) = \frac{x^2}{(1+x^2)^n}$ ($x \in \mathbb{R}, n = 0, 1, 2, \dots$) and suppose $f(x) = \sum_{n=0}^{\infty} f_n(x)$. Find $f(x)$. Is the convergence uniform? Justify. [5]

Q4) a) Show that if $0 \leq x < 1$, then $\sum_{n=0}^{\infty} x^n = \frac{1}{1-x}$. If $x \geq 1$, then the series diverges. [6]

b) Prove that a set E is open if and only if its complement is closed. [6]

Q5) a) If $f \in \mathcal{R}$ on $[a, b]$ and if there is a differentiable function F on $[a, b]$ such that $F' = f$, then show that $\int_a^b f(x)dx = F(b) - F(a)$. [7]

b) Show that for any collection $\{G_\alpha\}$ of open sets, $U_\alpha G_\alpha$ is open. Give an example to show that arbitrary intersection of open sets is not open. [5]

Q6) a) Prove that e is irrational. [7]

b) Let f be defined on $[a, b]$; if f has a local maximum at a point $x \in (a, b)$, and if $f'(x)$ exists, then show that $f'(x) = 0$. [5]

Q7) a) Show that a subset E of the real line $\mathbb{R}$ is connected if and only if it has the following property: If $x \in E, y \in E$ and $x < z < y$, then $z \in E$. [7]

b) Let p_n be a sequence in a metric space X . If $p, p' \in X$, and if $\{p_n\}$ converges to p and p' , then show that $p' = p$. [5]



Total No. of Questions : 7]

SEAT No. :

PD3799

[Total No. of Pages : 2

[6489]-202

First Year M.Sc. (Industrial Mathematics with Computer Application)

IMT-552 MJ : APPLIED ALGEBRA

(2023 Pattern) (Semester -II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question 1 is Compulsory.
- 2) Attempt any Five questions from Q2 to Q7.
- 3) Figures to the right indicate full marks.
- 4) Use of non-programmable scientific calculators is allowed.

Q1) Solve any five from the following.

[10]

- a) Define permutation group with one example.
- b) Is the set of odd integers under addition a group? Justify your answer.
- c) Find the order of permutation $(1\ 2\)(3\ 4)$.
- d) Prove that in a group G , there is a unique element b in G such that $ab=ba=e$.
- e) Write the permutation $(1\ 3\ 2\ 5\ 6)(2\ 3)(4\ 6\ 5\ 1\ 2)$ as a product of disjoint cycles.
- f) Determine $a \in \{0,1,2,3\}$ such that $7 \equiv a \pmod{4}$.
- g) Define greatest common divisor with example.

Q2) a) Prove that The center of a group $Z(G)$ is a subgroup of G .

[7]

b) Construct a Cayley table for $U(14)$.

[5]

Q3) a) State and Prove Lagrange's theorem.

[7]

b) Prove that if $(ab)^2 = a^2b^2$ in a group G , then $ab = ba$.

[5]

P.T.O.

Q4) a) Show that the group of real numbers G under addition and the group of positive real numbers $\bar{G}$ under multiplication are isomorphic. [7]

b) Let $\alpha = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 2 & 3 & 4 & 5 & 1 & 7 & 8 & 6 \end{bmatrix}$ and [5]

$$\beta = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 1 & 3 & 8 & 7 & 6 & 5 & 2 & 4 \end{bmatrix}$$

- i) Write α, β and $\alpha\beta$ as products of disjoint cycles.
- ii) Write α, β and $\alpha\beta$ as products of 2-cycles.
- iii) Determine whether β is even permutation.

Q5) a) Find greatest common divisor d of 30 and 171 and find the integers m and n such that $d = 30m + 171n$ for some $m, n \in \mathbb{Z}$. [7]

b) By using mathematical induction, show that $1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$. [5]

Q6) a) A public key code has base 143 and exponent 103. It uses the following letter to number equivalents:

$J = 1, N = 2, R = 3, H = 4, D = 5, A = 6, S = 7, Y = 8, T = 9, O = 0$

A message has been converted to numbers and broken into blocks. When coded using the above base and exponent the message sent is 10/03.

Decode the message. [7]

b) Find remainder of 9^{87} when divided by 13. [5]

Q7) a) Solve the congruence

$$432x \equiv 12 \pmod{546} \quad [6]$$

b) Find the inverse of 23 modulo 73 using Euclidean algorithm. [6]



Total No. of Questions : 5]

SEAT No. :

PD3800

[Total No. of Pages : 1

[6489]-203

First Year M.Sc. (Industrial Mathematics with Computer Applications)

IMT-553 MJ : DATA STRUCTURE

(2023 Pattern) (Semester - II)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve any three questions from Q.2 to Q.5.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of a non - programmable scientific calculator is allowed.*

Q1) Attempt any Five of the following.

[5×1=5]

- a) What is the need for a dynamic array?
- b) Define is Empty () in stack.
- c) What is a Stack?
- d) What is a circular queue?
- e) Write the postfix expression of the following $(A+B) * (C-D)$.
- f) What is a full binary tree?
- g) What is data structure?

Q2) a) Define the structure of a linked list and give its static and dynamic representation. **[5]**

b) Write a note on the comparison between insertion sort and bubble sort based on its analysis **[5]**

Q3) a) Sort the following elements using the Bubble sorting method. **[5]**
25, 15, 45, 85, 75, 55, 35, 65.

b) Write a 'C' function for inserting an element into the singly linked list. **[5]**

Q4) a) Evaluate the following postfix expression: $DE * F$. **[5]**
(Let $D = 5$, $E = 6$, $F = 4$).

b) Explain any two tree traversal techniques. **[5]**

Q5) a) Explain the following: **[5]**

- i) Expression Tree
- ii) AVL trees.

b) Write a short note on Binary Search Tree(BST) **[5]**



Total No. of Questions : 5]

SEAT No. :

PD3801

[Total No. of Pages : 1

[6489]-204

First Year M.Sc. (I.M.C.A.)

IMT-560(A)-MJ : WEB TECHNOLOGY

(2023 Pattern) (Semester - II)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any three questions from 2 to 5.*
- 3) *Figures to the right indicate full marks.*

Q1) Attempt any five of the following. [5×1=5]

- a) How would you create a hyperlink in HTML? Provide an example.
- b) What is a tag? List any two tags in HTML?
- c) How do you define Function in JavaScript?
- d) What is JavaScript?
- e) What is REPL?
- f) What is mongoose?
- g) What is an Event? List any two events in JavaScript.

Q2) [2×5=10]

- a) Explain the purpose of HTML and describe the basic structure of an HTML document.
- b) How do you embed audio and video in a webpage using HTML5? Include syntax with examples.

Q3) [2×5=10]

- a) List and explain the different data types available in JavaScript with examples.
- b) How are arrays created and used in JavaScript? Write a program to loop through arrays.

Q4) [2×5=10]

- a) What is Node.js? Explain its key features and uses in modern web development.
- b) What is NPM? Explain its role in Node.js application development.

Q5) [2×5=10]

- a) Describe the EventEmitter class in Node.js with an example.
- b) Write a short note on MongoDB and its advantages in web applications.



Total No. of Questions : 7]

SEAT No. :

PD3802

[Total No. of Pages : 2

[6489]-301

S.Y.M.Sc. (Industrial Mathematics With Computer Applications)

IMT 601 MJ : ORDINARY DIFFERENTIAL EQUATIONS

(2023 Pattern) (Semester-III)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question No.1 is compulsory.
- 2) Solve any five questions from 2 to 7.
- 3) Figures to the right indicate full marks.
- 4) Use of non-programmable scientific calculator is allowed.

Q1) Solve any Five of the following.

[10]

- a) Verify the function $\phi(x) = \sin(x) - 1$ is the solution of the differential equation $y' + (\cos x)y = \sin x \cos x$.
- b) Find all solutions of the differential equation $y' - 2y = 1$.
- c) Find all solutions of the differential equation $y'' - 4y' + 5y = 0$.
- d) Compute the indicial polynomial and their roots for the differential equation $x^2 y'' + (\sin x)y' + (\cos x)y = 0$.
- e) Solve $yy' = x$.
- f) Determine whether the functions $\phi_1(x) = \sin$, $\phi_2(x) = e^{ix}$ are linearly dependent or independent.
- g) Check whether the differential equation is exact or not
 $(x^2 + xy)dx + xydy = 0$.

Q2) a) If ϕ_1, ϕ_2 are two solutions of $y'' + a_1 y' + a_2 y = 0$ on an interval I containing a point x_0 then

$$W(\phi_1, \phi_2)(x) = e^{-a_1(x-x_0)} W(\phi_1, \phi_2)(x_0). \quad [7]$$

b) Solve initial value problem $y'' + 10y = 0, y(0) = \pi, y'(0) = \pi^2$. [5]

P.T.O.

- Q3)** a) Let a_1, a_2 be constants, and consider the equation $y'' + a_1 y' + a_2 y = 0$. If r_1, r_2 are distinct roots of the characteristic polynomial then $\phi_1(x) = e^{r_1 x}, \phi_2 = e^{r_2 x}$ are solutions of $L(y) = 0$. If r_1 is repeated root of the characteristic polynomial then $\phi_1(x) = e^{r_1 x}, \phi_2 = x e^{r_1 x}$ are solutions of $L(y) = 0$. [7]
- b) Solve the differential equation $y''' - 27y = 0$. [5]
- Q4)** a) Solve the non-homogenous differential equation $y'' + 4y = \sec 2x$. [7]
- b) Solve $(3x - 1)^2 y'' + (9x - 3)y' - 9y = 0$. [5]
- Q5)** a) If one solution of $y'' - \frac{2}{x^2} y = 0$ is $\phi_1(x) = x^2$ then find the another solution by method of reduction of order. [7]
- b) Find singular points and determine those which are regular singular points $(1 - x)^2 y'' - 2xy' + 2y = 0$. [5]
- Q6)** a) Find the solutions of $y'' - \frac{2}{x^2} y = x$ if $\phi_1(x) = x^2, \phi_2(x) = \frac{1}{x}$ are the solutions of corresponding homogenous differential equation $y'' - \frac{2}{x^2} y = 0$. [7]
- b) Show that the function $f(x, y) = 4x^2 + y^2$ satisfies Lipschitz condition on $|x| \leq 1, |y| \leq 1$. [5]
- Q7)** a) Find two linearly independent power series solutions of the differential equation $y'' + y = 0$. [7]
- b) Solve $y' = \frac{y^2}{xy + x^2}$. [5]



Total No. of Questions : 5]

SEAT No. :

PD3803

[Total No. of Pages : 1

[6489]-302

**S.Y. M.Sc. (Industrial Mathematics with Computer Applications)
IMT-602-MJ : COMPUTER NETWORKS
(2023 Pattern) (Semester - III)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Question No. 1 is compulsory.*
- 2) *Attempt any three questions from 2 to 5.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable scientific calculator is allowed.*

Q1) Attempt any five of the following :

[5×1=5]

- a) What is Analog signal?
- b) Discuss various functions of network layer.
- c) Write any two application of computer network.
- d) What is Spreading in Bandwidth Utilization?
- e) Define Cipher Text.
- f) What is DNS?
- g) What is error control?

Q2) a) Write a note on Go-Back-N Protocol.

[5]

b) Compare virtual circuit and Datagram subnets.

[5]

Q3) a) Write a note on Bridge and Modem.

[5]

b) Explain in details Network Address Translation (NAT).

[5]

Q4) a) Write a note on IPV6 protocol.

[5]

b) Explain Message switching & Packet switching.

[5]

Q5) a) Comparison between OSI and TCP/IP Model.

[5]

b) Write a note on Network Topologies.

[5]



[6489]-303

S.Y. M.Sc. (Industrial Mathematics with Computer Applications)
IMT-603 - MJ : DESIGN AND ANALYSIS OF ALGORITHM
(2023 Pattern) (Semester-III)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question 1 is compulsory.
- 2) Attempt any FIVE questions from 2 to 7.
- 3) Figures to the right indicate full marks.
- 4) Use of non-programmable scientific calculators is allowed.

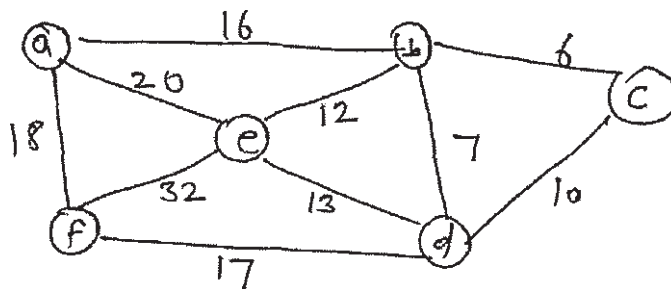
Q1) Solve any Five of the following :

[5×2=10]

- a) Show that $5n^2 + 4n = O(n^2)$
- b) Give time complexity of Merge sort in worst case and average case.
- c) Define big O notation.
- d) Explain “NP Hard”
- e) What is an Algorithm?
- f) Write a note on greedy strategy.
- g) Explain general method of backtracking.

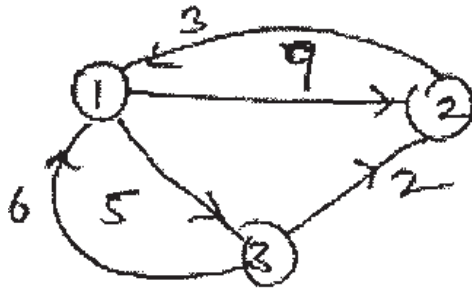
Q2) a) Write down dijkstra's algorithm of find shortest path from source to destination. [7]

b) Using Prim's algorithm find minimum spanning tree for following graph. [5]



P.T.O.

- Q3) a)** Apply Floyd-Warshall's algorithm to find shortest path between every pair of vertices for the following graph. [7]



- b) Find all pairs shortest path using ford war shall algorithm for following directed graph. [5]

- Q4) a)** Write a short note on n-queens problem. [7]

- b) Explain Articulation point and Bridge edge. [5]

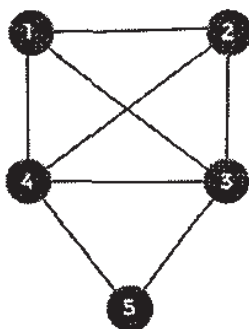
- Q5) a)** Explain Depth first search algorithm. [7]

- b) Determine longest common subsequences for

$X = (A, B, A, C, B, D, D)$ and $Y = (B, A, A, C, B, D, A)$ [5]

- Q6) a)** Traveling Salesman problem using LCBB method (variable tuple size) [7]

Given graph and adjacency matrix of the problem is given below:



	1	2	3	4	5
1	∞	20	30	10	11
2	15	∞	30	10	11
3	3	5	∞	2	4
4	19	6	18	∞	3
5	16	4	7	16	∞

- b) Explain Articulation point and Bridge edge. [5]

- Q7) a)** Solve knapsack problem using Merge & Purge method instance $M=8$, and $n=4$. let p_i and w_i are as shown below. **[7]**

i	p_i	w_i
1	1	2
2	2	3
3	5	4
4	6	5

- b)** Explain Relationship among P class, NP class, NP-hard and NP - Complete. **[5]**



Total No. of Questions : 5]

SEAT No. :

PD3805

[Total No. of Pages : 1

[6489]-305

S.Y. M.Sc. (Industrial Mathematics with Computer Application)

IMT - 611(B) - MJ : DOTNET PROGRAMMING

(2023 Pattern) (Semester - III)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any three questions from Q.2 to Q.5.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non - programmable scientific calculator is allowed.*

Q1) Attempt any FIVE of the following. **[5×1=5]**

- a) Name any four basic controls in Windows Forms. **[1]**
- b) Define an abstract class. **[1]**
- c) What is boxing and unboxing in C#. **[1]**
- d) What does LINQ stand for? **[1]**
- e) What is the purpose of a constructor? **[1]**
- f) What are the advantages of Random Access File? **[1]**
- g) Explain the concept of scope in variables. **[1]**

Q2) a) Explain the architecture of the .NET Framework and its key components. **[5]**

b) Discuss the benefits and limitations of using collections in C#. **[5]**

Q3) a) Write a short note on ADO.NET architecture in C#. **[5]**

b) Define Assembly. Explain private and public assembly. **[5]**

Q4) a) Explain the different types of access modifiers in C# with examples. **[5]**

b) What is Exception Handling? Explain with an example. **[5]**

Q5) a) Write a C# program to find maximum among 3 numbers. **[5]**

b) Write a C# program to reverse a given number. **[5]**



Total No. of Questions : 7]

SEAT No. :

PD3806

[6489]-401

[Total No. of Pages : 2

S.Y.M.Sc. (I.M.C.A.)

**IMT-651-MJ : SOFTWARE ENGINEERING AND TESTING
(2023 Pattern) (Semester - IV)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any FIVE questions from Q.2 to Q.7.*
- 3) *Figure to the right indicates full marks.*
- 4) *Draw the Diagrams wherever necessary.*

Q1) Solve any FIVE of the following:

[10]

- a) What is software engineering?
- b) What is Agile Development?
- c) What is Data Design?
- d) What is UML?
- e) Define verification and validation.
- f) What is Jira?
- g) What is pair programming in Extreme programming (xp)?

Q2) Answer the following:

- a) Explain Incremental Process Models with diagram. **[7]**
- b) Explain Agility Principles. **[5]**

P.T.O.

Q3) Answer the following:

- a) Explain Requirement Engineering Task. [7]
- b) What are the components of Class Model? Draw the Class Diagram for Medical Store. [5]

Q4) Answer the following:

- a) Explain White Box Testing with its types and example. [7]
- b) Explain the components of a Test Plan. [5]

Q5) Answer the following:

- a) Explain Extreme Programming (XP) with Diagram. [7]
- b) Explain the software testing life cycle (STLC) with its different phases.[5]

Q6) Answer the following:

- a) Explain Generic process model. [7]
- b) Discuss the importance of software requirement specification (SRS) and it's components. [5]

Q7) Answer the following:

- a) Explain Artifact Model with its types. [6]
- b) What is Defect Management? Explain its importance. [6]



Total No. of Questions : 7]

SEAT No. :

PD3807

[Total No. of Pages : 3

[6489]-402

S.Y.M.Sc. (IMCA)

IMT - 652 MJ : OPTIMIZATION TECHNIQUES

(2023 Pattern) (Semester -IV)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question No. 1 is Compulsory.
- 2) Solve any five questions from Q.2 to Q.7.
- 3) Figures to the right indicate full marks.
- 4) Use of non-programmable scientific calculators is allowed.

Q1) Solve any five of the following.

[10]

- a) What is example of CPM?
- b) Write the example of PERT estimate?
- c) Why use the dual simplex method?
- d) Explain present worth factor?
- e) Find maximin and minimax of the following game.

		Player B	
		B ₁	B ₂
Player A	A ₁	5	4
	A ₂	3	2

- f) Write any two assumptions of sequencing problem.
- g) Define critical activity in a project. Write the necessary and sufficient conditions for critical activity.

Q2) a) Obtain the optimal strategy for both person and the value of the game for zero sum two-person game whose pay off matrix is as follows; [7]

		Player B	
		B ₁	B ₂
Player A	A ₁	1	-3
	A ₂	-1	6
	A ₃	4	2
	A ₄	2	2
	A ₅	-5	0

- b) Explain linear programming solution of a game?

[5]

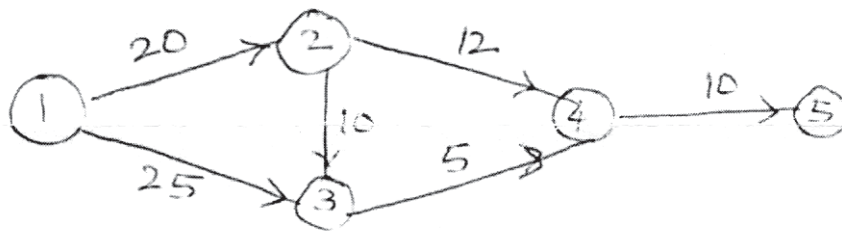
P.T.O.

Q3) a) The cost of maintenance of a machine is given as a function increasing with time, whose scrap value is constant. Prove that If time is measured in discrete units, then the average annual cost will be minimized by replacing the machine when the next period's maintenance cost becomes greater than the current average cost. [7]

b) The project activities and thier three-time estimates in weeks is given as below. Evaluate expected time and variance of each activity [5]

Activity	A	B	C	D	E	F	G
Optimistic (t_0)	1	1	2	1	2	2	3
Most Likely (t_m)	1	4	2	1	5	5	6
Pessimistic (t_p)	7	7	8	1	14	8	5

Q4) a) Calculate Earliest start time and Latest finish time of each node for the following network using forward pass and backward pass method respectively. Hence find critical path. [7]



b) Use dominance principle to find the optimal strategies for player A and player B for the following game. Also, find the value of game. [5]

Player A	Player B			
	B ₁	B ₂	B ₃	B ₄
A ₁	19	6	7	5
A ₂	7	3	14	6
A ₃	12	8	18	4
A ₄	8	7	13	-1

Q5) a) Show that (0, 3, 1) and (2, 1, 1) are stationary points of function [7]

$$f(x_1, x_2, x_3) = 2x_1x_2x_3 - 4x_1x_3 - 2x_2x_3 + x_1^2 + x_2^2 + x_3^2 - 2x_1 - 4x_2 + 4x_3$$

b) A company purchased the new machine at rupees 10,000. The economic life of machine is expected to be 9 years. The estimated annual running cost of the machine is rupees 8500. If the market interest rate is 6%, then find the present worth of the annual running cost of the machine. [5]

Q6) a) Let $f : \mathbb{R}^2 \rightarrow \mathbb{R}$ be a function defined as $f(x_1, x_2) = 16x_1x_2 + 6x_2^2$. Determine the local maximum or local minimum value of the function. [7]

b) Explain minimal spanning tree algorithm. [5]

Q7) a) The activities of a project and their time durations are given in following table. Draw a project network, find the critical path and the expected time of the completion of project. [7]

Activity	1-2	1-3	2-3	2-4	3-5	3-6	4-5	4-6	5-6
Duration in weeks	5	6	3	8	2	11	0	1	12

b) Write any three differences between CPM and PERT. [5]



Total No. of Questions : 5]

SEAT No. :

PD3808

[Total No. of Pages : 1

[6489]-404

S.Y. M.Sc. (Industrial Mathematics with Computer Applications)

IMT - 654(B) MJ : DEFI BLOCK CHAIN TECHNOLOGY

(2023 Pattern) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt any Three questions from 2 to 5.*
- 3) *Figures to the right indicate full marks.*

Q1) Attempt any Five of the following. [5×1=5]

- a) What is the definition of blockchain technology?
- b) How does blockchain provide security and transparency?
- c) How does immutability in blockchain benefit its users?
- d) Who created Bitcoin, and in what year was it introduced?
- e) Name one type of Bitcoin wallet.
- f) What is the purpose of “gas” in the Ethereum network?
- g) Name one feature of decentralized applications (DApps).

Q2) [2×5=10]

- a) Explain different Components of a blockchain.
- b) Compare and contrast centralized and decentralized systems.

Q3) [2×5=10]

- a) Explain the role of cryptography in blockchain technology.
- b) Differentiate Proof of Work (PoW) and Proof of Stake (PoS).

Q4) [2×5=10]

- a) Explain digital signatures & its process.
- b) Explain Ethereum Virtual Machine (EVM).

Q5) [2×5=10]

- a) Explain the concepts of hard forks and soft forks in blockchain technology.
- b) What is a Decentralized Autonomous Organization (DAO)? Explain.

