Total No. of Questions : 8]

SEAT No. :

PD3766

[Total No. of Pages : 3

[6489]-11

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

MATHEMATICS

MIM 101: Real Analysis

(2019 Pattern) (Semester-I)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt any five out of the eight questions.***
2) ***Figures to the right indicate full marks.***
3) ***Scientific calculators and statistical tables are allowed.***

Q1) a) Prove that a set E is open if and only if its complement is closed. **[5]**

b) If E is an infinite subset of a compact set k then prove that E has a limit point in k. **[5]**

c) Define Dense subset of a metric space. Give an example of a dense subset of $\mathbb{R}$ with usual metric. **[2]**

d) Define limit point of a set E in a metric space X. **[2]**

Q2) a) If $\overline{E}$ is the closure of a set E in a metric space X, then prove that diam $\overline{E}$ = diam E. **[5]**

b) In any metric space X, prove that every convergent sequence is a cauchy sequence. **[5]**

c) If $\sum a_n$ converges then prove that $\lim_{n\to\infty} a_n = 0.$ **[2]**

d) Test the convergence of the series $\sum_{n=1}^{\infty} \frac{2n+1}{3n+2}.$ **[2]**

Q3) a) Suppose a sequence $\{S_n\}$ is monotonic. Prove that $\{S_n\}$ is convergent if and only if it is bounded. **[5]**

b) Prove that the series $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^P}$ is convergent if p>1 and divergent if p≤1. **[5]**

P.T.O.

c) Find radius of convergence of $\sum_{n=1}^{\infty} \frac{z^n}{n^2}$. **[2]**

d) If Σa_n converges absolutely then prove that Σa_n is convergent series. **[2]**

Q4) a) Prove that a mapping f of a metric space X into a metric space Y is continous on X if and only if $f^{-1}(V)$ is open in X for every open set V in Y. **[5]**

b) If f is a continuous mapping of a metric space X in to a metric space Y and if E is a connected subset of X then prove that $f(E)$ is connected. **[5]**

c) Let X be a metric space and Z(f) be a set of zeros of a contiouous function $f: X \to \mathbb{R}$. Prove that $z(f)$ is closed subset of X. **[2]**

d) If $f: \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = \frac{x}{1+x^2}$ and E = [1,∞) then find $f(\bar{E})$. **[2]**

Q5) a) Let f be defined on [a,b] and f has a local maximum at a point $x \in (a,b)$ and if $f'(x)$ exists then prove that $f'(x) = 0$. **[5]**

b) If f and g are continuous real functions on [a,b] which are differentiable in (a,b), then prove that there is a point $x \in (a,b)$ such that

$$[f(b) - f(a)]g'(x) = [g(b) - g(a)]f'(x).$$ **[5]**

c) Let $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & , x \neq 0 \\ 0 & , x = 0. \end{cases}$

Prove that f is differentiable at each $x \in \mathbb{R}$ but f' is not continuous at x=0. **[4]**

Q6) a) Prove that a bounded function $f \in \Re(\alpha)$ on [a,b] if and only if for every $\in > 0$ there exists a partition P such that U(P, f, α)–L(P, f, α)<∈, where α is monotonically increasing function. **[5]**

b) State and prove the fundamental theorem of calculus. **[5]**

c) If $f(x) = \int_x^{x+1} \sin(t^2)\, dt$ and $x > 0$ then prove that $|f(x)| < \frac{1}{x}$.

[4]

Q7) a) If $f, \in \Re(\alpha)$ and $f_2 \in \Re(\alpha)$ on [a,b] then prove that $f_1 + f_2 \in \Re(\alpha)$. Also prove that.

$$\int_a^b (f_1 + f_2)d\alpha = \int_a^b f_1 d\alpha + \int_a^b f_2 d\alpha. \qquad \textbf{[5]}$$

b) Prove that the sequence of functions $\{f_n\}$, defined on E converges uniformly on E if and only if for $\in > 0$ there exists an integer N such that $m \geq N$, $n \geq N$, $x \in E$ implies $|f_n(x) - f_m(x)| \leq \in$. **[5]**

c) Let $f_n(x) = \frac{x}{1+nx^2}, n = 1,2,3,...., x \in \mathbb{R}$. Show that $\{f_n\}_{n=1}^{\infty}$ converges uniformly to a function f and the equation $f'(x) = \lim_{n\to\infty} f_n'(x)$ holds true for $x \neq 0$. **[4]**

Q8) a) Suppose $\{f_n\}$ is a sequence of functions defined on E, and suppose $|f_n(x)| \leq M_n$. $(x \in E, n = 1,2,3,....)$. Prove that if $\sum_{n=1}^{\infty} M_n$ converges then $\sum_{n=1}^{\infty} f_n$ converges uniformly on E. **[5]**

b) Consider $f_n(x) = n^2 x(1-x^2)^n$, $0 \leq x \leq 1, n = 1,2,3,.....$ Prove that

$$\lim_{n\to\infty} \int_0^1 f_n(x)dx \neq \int_0^1 \left[\lim_{n\to\infty} f_n(x)\right]dx. \qquad \textbf{[5]}$$

c) Test the convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n^2 + x^2}$, $0 \leq x < \infty$. **[4]**

Total No. of Questions : 8]

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PD3767

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[6489]-12

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

MIM-102 : LINEAR ALGEBRA AND IT'S APPLICATIONS

(2019 Pattern) (Semester-I)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any FIVE of the given EIGHT questions.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt each of the following : **[14]**

a) Let W_1 & W_2 be subspaces of a vector space V. Prove that $W_1 + W_2 = \{\bar{u} + \bar{v} / \bar{u} \in W_1, \bar{v} \in W_2\}$ is also a subspace of V. **[5]**

b) Determine the value/s of λ, for which the set $S = \{\bar{v}_1, \bar{v}_2, \bar{v}_3\}$ is linearly dependent in $\mathbb{R}^3$, where

$\bar{v}_1 = (\lambda, -\frac{1}{2}, -\frac{1}{2}), \bar{v}_2 = (-\frac{1}{2}, \lambda, -\frac{1}{2}), \bar{v}_3 = (-\frac{1}{2}, -\frac{1}{2}, \lambda)$. **[5]**

c) If $\{\bar{v}_1, \bar{v}_2\}$ is a linearly independent set in a vector space V and the vector $\bar{v}_3$ does not lie in the linear span of $\{\bar{v}_1, \bar{v}_2\}$, then prove that $\{\bar{v}_1, \bar{v}_2, \bar{v}_3\}$ is also linearly independent. **[4]**

Q2) Attempt each of the following : **[14]**

a) Let $\bar{v}_1 = (1,2,1), \bar{v}_2 = (2,9,0), \bar{v}_3 = (3,3,4)$. Show that $S = \{\bar{v}_1, \bar{v}_2, \bar{v}_3\}$ is a basis for $\mathbb{R}^3$. **[5]**

b) Find a basis for the column space of **[5]**

$$A = \begin{bmatrix} 1 & -3 & 2 & 2 & 1 \\ 0 & 3 & 6 & 0 & -2 \\ 2 & -3 & -2 & 4 & 4 \\ 3 & -3 & 6 & 6 & 3 \\ 5 & -3 & 10 & 10 & 5 \end{bmatrix}$$

P.T.O.

c) Find $\bar{q}$ if $(\bar{q})_s$ = (3, 0, 4) and $S = \{\bar{p}_1, \bar{p}_2, \bar{p}_3\}$ is a basis for $\mathbb{P}_2$ with $\bar{p}_1 = 1 + x$, $\bar{p}_2 = 1 + x^2$, $\bar{p}_3 = x + x^2$. **[2]**

d) Find the rank and nullity of the matrix $A = \begin{bmatrix} 1 & 1 & 2 & 1 \\ 1 & 0 & 1 & 2 \\ 2 & 1 & 3 & 4 \end{bmatrix}$. **[2]**

Q3) Attempt each of the following : **[14]**

a) Let $\mathbb{P}_2$ have the inner product $\langle \bar{p}, \bar{q} \rangle = \int_{-1}^{1} p(x)\, q(x)\, dx$.

Find $\|\bar{p} - \bar{q}\|$ if $\bar{p} = 2 - x + x^2$ and $\bar{q} = 1 + 5x^2$ **[5]**

b) Let $\mathbb{R}^3$ have the Euclidean inner product and W be the subspace of $\mathbb{R}^3$ spanned by orthogonal vectors $\bar{v}_1 = \left(\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}}\right)$, $\bar{v}_2 = \left(\frac{-1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}}\right)$ let $\bar{u}$ = (1, 2, 3). Find the projection of $\bar{u}$ on W and the component of $\bar{u}$ orthogonal to W. **[5]**

c) Let $\mathbb{R}^3$ have the Euclidean inner product. Find the value/s of *k* for which $\bar{u}$ = *(k, k, 1)* and $\bar{v} = (k, 5, 6)$ are orthogonal. **[2]**

d) Let V be a real inner product space. For any two vectors $\bar{u}, \bar{v} \in V$, prove that $\langle \bar{u}, \bar{v} \rangle = \frac{1}{4}\left\{\|\bar{u} + \bar{v}\|^2 - \|\bar{u} - \bar{v}\|^2\right\}$. **[2]**

Q4) Attempt each of the following : **[14]**

a) Let $\mathbb{R}^2$ have the Euclidean inner product. Let $\bar{v}_1 = (1, -3)$, $\bar{v}_2 = (2, 2)$.

Use Gram Schmidt process to transform $S = \{\bar{v}_1, \bar{v}_2\}$ into an orthonormal basis. **[5]**

b) Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be multiplication by $A = \begin{bmatrix} 2 & -1 \\ -8 & 4 \end{bmatrix}$

Determine which of the following are in Ker(T)

(i) $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$ (ii) $\begin{bmatrix} 5 \\ 10 \end{bmatrix}$ (iii) $\begin{bmatrix} 3 \\ 2 \end{bmatrix}$ **[5]**

c) Let $T_1 : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear transformation given by $T_1(x, y) = (-2x, -3y, x + y)$ and $T_2 : \mathbb{R}^3 \to \mathbb{R}^2$ be a linear transformation given by $T_2(x, y, z) = (x-y, y + z)$. Find a formula for $T_1 o T_2$ and $T_2 o T_1$. **[4]**

Q5) Attempt each of the following : **[14]**

a) State and prove the rank nullity theorem for linear transformations. **[7]**

b) Find all eigen values and eigen vector corresponding to the largest eigen value of the matrix **[5]**

$$A = \begin{bmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$$

c) Show that $\lambda = 0$ is an eigen value of a matrix A iff A is not invertible. **[2]**

Q6) Attempt each of the following : **[14]**

a) Check whether $A = \begin{bmatrix} 3 & -2 & 0 \\ -2 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is diagonalizable. If so, then find a matrix P that diagonalizes A and also find $P^{-1}AP$. **[7]**

b) Prove that eigen vectors corresponding to distinct eigen values of a square matrix are linearly independent. **[5]**

c) Find the eigen values of A^5 if $A = \begin{bmatrix} 3 & 0 & 0 \\ 1 & -2 & 0 \\ 4 & 0 & 1 \end{bmatrix}$. **[2]**

Q7) Attempt each of the following : **[14]**

a) Find a single matrix that performs the indicated succession of operations: Compresses by a factor of $1/2$ in the x - direction, then expands by a factor of 5 in the y - direction. **[5]**

b) Find the least squares approximation of $f(x) = x$ on $[0, 2\pi]$ by a trigonometric polynomial of order 2 or less. **[5]**

c) Find an Lu Decomposition of $A = \begin{bmatrix} 2 & 1 & -1 \\ -2 & -1 & 2 \\ 2 & 1 & 0 \end{bmatrix}$. **[4]**

Q8) Attempt each of the following : **[14]**

a) Let T be a linear operator on a finite dimensional vector space V. Let C_1, C_2, ..., C_k be the distinct characteristic values of T and let Wi be the space of characteristic vectors associated with the characteristic value G. If $W = W_1 + W_2 + \ldots W_k$, then prove that

dim W = dim W_1 + dim W_2 + . . . + dim W_k. **[5]**

b) Let A be a square matrix of order *n* and P be an orthogonal matrix such that $p^t AP$ is a diagonal matrix. Prove that A must be symmetri. **[5]**

c) Find the minimal polynomial for the operator **[4]**

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

Total No. of Questions : 8]

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PD3768

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[6489]-13

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

MIM 103 : C PROGRAMMING

(2019 Pattern) (Semester - I)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any Five out of Eight questions given.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt the following: **[14]**

a) Explain call by value and call by reference with suitable example. **[5]**

b) Define an array. How to initialize one-dimensional array? Explain with example. **[5]**

c) Define: **[2]**

i) Variable ii) Datatypes

d) Predict the output and justify your answer **[2]**

```
main()
{
 int c=1;
While((c>0)&&(c<60))
{
 c++;
 printf("%d",c); N
}
```

Q2) Attempt the following: **[14]**

a) Differentiate between break and continue statement. **[5]**

b) Write a 'C' program to sort the given array elements in Ascending order. **[5]**

c) Define the use of conditional operator with syntax. **[2]**

d) Predict the output and justify your answer **[2]**

```
void main()
 {
    int fruit=1;
   switch(fruit+2)
    {
   default:printf("apple");
    case 4: printf("banana");
    case 5: printf("orange");
    case 8: printf("grape");
  }
}
```

P.T.O.

Q3) Attempt the following: **[14]**

a) Explain different arithmetic operations on pointers with suitable example. **[5]**

b) Write a recursive function to calculate sum of digits of a number. **[5]**

c) Define: **[2]**

i) Static variables ii) Register variables

d) Predict the output and justify your answer: **[2]**

```
main()
 { int i;
   for(i=1 ;i<5;i++)
     {
        if (i==3)
          continue;
        Printf("%d",i);
      }
}
```

Q4) Attempt the following: **[14]**

a) Explain: **[5]**

i) Nested structures

ii) Array of structures

b) Write down the difference between while and do-while loop. **[5]**

c) Write the use and syntax of sizeof ( ) operator. **[2]**

d) Predict the output and justify your answer: **[2]**

```
main()
 { int i=abc(10);
   printf("%d",--i);
  }
int abc(int i)
   {
     return(i++);
      }
```

Q5) Attempt the following: **[14]**

a) Write a 'C' program to copy the contents from one file to another file. **[5]**

b) Explain Switch control statement with example. **[5]**

c) Explain the following preprocessor directives with example. **[4]**

i) #include ii) #deflne

Q6) Attempt the following: **[14]**

a) How to declare and initialize a Two-dimensional array? Discuss with examples. **[5]**

b) Write a 'C' program that defines a structure employee containing the details such as empno, empname, department name and salary. The structure has to store 20 employees in an organization. Use the appropriate method to accept and display details of employee. **[5]**

c) Explain: **[4]**

i) Relational Operator

ii) Bitwise Operator

Q7) Attempt the following: **[14]**

a) Write a 'C' menu driven program to calculate factorial of number, number is odd or even and prime number. **[5]**

b) Write a'C' program to display the following pattern. **[5]**

```
* * * *
 * * *
  * *
   *
```

c) Write a short notes on Command Line argument. **[4]**

Q8) Attempt the following: **[14]**

a) Explain various file opening modes in C. **[5]**

b) Explain:Function prototype,Function call and return statement. **[5]**

c) Explain: **[4]**

i) Self-referential structures

ii) Array of structures

Total No. of Questions : 8]

SEAT No. :

PD3769

[Total No. of Pages : 3

[6489]-14

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

MIM 104: DBMS

(2019 Pattern) (Semester-I)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt any five out of the eight questions.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt the following:

a) Explain and differentiate between the terms primary key, candidate key and superkey with example. **[5]**

b) Explain with an example "Tabular representation of multivalued attributes." **[5]**

c) Define data model. List the various types of data models. **[2]**

d) Give any two notations used to draw an E-R diagram. **[2]**

Q2) Attempt the following:

a) Explain the following SQL set operations with example. **[5]**
   i) Union operation
   ii) Union all operation

b) Explain the structure of PL/pgSQL code block. **[5]**

c) What is a descriptive attribute? Give an example. **[2]**

d) Define DBMS. List the different types of database system users. **[2]**

Q3) Attempt the following:

a) Give the syntax and explain %TYPE and %ROWTYPE variable attributes of PL/pgSQL. **[5]**

b) Define a trigger. State and explain its syntax. **[5]**

c) What is an identifying relationship? Give an example. **[2]**

d) Define strong and weak entity sets. **[2]**

P.T.O.

Q4) Attempt the following:

a) Consider the following database **[5]**

Item(Item no,Item_name,price)

Supplier(Supplier id,Supplier_name,City)

Item and Supplier are related with many-to-many relationship.

Create a relational database in 3NF and give expression in SQL query for

i) List the names of items with highest price.

ii) List the details of all the suppliers supplying item "Keyboard".

b) Consider the database from Q4 a) and give expression in relational algebra for **[5]**

i) List the names of all suppliers.

ii) List the name and price of all items supplied by "Mr. Patil".

iii) List the names of suppliers who supply the item "mouse" for less than 200 rupees.

c) Give the basic structure of a SQL query. **[2]**

d) What is a Referential integrity constraint? Give an example. **[2]**

Q5) Attempt the following:

a) Consider the following database

Student (Roll-number, integer, name varchar(30), marks integer)

Write a PL/pgSQL function which will accept Roll number and displays the name and marks of the student. **[5]**

b) Consider the relation schema R(A,B,H,I,J,K) and the set of functional dependencies defined on R as

F={A–>B, A–>H, BJ–>K, BI–>K, B–>H, H–>K}

Compute closure of F, i.e. F+. **[5]**

c) Consider the relation schema R(A,B,C,D,E) and set of functional dependencies F for R as

F= (A–>BC, CD–>E, B–>D, E–>A). Find a candidate key for R. **[4]**

Q6) Attempt the following:

a) Explain the difference between Cartesian product and natural join operation with example. **[5]**

b) Explain specialization and generalization with example. **[5]**

c) Explain the different types of attributes with respect to E-R model. **[4]**

Q7) Attempt the following:

a) Give example to explain **[5]**

i) Left outer join

ii) Right outer join

b) Consider the following database **[5]**

Employee(Employee_id, name,age,salary,city)

Project(Project_id, project_name,duration,budget)

Project and Employee are related with one-to-many relationship.

Create a relational database in 3NF and give expression in SQL query for

i) List the details of employees in ascending order of their age.

ii) Find the maximum salary of an employee.

iii) Give the names of projects having budget less than 90000.

iv) List the details of employees who do not live in "Pune" city.

c) Consider the database from Q7 b) and give expression in relational algebra for **[4]**

i) List the name and salary of all employees.

ii) Give the names of employees having age less than 50.

iii) Give the names of projects having budget more than 50000.

iv) List the details of employees who live in "Nagpur" city.

Q8) Attempt the following

a) What is normalization? Explain 1NF, 2NF forms of normalization with example. **[5]**

b) What is data abstraction? Explain the various levels of data abstraction. **[5]**

c) Write a short note on mapping cardinalities. **[4]**

Total No. of Questions : 8]

SEAT No. : ____

PD3770

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[6489]-21
First Year M.Sc. (I.M.C.A.)
MATHEMATICS
MIM-201 : Complex Analysis
(2019 Pattern) (Semester -II)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any five questions out of eight questions.***
2) ***Figures to the right indicate full marks.***

Q1) a) Find Laurent series representation for $f(z)=\frac{\sin z^2}{z^4}$. **[5]**

b) Derive integral representation of f at z_0 using Cauchy Integral Formula. **[5]**

c) Comment whether the function cos z is bounded? **[2]**

d) What is period of the function $f(z)=e^z$. **[2]**

Q2) a) Find P.V. $\int_{-\infty}^{\infty}\frac{dx}{x^2+1}$. **[5]**

b) Suppose that $|f(z)|\leq|f(z_0)|$ at each point z in some neighbourhood $|z-z_0|<\varepsilon$ in which f is analytic then prove that $f(z)$ has the constant value $f(z_0)$ throughout that neighbourhood. **[5]**

c) Justify that:- Multiplicative inverse of each non-zero complex number z exists. **[2]**

d) Determine singular points of the function $f(z)=\frac{2z+5}{z(z^2+3)}$. **[2]**

Q3) a) Show that $\underset{z=\infty}{Res}[f(z)]=-\underset{z=0}{Res}\left[\frac{1}{z^2}f\left(\frac{1}{z}\right)\right]$. **[5]**

b) Find a harmonic conjugate $v(x,y)$ *for* $u(x,y)=2x(1-y)$. **[5]**

c) Define removable singularity with its example. **[2]**

d) Show that $\lim_{z\to z_0}\mathrm{Re}\,z=\mathrm{Re}\,z_0$ **[2]**

P.T.O.

Q4) a) Derive Cauchy Riemann Equations in polar coordinates form. **[5]**

b) Find the values of z such that $e^z = 1 + i.$ **[5]**

c) Write derivatives of **[2]**

i) tanh *z*

ii) cosh *z*

d) Comment at which point cosec z is not analytic **[2]**

Q5) a) Show that $\int_0^{\infty} \frac{dx}{(x^4+1)} = \frac{\pi}{2\sqrt{2}}.$ **[5]**

b) Suppose that **[5]**

i) two functions *p* and *q* are analytic at a point z_0

ii) $p(z_0) \neq 0$ and q has a zero of order *m* at z_0. then prove that the quotient $p(z)/q(z)$ has a pole of order *m* at z_0.

c) Find residue of the function $f(z) = \frac{1}{z(e^z - 1)}$ at $z = 0.$ **[4]**

Q6) a) Prove that $\frac{d}{dz}[f(z)g(z)] = f(z)g'(z) + g(z)f'(z).$ **[5]**

b) Find the Maclaurin series expansion of the function $f(z) = \frac{z}{z^4+9}.$ **[5]**

c) Find all roots in rectangular coordinates of the equation $z^4 = -16.$ **[4]**

Q7) a) Suppose that a function $f(z)$ is continuous on a domain D and if the integral of $f(z)$ around closed contours lying entirely in D all have value zero then prove that $f(z)$ has an antiderivative $F(z)$ throughout D. **[5]**

b) If a function *f* is analytic throughout a simply connected domain D, then prove that $\int_c f(z)\,dz = 0$ for every closed contour C lying in D. **[5]**

c) Show that $\int_c \frac{z+2}{z} dz = 4\pi i;$ where C is the positively oriented circle |*z*|=2. **[4]**

Q8) a) Suppose that $z_n = x_n + iy_n$ $(n = 1,2,3,....)$ and $z = x + iy$ then prove that $\lim_{n\to\infty} z_n = z$ if and only if $\lim_{n\to\infty} x_n = x$ and $\lim_{n\to\infty} y_n = y.$ **[5]**

b) Derive that $\cos^{-1} z = -i \log\left[z + i(1-z^2)^{\frac{1}{2}} \right].$ **[5]**

c) Find the Laurent series representation for $f(z) = ze^{\frac{1}{z}}$. Determine the type of singularity of $f(z)$ and residue at z = 0. **[4]**

Total No. of Questions : 7]

SEAT No. : ____

PD3771

[Total No. of Pages : 2

[6489]-22
M.Sc.-I (IMCA)
MATHEMATICS
MIM-202 : Discrete Mathematical Structures
(2019 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) ***Scientific calculator is allowed.***

Q1) Attempt any five of the following. **[10]**

a) Prove that the degree of every vertex in a complete graph on n vertices is $n-1$.

b) What is the number of non isomorphic binary trees on 7 vertices? Justify!

c) State true or false: Kruskal's algorithm is used to find shortest path between any two vertices in a graph. Justify!

d) How many bit strings of length seven are there?

e) How many different committees of three students can be formed from a group of four students?

f) In how many ways can 6 people be seated at a round table?

g) Construct circuit that produce the output : $(x+y)\overline{x}$.

Q2) Attempt each of the following.

a) Find the sum-of-products expansion for the function $F(x,y,z)=(x+y)\overline{z}$. **[5]**

b) Show that among any $n+1$ positive integers not exceeding 2n there must be an integer that divides one of the other integers. **[7]**

P.T.O.

Q3) Attempt each of the following.

a) What is the solution of the recurrence relation **[5]**

$a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$?

b) Use K-maps to simplify these sum-of-products expansion **[7]**

$wxyz + wxy\bar{z} + wx\bar{y}\,\bar{z} + w\bar{x}\,\bar{y}z + w\bar{x}yz + w\bar{x}\,\bar{y}\,\bar{z} + \bar{w}x\bar{y}z + \bar{w}\,\bar{x}yz + \bar{w}\,\bar{x}y\bar{z}.$

Q4) Attempt any Two of the following.

a) Explain the Quine-McCluskey method used to simplify a sum-of-products expression. [**6]**

b) Hom many solutions does the equation $x_1 + x_2 + x_3 = 11$ have, where x_1, x_2, and x_3 are non-negative integers? [**6]**

c) Let G be a connected planar simple graph with e edges and v vertices. Let *r* be the number of regions in a planar representation of G. Then prove that $r = e - v + 2.$ [**6]**

Q5) Attempt each of the following.

a) Define a tree. Prove that a tree with *n* vertices has *n*–1 edges. **[5]**

b) Define a bipartite graph. Prove that a simple graph is bipartite if and only if it is possible to assign one of two different colors to each vertex of the graph so that no two adjacent vertices are assigned the same color. **[7]**

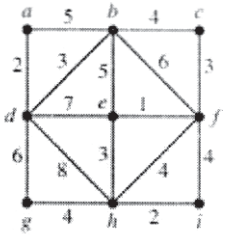
Q6) Attempt each of the following.

a) What is the value of the postfix expression 521 – – 314 + +*? **[5]**

b) Explain Dijkstra's algorithm. **[7]**

Q7) Attempt each of the following.

a) Use Prime's algorithm to find a minimum spanning tree for the following weighted graph. **[5]**



b) Define *m*-ary tree. Prove that there are at most m^h leaves in an *m*-ary tree of height *h*. **[7]**

Total No. of Questions : 8]

SEAT No. :

PD3772

[Total No. of Pages : 3

[6489]-23

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

OPERATING SYSTEMS (COMPUTER SCIENCE)

MIM 203 : Data Structures

(2019 Pattern) (Semester-II)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt any five of the following.***
2) ***Figures to the right indicates full marks.***

Q1) Attempt all.

a) Define complexity. Explain space and time complexity. **[5]**

b) Write an algorithm for Bubble sort. Give its complexity for all three cases. **[5]**

c) Define indegree and outdegree of a vertex. **[2]**

d) Give any two types of data structures. **[2]**

Q2) Attempt all.

a) What is Binary search tree? Explain its any 2 operations. **[5]**

b) Explain static and dynamic queue in detail. **[5]**

c) Give any two goals of analysis of algorithms. **[2]**

d) List two operations of stack. **[2]**

Q3) Attempt all.

a) Explain circular queue with its structure. **[5]**

b) Give any two applications of linked list in detail. **[5]**

c) What is strongly connected graph? **[2]**

d) Define Big-oh notation with mathematical expression. **[2]**

P.T.O.

Q4) Attempt all.

a) Write a note on static and dynamic implementation of linked list. **[5]**

b) Explain multiple queues in detail. **[5]**

c) Give the best and worst case complexity of insertion sort. **[2]**

d) Give the dynamic representation of stack. **[2]**

Q5) Attempt all.

a) Explain any two types of tree traversal techniques with example. **[5]**

b) Explain the following. **[5]**

i) Adjacency matrix

ii) Adjacency list.

c) Explain the working of quick sort algorithm with example. **[4]**

Q6) Attempt all.

a) Explain any two types of linked lists with its structure. **[5]**

b) Sort the following numbers in increasing order using merge sort and give its analysis: **[5]**

8, 3, 2, 9, 7, 1, 5, 4.

c) Explain the following: **[4]**

i) XOR tree

ii) Expression tree

Q7) Attempt all.

a) Explain the following with the help of example: **[5]**

i) infix to prefix

ii) infix to postfix

b) Define Heapify property. Write an algorithm for Heap sort and give its analysis. **[5]**

c) Explain any two operations of linked list. **[4]**

Q8) Attempt all.

a) Define the following terms: **[5]**

i) AVL tree

ii) Threaded Binary tree

iii) Counting Leaf

iv) Depth of tree

v) Complete binary tree

b) Write the difference between comparison and non-comparison sorting techniques. Explain any one non-comparison based sorting technique with its algorithm. **[5]**

c) Explain priority queue with its structure and example. **[4]**

Total No. of Questions : 8]

SEAT No. : ____

PD3773

[Total No. of Pages : 2

[6489]-24
First Year M.Sc. (I.M.C.A.)
MATHEMATICS
MIM - 204 : Software Engineering
(2019 Pattern) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any five questions.***
2) ***All questions carry equal marks.***
3) ***Figures to the right indicate full marks***

Q1) Answer the following:

a) Explain in detail Activities involved in System Design Process. **[5]**

b) Write a note on Collaboration Diagram. **[5]**

c) List any 4 Behavioral Diagrams. **[2]**

d) Write any two types of Software Myths? **[2]**

Q2) Answer the following:

a) Draw a use case diagram for ATM Banking System. **[5]**

b) Write a note on Extreme Programming Practices. **[5]**

c) List any 4 benefits of UML. **[2]**

d) Define: **[2]**

i) Classifier

ii) Class

Q3) Answer the following:

a) Write a detail note on Rational Unified Process. **[5]**

b) Draw a class diagram of college management system. **[5]**

c) What is Inception and Elaboration in UML. **[2]**

d) What is the role of Task Management Component in Object Oriented Design? **[2]**

Q4) Answer the following:

a) What are the steps to be taken in Elaboration Phase. **[5]**

b) Write a note on Structural Diagrams. **[5]**

c) Define: **[2]**

i) Test case

ii) Test design

d) What is Activity? What is the Graphical Notation used in UML for Activity? **[2]**

P.T.O.

Q5) Answer the following:

a) Write a note on Agile method. **[5]**

b) Explain Use case, use case Diagram and its stereotypes using one example. **[5]**

c) Draw the Deployment diagram for the Library Management System. **[4]**

Q6) Answer the following

a) Explain with example: Inheritance. **[5]**

b) Draw a state machine diagram of simple microwave oven. **[5]**

c) Explain Include Relationship Between Two Use Cases with an example. **[4]**

Q7) Answer the following:

a) Write a note on Object Oriented Testing Techniques. **[5]**

b) Write a note on Common Mechanisms in UML. **[5]**

c) Briefly explain the stages of Object-Oriented Design. **[4]**

Q8) Answer the following:

a) Explain in detail Rapid Application Development (RAD) Model. **[5]**

b) Write a note on Sequence Diagram in detail. **[5]**

c) Write a note on Artifacts Diagram and Artifacts of the System. **[4]**

Total No. of Questions : 7]

SEAT No. : ____

PD3774

[Total No. of Pages : 2

[6489]-25

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

MIM - 205 : JAVA

(2019 Pattern) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Solve any Five questions from Q.2 to Q.7.***
3) ***Q.2 to Q.7 carry equal marks.***
4) ***Figures to the right indicate full marks.***

Q1) Attempt any FIVE of the following: **[5×2=10]**

a) What is difference between paint() and repaint() method of the applet?

b) What is a stream? List types of streams in java.

c) State the use of finally block.

d) An abstract class can have constructor. State true/false. Justify.

e) List any two methods of java.io.BufferedReader class.

f) What is the purpose of instanceof?

g) State the purpose of following java tools:

i) javap

ii) javadoc

Q2) Attempt the following questions.

a) Describe How multidimensional arrays are created in java? With example. **[7]**

b) What is the use of MouseMotionListener? Explain any two methods of MouseMotionListener. **[5]**

Q3) Attempt the following questions:

a) Explain the concept of Package in detail with suitable example. **[7]**

b) Explain any five methods of File class with syntax. **[5]**

P.T.O.

Q4) Attempt the following questions:

a) What is Runtime Polymorphism? How to achieve Runtime Polymorphism in java? **[7]**

b) Write a note on protected keyword in java. **[5]**

Q5) Attempt the following questions:

a) What is an Assertion? State the use of Assertions. Also state any three assertion rules. **[7]**

b) Explain method overriding in java with example. **[5]**

Q6) Attempt the following questions:

a) Write a java program to copy the content of one java source file to another by removing comments and extra blank. spaces. **[7]**

b) Write a note on AWT class hierarchy. **[5]**

Q7) Attempt the following questions:

a) Write a java program to create an applet which contains a list of courses. Display selected course in a text box. **[7]**

b) Explain the use of try, catch, throw, throws and finally in exception handling. **[5]**

Total No. of Questions : 8]

SEAT No. :

PD3775

[Total No. of Pages : 5

[6489]-31

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

MATHEMATICS

MIM 301 : Operational Research

(2019 Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt any FIVE out of the EIGHT questions given.***
2) ***Figures to the right indicates full marks.***

Q1) a) Solve the following LPP by graphical method: **[5]**

$$\min z = 2x_1 + 3x_2$$

subject to

$$x_1 + x_2 \le 30$$
$$x_2 \ge 3$$
$$x_2 \le 12$$
$$x_1 - x_2 \ge 0$$
$$x_1, x_2 \ge 0$$

b) Explain the North-West corner method for finding an IBFS of a Transportation problem. **[5]**

c) Define the terms- **[2]**

i) Basic Variable

ii) Basic Solution

d) State how an Unbalance assignment problem can be converted to a balanced problem. **[2]**

Q2) a) A calculator company produces a scientific calculator and a standard calculator. Long-term projections indicate an expected demand of at least calculators can be made daily. To satisfy a shipping contract, a total of at least 200 calculators must be shipped each day. If each scientific calculator sold results in an Rs 2 loss, but each graphing calculator produces an Rs 5 profit, how many of each type should be made daily to maximize net profits? Formulate as a LPP and solve. **[5]**

P.T.O.

b) Find IBFS of the following Transportation Problem using Least-Cost Method: **[5]**

Origins	Destinations				Availability
	E	F	G	H	
A	10	30	25	15	15
B	20	15	20	10	6
C	10	30	20	20	14
D	30	40	35	45	11
Demand	10	12	15	9	

Is the solution Degenerate? Justify.

c) Define an Assignment Problem. **[2]**

d) Can a LPP have exactly 2 optimum solutions? Justify. **[2]**

Q3) a) Solve the following Assignment problem where Four Jobs J_1 to J_4 can be done on Four machines M_1 to M_4. The costs in Rs. Of producing job J_i on machine M_i are given in following matrix:

	M_1	M_2	M_3	M_4
J_1	5	7	11	6
J_2	8	5	9	6
J_3	4	7	10	7
J_4	10	4	8	3

How should the jobs be assigned to various machines so that total production cost will be minimum? **[5]**

b) Write the dual of the following LPP: **[5]**

$$\min\ z = 2x + 3y + 5z$$

subject to

$$x + 2y + 3z \geq 12$$
$$2x - 3y \quad \geq 10$$
$$x, y, z \geq 0$$

c) What exactly does Sensitivity Analysis exactly means? **[2]**

d) Explain how degeneracy is located in Transportation problem. **[2]**

Q4) a) The following table gives the activities involved in a project and their duration. **[5]**

Activity	Immediate Predecessors	Estimated duration
A	-	5
B	-	1
C	B	2
D	A,C	4
E	B	6
F	D,E	3

Draw the project network and find critical path.

b) Solve the following LPP by Simplex Method: **[5]**

$$\max\ z = 2x_1 + 3x_2 + 5x_3$$

subject to

$$-3x_1 + 2x_2 + 3x_3 \le 8$$

$$-3x_1 + 2x_2 + 3x_3 \le 10$$

$$x_1, x_2, x_3 \ge 0$$

c) Define the following for LPP: **[2]**

i) Feasible solution

ii) Optimum solution

d) Write the LPP in Standard form **[2]**

$$\max\ z = x_1 + x_2$$

subject to

$$x_1 + 4x_2 \le 5$$

$$x_1 + 4x_2 \le 3$$

$$x_1, x_2 \ge 0$$

Q5) a) Find the initial basic feasible solution using Vogel's Approximation method(VAM) and optimize it using MODI method. **[7]**

Factories	Stores			Production Supply
	D_1	D_2	D_3	
O_1	13	15	16	17
O_2	7	11	2	12
O_3	19	20	9	16
Demand	14	8	23	

b) Use Big-M method to solve the LPP: **[7]**

$$\max\ z = 4x_1 + 3x_2$$

subject to,

$$2x_1 + x_2 \geq 10$$
$$-3x_1 + 2x_2 \leq 6$$
$$x_1 + x_2 \geq 6$$
$$x_1, x_2 \geq 0$$

Q6) a) Explain Hungarian Method of an Assignment Problem. **[7]**

b) The following table gives the activities involved in a project and their duration: **[7]**

	Estimated duration(in weeks)		
Activity	optimistic	most likely	pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

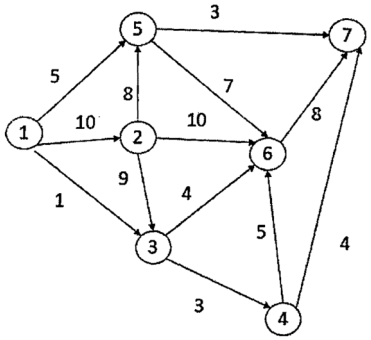
i) Draw the Project network.

ii) Find the expected duration and variance in the activity.

Q7) a) Solve the following Assignment Problem for Maximization. **[5]**

	I	II	III	IV
A	100	140	280	70
B	130	160	200	60
C	80	130	300	90
D	150	110	250	50

b) Determine the critical path for the project network in the following figure. **[5]**



c) Give any Four Illustrative Applications of the Integer Programming Problem. **[4]**

Q8) a) Use Branch and Bound Method to find only the first Sub-problem of integer programming problem **[5]**

$$\max\ z = 7x_1 + 9x_2$$

subject to,

$$-x_1 + 3x_2 \geq 10$$
$$7x_1 + 2x_2 \leq 6$$
$$x_1 \geq 0,\ x_2 \leq 7$$
$$x_1, x_2 \text{ are integers}$$

b) Explain the following term in simplex method- **[5]**

i) Optimality condition

ii) Feasibility condition

c) Use dual simplex method to solve the LPP- **[4]**

$$\max\ z = 2x_1 + 2x_2$$

subject to,

$$2x_1 - x_2 - x_3 \geq 3$$
$$x_1 - x_2 + x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

Total No. of Questions : 7]

SEAT No. : ____

PD3776

[Total No. of Pages : 2

[6489]-32

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

MIM-302 : ALGEBRA

(2019 Pattern) (Semester-III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) Solve any Five of the following : **[5×2=10]**

a) Give an example of a (i) finite non cyclic group and (ii) an infinite non cyclic group.

b) Express the following permutation in S_8 as a product of disjoint cycles:

(1,3,2,7) (4,8,6) and find its order.

c) Find all zero divisors in the ring Z_{12}.

d) Give the characteristic of the following rings : (i) $Z_3 \times Z_8$ (ii) $Z_4 \times Z_{16}$.

e) Define simple group and give one example.

f) Draw the Cayley table for U(8).

g) Show that in a group G, there is only one identity element.

Q2) a) State and prove Lagrange's theorem. **[7]**

b) Determine the order of every element in the group $(Z_7, +_7)$. **[5]**

P.T.O.

Q3) a) Let G be a finite group of even order. Prove that there is at least one element $a \in G, a \neq e$ such that $a = a^{-1}$. **[7]**

b) Find all normal subgroups of the group $(Z_8, +_8)$. **[5]**

Q4) a) Let *G* be a group and let R be a relation defined on G by 'aRb' if and only if $a = x^{-1} bx$, for some $x \in G$. Prove that R is an equivalence relation on G. Further show that if G is an abelian group then every conjugacy class is a singleton set. **[6]**

b) Prove that intersection of normal subgroups is normal. **[6]**

Q5) a) Prove that every field is an integral domain, but not conversely. **[7]**

b) Give an example of a subring of $Z \times Z$ which is not an ideal of $Z \times Z$. Here Z denotes the ring of integers. **[5]**

Q6) a) Prove that $\frac{R}{I}$ is an Integral domain if and only if I is a prime ideal. **[7]**

b) Find all irreducible polynomials of degree 2 in $Z_2[x]$. **[5]**

Q7) a) State and prove Eisenstein's Criterion for irreducibility of polynomials. **[7]**

b) Prove that the intersection of any two subgroups of a group G is also a subgroup of G. Provide an example to illustrate your proof. **[5]**

Total No. of Questions : 8]

SEAT No. :

PD3777

[Total No. of Pages : 2

[6489]-33
S.Y. M.Sc. (I.M.C.A.)
MIM 303 : ADVANCED JAVA
(2019 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt any five out of eight questions given.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt the following questions : **[5]**

a) What are the steps to draw graphics 2D object.

b) What is Thread? What are advantages and disadvantages of thread in java. **[5]**

c) What does JDBC API do? **[2]**

d) What is difference between TreeSet and HashSet? **[2]**

Q2) Attempt the following questions :

a) Explain the process of creating TCP client and server with suitable example. **[5]**

b) What are different ways of session tracking? **[5]**

c) Define the collection in java. What are uses of collection? **[2]**

d) What is use of join( ) method in multithreading? **[2]**

Q3) Attempt the following questions :

a) What is use of Runnable interface? Explain with suitable example. **[5]**

b) What is ResultSet? What are different types of ResultSets? **[5]**

c) What are advantages of Iterator? **[2]**

d) What is session? **[2]**

Q4) Attempt the following questions :

a) Explain JSP life cycle in detail. **[5]**

b) Explain URL class in java.net package. **[5]**

c) What is savepoint? What is use of savepoint. **[2]**

d) What is need of RowSet? **[2]**

P.T.O.

Q5) Attempt the following questions:

a) Explain any five interfaces from java.sql package. **[5]**

b) Discuss thread class in detail. **[5]**

c) Write a note on color class in java.awt package. **[4]**

Q6) Attempt the following questions :

a) Explain any five methods of server socket class. **[5]**

b) What is cookie? How to create cookie? Explain with suitable example. **[5]**

c) Write a program to display all details of the student table using JDBC. Student table is having column as rno, name, percentage. **[4]**

Q7) Attempt the following questions :

a) Discuss the use of notify( ), notifyall( ) and wait( ) with suitable example. **[5]**

b) Explain different constructors available to draw different shape using graphics 2D object. **[5]**

c) What are ways available to create a new thread? **[4]**

Q8) Attempt the following questions :

a) What is FontMetric? Explain FontMetric class in detail. **[5]**

b) Explain different versions of JDBC in detail. **[5]**

c) What is difference between ArrayList and LinkedList? **[4]**

Total No. of Questions : 8]

SEAT No. : ____

PD3778

[Total No. of Pages : 3

[6489]-34

M.Sc. - II (Industrial Mathematics With Computer Application)

MIM-304: OPERATING SYSTEM

(2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any FIVE out of EIGHT questions given.***
2) ***Figures to the right indicates full marks.***

Q1) Attempt each of the following: **[14]**

a) Explain the following system structures: **[5]**
   i) Layered system
   ii) Microkernels

b) Give the definitions for the following: **[5]**
   i) CPU Utilization
   ii) Throughput
   iii) Turn Around Time
   iv) Waiting Time
   v) Response Time

c) Define the critical section problem. **[2]**

d) Give the difference between internal and external fragmentation. **[2]**

Q2) Attempt each of the following: **[14]**

a) Write a note on process control Block. **[5]**

b) Explain contiguous memory allocation. **[5]**

c) Explain the working of Look algorithm in brief. **[2]**

d) Discuss bit vector approach in free space. **[2]**

Q3) Attempt each of the following: **[14]**

a) Consider the following snapshot of the system: **[5]**

Process	Burst Time	Arrival Time
P_1	5	1
P_2	3	0
P_3	2	2
P_4	4	3

Computer average turn around time and average waiting time using FCFS and SJF (Pre - emptive).

b) Define the term Deadlock. Explain four necessary conditions for a deadlock to occur. **[5]**

c) Define - Context switch. **[2]**

d) What is segmentation? **[2]**

P.T.O.

Q4) Attempt each of the following: **[14]**

a) Explain usuage and implementation of binary semaphore. **[5]**

b) What is a file? Discuss several pieces of information associated with an open file. **[5]**

c) What is caching? **[2]**

d) Give any two advantages of multiprocessor system. **[2]**

Q5) Attempt each of the following: **[14]**

a) Define wait-for-graph. How resource allocation graph is converted to wait-for-graph? **[5]**

b) Explain any five kernel I/O subsystems. **[5]**

c) Draw and explain process state transition diagram. **[4]**

Q6) Attempt each of the following: **[14]**

a) How many page faults occur using LRU page replacement algorithm and FIFO page replacement algorithm for the following page reference string with three page frames: **[5]**

1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5.

b) Explain bounded buffer problem with semaphore. **[5]**

c) Explain any four types of directories. **[4]**

Q7) Attempt each of the following: **[14]**

a) Explain any two file access methods in detail. **[5]**

b) Explain the following operation system operations: **[5]**

i) Dual Mode operation

ii) Timer

c) Explain multilevel feedback queues in detail. **[4]**

Q8) Attempt each of the following: **[14]**

a) Suppose that a disk has 200 cylinders, 0 to 199. The drive is currently serving at cylinder 53, and the pending request queue is: 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, what is the total distance that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms: **[5]**

i) FCFS

ii) SSTF

b) What is a scheduler? Also define the dispatcher. Explain the different types of schedular. **[5]**

c) Consider the given snapshot of the system. A system has 5 processes and 3 types of resources A,B,C. **[4]**

	Allocation			Max			Tota Resources		
	A	B	C	A	B	C	A	B	C
P_0	0	1	0	7	5	3	3	3	2
P_1	2	0	0	3	2	2			
P_2	3	0	2	9	0	2			
P_3	2	1	1	2	2	2			
P_4	0	0	2	4	3	3			

Answer the following questions:

i) What are the contents of Need Matrix?

ii) Is the system in safe state? If yes, give the safe sequence.

ⓘⓘⓘⓘ

Total No. of Questions : 8]

SEAT No. :

PD3779

[Total No. of Pages : 2

[6489]-35
S.Y. M.Sc. (I.M.C.A.)
MATHEMATICS
MIM-306 : Computer Networks
(2019 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt any five out of eight questions.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt the following:

a) Differentiate between TCP/IP reference model and OSI model. **[5]**

b) Compare circuit-switched network and packet-switched network. **[5]**

c) Define Digital data and Analog data. **[2]**

d) What is polling? **[2]**

Q2) Attempt the following :

a) Explain any two persistence methods of CSMA. **[5]**

b) Write a short note on task performed by physical layer in OSI model. **[5]**

c) What is the relationship between period and frequency? **[2]**

d) Define the terms : **[2]**

i) Multicasting

ii) Multiplexing

Q3) Attempt the following :

a) Write a note on CSMA/CD. **[5]**

b) Explain different functions in polling access method with a neat diagram. **[5]**

c) Explain the terms Continuous time and Slotted time. **[2]**

d) Define Shannon capacity theorem. **[2]**

Q4) Attempt the following :

a) Compare TCP and UDP header. List the fields in TCP header that are missing in UDP header. **[5]**

b) Explain any one guided media with suitable diagram. **[5]**

c) What is cladding in an optical fibre. **[2]**

d) What is modulation? **[2]**

P.T.O.

Q5) Attempt the following :

a) Write short note on slotted ALOHA. **[5]**

b) Explain any five fields of IEEE 802.3 MAC frame. **[5]**

c) Write correct layer for following functions : **[4]**

i) Dialog control

ii) Encryption

iii) Service point address.

iv) Transmission mode

Q6) Attempt the following :

a) Write a note on pulse code modulation. **[5]**

b) What is the role of packet filtering router and application gateway in firewall? **[5]**

c) What is congestion? Discuss data link layer policies to avoid congestion. **[4]**

Q7) Attempt the following :

a) Compare circuit and message switching. **[5]**

b) What is transmission impairment? What are its different types? Explain any one in brief with neat diagram. **[5]**

c) Construct CRC message for the bit stream 10011101 where generator polynomial is $x^3 + 1$. **[4]**

Q8) Attempt the following :

a) Write a short note on unguided media. **[5]**

b) Compare virtual circuit and datagram subnet. **[5]**

c) Explain different transport service primitives. **[4]**

Total No. of Questions : 7]

SEAT No. : ____

PD3780

[Total No. of Pages : 2

[6489]-41
S.Y.M.Sc. (IMCA)
MIM -401 : DIFFERENTIAL EQUATIONS
(2019 Pattern) (Semester -IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 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) Attempt any five of the following. **[5×2=10]**

a) Find the singular points of $x^2y'' + (x + x^2)y' - y = 0.$

b) Prove that for $y, z \in \mathbb{C}_n, |y + z| \leq |y| + |z|$.

c) Find the solutions of $y'' + \omega^2 y = 0.$

d) Define Lipschitz Condition.

e) Write Euler equation.

f) Check whether the following set of functions defined on $-\infty < x < \infty$ linealy independent or dependent: $\varphi_1(x) = 1, \varphi_2(x)\ x, \varphi_3(x) = x^3.$

g) Find Wronskian of the set $\{x^2, x^3\}$ on $(-\infty, \infty)$.

Q2) a) Consider the equation $y' + ay = b(x)$ where *a* is constant and *b* is a continuous function on an interval I. if x_0 is a point in I and c is any constant, then prove that the function defined by $\varphi(x) = e^{-ax}\int_{x_0}^{x} e^{at}b(t)dt + ce^{-ax}$ is the solution of given equation. **[7]**

b) Let φ_1 and φ_1 be two solutions of *a* second order differential equation $L(y) = 0$ and let x_0 be any point in interval I. Then prove that φ_1 and φ_1 are linearly independent if and only if $W(\varphi_1, \varphi_1)\ (x_0) \neq 0.$ **[5]**

P.T.O.

Q3) a) Prove that there exist *n* linearly independent solutions of differential equation of n^{th} order with variable coefficients. **[7]**

b) Find the solution of $L(y) = y'' - xy = 0$ by power series method. **[5]**

Q4) a) Let *g, h* be continuous real valued functions for $a \le x \le b, c \le y \le d$ respectively, and consider the equation $h(y)y' = g(x)$. If G and H are any functions such that $G' = g, H' = h,$ and c is any constant such that the relation $H(y) = G(x) + c$ defines a real valued differential function φ for x in some interval I contained in $a \le x \le b,$ then prove that φ is the solution of $h(y)y' = g(x)$ on I. **[7]**

b) Find the Wronskian of $\varphi_1 = x, \varphi_2 = x^4.$ **[5]**

Q5) a) Consider the equation $L(y) = y'' + ay' + by = 0$ where a, b be any constants. If *r* is the repeated roots of the characteristic polynomial p where $p(r) = r^2 + ar + b = 0,$ then prove that the functions φ_1, φ_2 defined by $\varphi_1(x) = e^{rx}, \varphi_2(x) = xe^{rx}$ are the solutions of $L(y) = 0.$ **[7]**

b) Find the indicial polynomial and its roots for the equation **[5]**
$x^2y'' - 5xy' + 3x^2y = 0.$

Q6) a) Prove that the function φ is the solution of the initial value problem $y' = f(x, y)$ if and only if it is the solution of the integral equation $y = y_0 + \int_{x_0}^{x} f(t, y)dt$ on interval I. **[7]**

b) Show that $f(x, y) = 4x^2 + y^2$ satisfy Lipschitz condition on $S : |x| \le 1, |y| \le 1.$ **[5]**

Q7) a) Find the solution of $y'' - 3y' + 2y = x^2$ by annihilator method. **[6]**

b) Find the singular point of **[6]**

i) $xy'' + 4y = 0$

ii) $(1 - x^2)y'' - 2xy' + 2y = 0$

Total No. of Questions : 7]

SEAT No. : ____

PD3781

[Total No. of Pages : 2

[6489]-42
M.Sc.-II (IMCA)
MATHEMATICS
MIM-402 : Statistical Methods
(2019 Pattern) (Semester -IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 1 is Compulsory.***
2) ***Attempt any Five questions from Q.2 to Q.7.***
3) ***Figures to the right indicate full marks.***
4) ***Scientific calculators and statistical tables are allowed.***

Q1) Solve any five of the following. (2 marks each) **[10]**

a) Explain mutually exclusive events.

b) A card is selected from 52 playing cards. What is probability that the card is a king?

c) Define a discrete random variable with example.

d) Given $f(x) = k / x^2, x = 1,2$ is probability distribution function, find k.

e) If E(X)=1.4, then find E(5x–4).

f) Find the number of trials of a binomial distribution which has mean = 12 and S.D=2.

g) Write down R-code if $X \to P(\lambda = 5.6)$. Find

i) $P(X > 1]$

ii) $P[2 \le X \le 4]$

Q2) a) In a population, the average IQ is 100 with a standard deviation of 15.A team of scientists want to test a new medication to see if it has either a positive or negative effect on intelligence, or no effect at all. A sample of 30 participants who have taken the medication has a mean of 140. Did the medication affect intelligence? **[7]**

b) Explain Normal distribution and its properties. **[5]**

Q3) a) Describe χ^2 test for goodness of fit. **[7]**

b) Prove that if X is exponential random variable, then **[5]**

$P(X > s + t \mid X > s) = P(X > t)$

P.T.O.

Q4) a) Derive moment generating function for Poisson random variable X with mean $= \lambda$. **[7]**

b) Write a R-code for following problem: **[5]**

Suppose age is a vector containing ages of 10 persons as 22, 27, 31, 41, 30, 25, 19, 20, 23, 35

i) Access age of fourth person.

ii) Create a vector 'age 30' with age of person > 30.

iii) Access age of last 3 persons.

iv) Find number of elements in vector age.

v) Access ages of persons except 5^{th} and 7^{th}.

Q5) a) Describe paired t-test for difference of means. **[7]**

b) A, B and C was 50%, 30% and 20% of the cars in a service station respectively. They fail to clean the glass in 5%, 7% and 3% of the cars respectively. The glass of a washed car is checked. What is the probability that the glass has been cleaned? **[5]**

Q6) a) In a shooting competition, the probabilty of a man hitting a target is 1/5. If he shoots at the target 5 times, what is the probability distribution and probability of hitting the target? **[7]**

i) only two times

ii) At least 2 times

iii) at most two times

b) Derive mean and variance for binomial random variable. **[5]**

Q7) a) Find the Coefficient of correlation for the following data: **[6]**

x	35	40	60	79	83	95
y	17	28	30	32	38	49

b) Fill the blanks in the following ANNOVA table for two way classification. **[6]**

Sources of Variation	d.f.	sum of squares	Mean Sum of squares	F ratio
Between Columns	.....	SSC=.....	MSC	.....
Between Rows	k-1	SSR	MSR	.....
Errors	.....	SSE	MSE=.....	
Total	hk-1	TSS		

Total No. of Questions : 7]

SEAT No. : ____

PD3782

[Total No. of Pages : 2

[6489]-43

M.Sc. - II (Industrial Mathematics with Computer Applications)

MATHEMATICS

MIM - 403 : Design and Analysis of Algorithms

(2019 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) ***Figures to the right indicate full marks.***
4) ***Scientific calculators and statistical tables are allowed.***

Q1) Solve any five out of seven. **[10]**

a) What is the Time and Space Complexity of an algorithm?

b) Define Asymptotic notation Big theta.

c) What is Convex Hull?

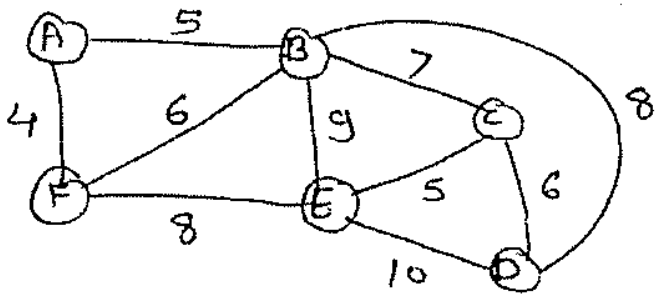
d) Show that $5n^2 + 4n = O(n^2)$.

e) Give time complexity of quicksort in worst case and average case.

f) Define fractional knapsack problem.

g) What is an algorithm? List any two properties of an algorithm.

Q2) a) Find the minimum spanning tree for following graph using Prim's and Kruskal's algorithm **[7]**



b) Explain Tree Vertex Splitting with one example. **[5]**

P.T.O.

Q3) a) Find a minimum number of multiplications required to multiply a chain of matrices; 20 ×10, 10 × 30, 30 × 5, 5 ×15 using dynamic programming.What is the best way to multiply this chain? **[7]**

b) Write a note on Quick sort performance analysis. **[5]**

Q4) a) Define Greedy method. Using greedy method find an optimal solution to the knapsack instances n=6, m=14 p=(12,7,6,20,3,4) w=(2,7,2,5,1,4)**[7]**

b) Write an algorithm to find the minimum and maximum element from a given array. **[5]**

Q5) a) Apply merge sort to sort following set {30, 192,41,38,30,58,90,6, 42}. Give time complexity of merge sort in best and worst case. **[7]**

b) Write the QuickHull Algorithm. **[5]**

Q6) a) What is the principle of optimality? Explain String editing problem with an example. **[7]**

b) Find optimal binary merge pattern for files having lengths 28, 32, 12, 5, 48, 13 and 11. **[5]**

Q7) Attempt any TWO.

a) Explain the ordering paradigm of greedy method? Using greedy method obtain a set of optimal Huffman codes for following set of frequencies a: 1, b : 1, c:2, d:3, e :5, f: 8, g:11. **[6]**

b) Give control abstraction for divide and conquer strategy. Write Binary Search Algorithm using divide and conquer strategy. **[6]**

c) Write a note on Strassen's matrix multiplication algorithm. **[6]**

Total No. of Questions : 8]

SEAT No. : ____

PD3783

[Total No. of Pages : 2

[6489]-44

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

COMPUTER SCIENCE

MIM 404 : Internet Programming

(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any five out of eight questions.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt all of the following.

a) Explain different data types supported by PHP. **[5]**

b) Write a short note on XML parsers. **[5]**

c) Write any two advantages of XML over HTML. **[2]**

d) What is natural order sorting? Explain function supported by PHP for natural order sorting with syntax & example. **[2]**

Q2) Attempt all of the following.

a) What is session? Explain various functions supported by PHP to handle session. **[5]**

b) Differentiate between GET and POST methods. **[5]**

c) How to declare class in PHP? Explain with syntax. **[2]**

d) Explain hexdoc statement supported by PHP. **[2]**

Q3) Attempt all of the following.

a) Write a short note on : Regular expressions. **[5]**

b) Explain variable parameters feature of PHP functions in detail. **[5]**

c) Explain variable interpolation with example. **[2]**

d) "XML is a replacement of HTML". State true/false. Justify. **[2]**

P.T.O.

Q4) Attempt all of the following.

a) Explain reading and writing file with suitable example, also explain modes of files. **[5]**

b) What is array? Explain its types with syntax and example. **[5]**

c) Write following function with their syntax and example. **[2]**

i) array - push ( )

ii) array - shift ( )

d) Write an anonymous function to find largest of two numbers. **[2]**

Q5) Attempt all of the following.

a) Write various string searching functions supported by PHP (any five). **[5]**

b) What is serialization? Explain with different built in functions. **[5]**

c) What is inheritance? Explain with example. **[4]**

Q6) Attempt all of the following.

a) Write a PHP script to accept 2 strings and count the occurances of first string in second string. **[5]**

b) Explain character classes in PHP. **[5]**

c) Explain following control statements with their 2 ways syntax with suitable example. **[4]**

Q7) Attempt all of the following.

a) Write a note on sticky form with suitable example. **[5]**

b) Write a PHP script to check how many times the web page accept by using cookies. **[5]**

c) Explain concept of constructor and destructor with suitable example. **[4]**

Q8) Attempt all of the following.

a) Explain following functions with syntax & example. **[5]**

i) array - slice ( )

ii) Ucwords ( )

iii) Strip taps ( )

iv) Itrim ( )

v) Implode ( )

b) Explain various functions supported by PHP to examine class. **[5]**

c) Explain array global variables. **[4]**

Total No. of Questions : 8]

SEAT No. : ____

PD3784

[Total No. of Pages : 2

[6489]-45

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

MIM - 405 : MOBILE TECHNOLOGIES

(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any Five out of Eight questions given.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn whenever necessary.***

Q1) Attempt the following questions:

a) Explain Notification with the help of example. **[5]**

b) Explain JSON Parsing with example. **[5]**

c) List Types of communication devices. **[2]**

d) What is Absolute Layout? **[2]**

Q2) Attempt the following questions;

a) Explain Async Task in detail with example. **[5]**

b) Explain working of PhoneGap. **[5]**

c) What is manifest file? **[2]**

d) List any 4 mobile operating system. **[2]**

Q3) Attempt the following questions:

a) What are services? Explain any 2 types of services with example. **[5]**

b) What are intent? Write any 3 uses of intents. **[5]**

c) What is JSON ? Write one purpose. **[2]**

d) What is Menu? List two types of Menu. **[2]**

P.T.O.

Q4) Attempt the following questions:

a) What is Toast in Android? Explain with syntax. **[5]**

b) Explain Notification with the help of example. **[5]**

c) What is a worker thread? **[2]**

d) What is Linear Layout? **[2]**

Q5) Attempt the following questions:

a) What is Android OS? Explain its architecture in detail with suitable diagram. **[5]**

b) Describe pros and cons of phoneGap. **[5]**

c) What is difference between JVM and Dalvik Virtual Machine? **[4]**

Q6) Attempt the following questions:

a) Explain Activity lifecycle in Android with diagram. **[5]**

b) Explain iOS application life cycle state with diagram. **[5]**

c) Write advantages and disadvantages of Swift. **[4]**

Q7) Attempt the following questions:

a) What is mobile computing? Explain its future and need in brief. **[5]**

b) Explain restful web services in detail. **[5]**

c) Explain any 4 iOS features. **[4]**

Q8) Attempt the following questions:

a) Explain any 5 methods for creating notifications. **[5]**

b) Explain Content Providers. **[5]**

c) Explain any 4 characteristics of swift. **[4]**

Total No. of Questions : 7]

SEAT No. :

PD3785

[Total No. of Pages : 3

[6489]-51

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

MIM-501: NUMERICAL ANALYSIS

(2019 Pattern) (Semester - V)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No. 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 calculator is allowed.***

Q1) Solve any five from the following. **[10]**

a) Define :

i) Trapezoidal Rule

ii) Simpson's $\left(\frac{3}{8}\right)^{th}$ Rule

b) Round off the number 0.005998 to three significant digits and calculate the relative error.

c) Find the root of equation $x^3 - 10x^2 + 2 = 0$ using bisection method which lies in the interval [0, 1]. (Perform 2 iterations.)

d) Find the absolute error and relative error in the approximation of $x = 3.7182596$ and $\overline{x} = 3.7182$.

e) Assume that $g(x)$ is continuous function and $\{P_n\}_{n=0}^{\infty}$ is a sequence generated by a fixed-point iteration. If $\lim_{n\to\infty} P_n = P$ then prove that 'P' is a fixed point of $g(x)$.

f) Is the following system consistent?

$$4x_1 - x_2 + 2x_3 + 3x_4 = 20$$
$$7x_3 - 4x_4 = -7$$
$$3x_3 + \frac{5}{2}x_4 = 2$$
$$2x_4 = 4$$

P.T.O.

g) Find the Jacobian matrix $J(x, y, z)$ of order 3×3 at the point $(1, 3, 2)$ for the functions.

$f_1(x, y, z) = x^3 - y^2 + y - z^4 + z^2$

$f_2(x, y, z) = xy - yz + xz$

$f_3(x, y, z) = \frac{y}{xz}$

Q2) a) Find root of equation $2x^3 - 2x - 5 = 0$ correct up to 4 decimals places using Newton Raphson method. **[7]**

b) Start with $f(x) = x^3 - A$, where A is any real number, and determine recursive formula $P_k = \frac{2P_{k-1} + \frac{A}{p_{k-1}^2}}{3}$, for $k = 1, 2, 3.....$ **[5]**

Q3) a) Assume that $g \in C[a, b]$. The range of the mapping $y = g(x)$ satisfies $a \le y \le b$ for all $a \le x \le b$ then prove that g has a fixed point in $[a, b]$. **[7]**

b) Consider the following system.

$x + y + z = 7$

$x + 2y + 2z = 13$

$x + 3y + z = 13$ (Perform 4 iterations)

Start with $p_0 = 0$ and use Gauss - Seidel iteration to find p_k $(k = 1, 2, 3)$. **[5]**

Q4) a) Use the power method to find the eigenvalue and eigenvector for the matrix $A = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$. **[7]**

b) Construct the divided difference table from the following data and hence Find $f(5)$; $f(0) = 1, f(1) = 3, f(3) = 49, f(4) = 129, f(7) = 813$. **[5]**

Q5) a) Show that the matrix $A = \begin{bmatrix} 1 & -1 & 0 \\ -1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix}$ is diagonalizable. **[7]**

b) Derive the formula $f''(x_0) \approx \frac{2f_0 - 5f_1 + 4f_2 - f_3}{\lambda^2}$ using Lagrange's Interpolation formula. **[5]**

Q6) a) Solve LY = B, UX = Y and verify that AX = B for $B^T = (-4, 10, 5)$ and A = LU where, $A = \begin{bmatrix} 2 & 4 & -6 \\ 1 & 5 & 3 \\ 1 & 3 & 2 \end{bmatrix}$; $L = \begin{bmatrix} 1 & 0 & 0 \\ ½ & 1 & 0 \\ ½ & ⅓ & 1 \end{bmatrix}$; $U = \begin{bmatrix} 2 & 4 & -6 \\ 0 & 3 & 6 \\ 0 & 0 & 3 \end{bmatrix}$ **[7]**

b) Solve $\frac{dy}{dx} = y^2 - x$, with the initial condition $y(0) = 1$. Find $y(0.1)$, $y(0.2)$ and $y(0.3)$ by Euler's method. **[5]**

Q7) a) Find the parabola $y = A + Bx + Cx^2$ that passes through the points (1, 4), (2, 7) and (3, 14). **[7]**

b) Calculate the approximate value of $\int_0^1 \frac{1}{1+x^2}\,dx$ by using Simpson's one third rule. Take $h = 0.25$. **[5]**

Total No. of Questions : 7]

SEAT No. : ____

PD3786

[Total No. of Pages : 2

[6489]-52

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

MIM-502 : COMPUTATIONAL GEOMETRY

(2019 Pattern) (Semester-V)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Attempt any FIVE questions from Q.No.2 to Q.No.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) If a 2 × 2 transformation matrix $[T]=\begin{bmatrix} 4 & 2 \\ -1 & 3 \end{bmatrix}$ is used to transform a line $y= 2x +1$, then find the equation of resulting line.

b) Obtain the transformation matrix for reflection through $X = 5$ plane.

c) Define parallel projection and perspective projection.

d) Write the transformation matrix of an isometric projection.

e) What are the types of oblique projection.

f) Find the value of $\delta\theta$ to generate 10 points on the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$.

g) Write any four properties of Be'zier Curve.

Q2) a) Prove that the transformation matrix for rotation about the origin through an angle θ is $[T]=\begin{bmatrix} \cos\theta & \sin\theta \\ -sin\theta & \cos\theta \end{bmatrix}$. **[7]**

b) Apply the following transformations on the point *P* having position vector [2 –5]. **[5]**

i) Scaling in *x* - co-ordinate by factor 3.

ii) Reflection through the line $y = x$.

iii) Shearing in *y*-direction by 5 units.

P.T.O.

Q3) a) Find the concatenated transformation matrix for reflection through the line $y=5$. Apply it on the position vector [–2 4]. **[7]**

b) Write an algorithm for the rotation about an arbitrary point. **[5]**

Q4) a) Find the concatenated transformation matrix for transformations required to make the plane $x + y + z = 0$ coincident with the $z = 0$ plane. **[7]**

b) Consider the line with direction ratios 1, 1, 1 and passing through the origin. Determine the angles through which the line should be rotated about X axis and then about Y axis so that it coincides with the Z axis. **[5]**

Q5) a) Show that the transformation matrix for oblique projection is **[7]**

$$[T] = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ -f\cos\alpha & -f\sin\alpha & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix},$$ where α is the horizontal inclination angle.

b) Obtain the transformation matrix for the trimetric projection formed by rotation about Y axis through an angle $\varphi = 45^{o}$ followed by rotation about X axis through an angle $\theta = 60^{o}$ followed by an orthographic projection on $Z = 0$ plane. Also determine principal foreshortening factors. **[5]**

Q6) a) Obtain four uniformly spaced points in the first quadrant of unit circle with centre at origin. **[7]**

b) State any Five properties of perspective transformation. **[5]**

Q7) a) If B_0 [2 1], B_1[4 4], B_2[5 3] and B_3 [5 1] are vertices of a Be'zier curve then find $P(t)$. Also find $P(0.3)$. **[6]**

b) Write an algorithm to generate n - points on parabolic segment **[6]**

$\left(x_{max} \le x \le x_{max}\right)$ of parabola $y^2 = 4ax$.

✪ ✪ ✪

Total No. of Questions : 8]

SEAT No. : ____

PD3787

[Total No. of Pages : 2

[6489]-53

M.Sc. - III (I.M.C.A.)

MIM - 503 : DATA ANALYSIS WITH PYTHON

(2019 Pattern) (Semester - V)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt any five questions out of eight.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt the following.

a) List various modes of operation to open a file? Write one example. **[5]**

b) Explain 'while' and 'for' loop control structure with example. **[5]**

c) Write What is string? Explain how subset of a string can be obtained with proper example. **[2]**

d) What is anonymous function? Explain with syntax and example. **[2]**

Q2) Attempt the following.

a) Write a note on functions used from numpy package. **[5]**

b) Explain following file built-in functions with Syntax example. **[5]**

i) Open()
ii) File()
iii) Seek ()
iv) Tell()
v) Read()

c) Define recursive function. **[2]**

d) List any two built-in math module functions. **[2]**

Q3) Attempt the following.

a) Write a short note on: Regular Expressions matching and searching function. **[5]**

b) Differentiate between list & tuple. **[5]**

c) What is meant by immutable strings. **[2]**

d) Explain indexing and slicing operation on string. Reverse string using slicing operator. **[2]**

P.T.O.

Q4) Attempt the following:

a) Write a short note on: Exception handling in Python. **[5]**

b) Write a note on command line arguments in python. **[5]**

c) Explain with syntax and example, how the add and remove from list in python **[2]**

d) Explain classes and objects in python. **[2]**

Q5) Attempt the following:

a) Explain various operation on dictionary in python. **[5]**

b) How exceptions are handled in python? Explain with examples. **[5]**

c) Write a python script to check given number is perfect or not. **[4]**

Q6) Attempt the following:

a) What are packages? Give an example of package in python. **[5]**

b) How exceptions are handled in python? Explain with examples. **[5]**

c) Write a python code to print odd number from a list.(use for and if loop). **[4]**

Q7) Attempt the following:

a) Write a note on functions used from panda's package. **[5]**

b) Define function write a syntax to define function. Write a python script using function to find greater of 2 number. **[5]**

c) What is a binary file? List its applications. **[4]**

Q8) Attempt the following:

a) Write a program in Python to return even numbers from the following list. List 1 = [3, 17,9,2,4, 8,97,43,39]. **[5]**

b) Write a note on Django Framework. **[5]**

c) Write a python script to create queue and stack. **[4]**

Total No. of Questions : 7]

SEAT No. : ____

PD3788

[Total No. of Pages : 2

[6489]-54
M.Sc. - III (IMCA)
MIM-504: DIGITAL IMAGE PROCESSING
(2019 Pattern) (Semester - V)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Solve any five questions from Q.2 to Q. 7.***
3) ***Questions 2 to 7 carry equal marks.***

Q1) Solve any five of the following. **[10]**

a) Define the terms

i) Digital Image Processing

ii) Noise

b) Give the equation of discrete Fourier Transform.

c) What is image histogram?

d) Mention the general approach for operating image in the linear transform Domain.

e) State any two main types of high pass filtering.

f) What is line detection in digital image processing?

Q2) Answer the following:

a) What is adjacency? Explain 4, 8 and m - adjacency with their conditions. For $v = \{1\}$ determine whether the two subsets are 4-adjacent, 8-adjacent and *m*-adjacent. **[7]**

S_1 S_2

0 0 0 0 0 0 0 1 1 0

1 0 0 1 0 0 1 0 0 1

1 0 0 1 0 1 1 0 0 0

0 0 1 1 1 0 0 0 0 0

0 0 1 1 1 0 0 1 1 1

b) What are the applications of digital image processing? **[5]**

P.T.O.

Q3) Attempt the following:

a) Explain Hit-or-Miss Transformation in details. **[7]**

b) Explain the terms with equations. **[5]**

i) Geometric mean filter

ii) Harmonic mean filter

Q4) Attempt the following:

a) Draw histogram & give P(s) (S_k) for each S_k. **[7]**

r_k	n_k
r = 0	790
r_1 = 1	1023
r_2 = 2	850
r_3 = 3	656
r_4 = 4	329
r_5 = 5	245
r_6 = 6	122
r_7 = 7	81

b) Mention any four types of grey level transformation. **[5]**

Q5) Attempt the following:

a) Give the objective of image restoration and reconstruction process. Explain any two noise model. **[7]**

b) Write a short note on image enhancement. **[5]**

Q6) Attempt the following:

a) What is edge detection? Explain edge detection technique of segmentation. **[7]**

b) Discuss image sharpening in the frequency domain. **[5]**

Q7) Write short notes on any two of the following: **[12]**

a) Methods of image representation.

b) Regional Descriptors.

c) Components of digital image processing.

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Total No. of Questions : 5]

SEAT No. :

PD3789

[Total No. of Pages : 1

[6489]-55
Third Year M.Sc. (IMCA)
MIM-506 : CRYPTOGRAPHY AND NETWORK SECURITY
(2019 Pattern) (Semester - V)

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) What is the function of a digital signature?

b) What frequency bands are used in Wi-Fi?

c) What is the difference between half-duplex and full-duplex Ethernet?

d) What is the primary function of the ATM Adaptation Layer (AAL)?

e) What is the main purpose of the UDP protocol?

f) What is the purpose of ADSL in networking?

g) What is mean by authentication?

Q2) a) Describe the components of a Bluetooth communication system. **[5]**

b) Describe the working of firewalls in network security. **[5]**

Q3) a) Discuss the importance of the ATM Adaptation Layer (AAL). **[5]**

b) Compare IPv4 and lPv6 header formats. **[5]**

Q4) a) Describe how LAN switching improves network efficiency. **[5]**

b) Discuss the challenges in implementing high-speed packet-switching networks. **[5]**

Q5) a) Compare DSL and ADSL in terms of bandwidth and connectivity. **[5]**

b) What are the benefits of using QoS in high-speed networks? **[5]**

Total No. of Questions : 5]

SEAT No. : ____

PD3790

[Total No. of Pages : 2

[6489]-56
T.Y.M.Sc. (Industrial Mathematics with Computer Applications)
MIM-507 : INTERNET OF THINGS
(2019 Pattern) (Semester - V)

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) ***Neat diagrams must be drawn whenever necessary.***

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

a) What is internet of things?

b) Mention any 2 IoT key features.

c) What is the full form of RFID?

d) What is Internet? Internet is owned by whom?

e) What do you mean by Interoperability?

f) Define the term H2M Communication.

g) Mention any 2 key IoT technologies.

Q2) Attempt the following questions:

a) Explain the IOT Components. **[5]**

b) Explain the Advantages and Disadvantages of RFID. **[5]**

P.T.O.

Q3) Attempt the following questions:

a) Explain WSN architecture. **[5]**

b) Explain applications of IoT in e-Health. **[5]**

Q4) Attempt the following questions:

a) Explain the 5 Layer Architecture of IoT with neat diagram. **[5]**

b) Explain application of IoT in agriculture field. **[5]**

Q5) Attempt the following questions:

a) Explain the concept of Scalability in detail. **[5]**

b) Differentiate between EPC and RFID. **[5]**

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