

Total No. of Questions : 8]

SEAT No. :

**P2693**

[Total No. of Pages : 3

[5039]-101

**M.Sc.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER**

**APPLICATIONS**

**MIM-101 : Real Analysis**

**(2013 Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Unless specified,  $\mathbb{R}^n$  is assumed to have usual metric for all  $n \geq 1$ .*

**Q1)** a) Prove that a set  $E$  of a metric space is open if and only if its complement is closed. **[4]**

b) If  $F$  is a closed subset and  $K$  is a compact subset of a metric space  $M$  then prove that  $F \cap K$  is compact. **[3]**

c) Let  $\{P_n\}_{n=1}^{\infty}$  be a sequence in a metric space  $X$ . Prove that if  $\{P_n\}$  is convergent then it is bounded. **[3]**

**Q2)** a) If  $\{P_n\}$  is a sequence in a compact metric space  $X$ , then prove that some subsequence of  $\{P_n\}$  converges to a point of  $X$ . **[4]**

b) Prove that the convergence of  $\{S_n\}$  implies convergence of  $\{|S_n|\}$ . Is converse true? **[3]**

c) If  $P > 0$  then prove that  $\lim_{n \rightarrow \infty} \frac{1}{n^P} = 0$ . **[3]**

**P.T.O.**

- Q3)** a) Prove that closed subset of a compact set is closed. [4]
- b) If  $X$  is a metric space and  $E \subseteq X$ , then prove that  $E = \bar{E}$  if and only if  $E$  is closed. [4]
- c) Construct a bounded set of real numbers with exactly three limit points. [2]
- Q4)** a) If  $S_1 = \sqrt{2}$  and  $S_{n+1} = \sqrt{2 + \sqrt{S_n}}$ ,  $n = 1, 2, 3, \dots$  then prove that  $\{S_n\}$  is convergent. [4]
- b) Prove that the series  $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^p}$  is convergent if  $p > 1$ . [4]
- c) Find the radius of convergence of  $\sum n^n z^n$ , where  $z$  is a complex number. [2]
- Q5)** a) If  $f$  is a continuous mapping of a metric space  $X$  into a metric space  $Y$  and  $E$  is a connected subset of  $X$  then prove that  $f(E)$  is connected. [5]
- b) Let  $f(x) = |x|^3$ . Compute  $f'(0)$  if it exists. [3]
- c) Let  $f$  be defined on  $[a, b]$ . If  $f$  is differentiable at a point  $x \in [a, b]$  then prove that  $f$  is continuous at  $x$ . [2]
- Q6)** a) 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 prove that  $f'(x) = 0$ . [5]
- b) If  $c_0 + \frac{c_1}{2} + \dots + \frac{c_{n-1}}{n} + \frac{c_n}{n+1} = 0$  where  $c_0, c_1, \dots, c_n$  are real constants prove that the equation  $c_0 + c_1x + c_2x^2 + \dots + c_{n-1}x^{n-1} + c_nx^n = 0$  has at least one real root between 0 and 1. [3]

c) Let  $f$  be defined by

$$f(x) = \begin{cases} x \sin \frac{1}{x} & (x \neq 0) \\ 0 & (x = 0) \end{cases}$$

Prove that  $f'(0)$  does not exist. [2]

**Q7) a)** Suppose  $f$  be a bounded real function defined on  $[a, b]$ . Prove that  $f \in \mathbb{R}(\alpha)$  if and only if for every  $\epsilon > 0$  there exists a partition  $P$  such that  $U(P, f, \alpha) - L(P, f, \alpha) < \epsilon$ . [5]

b) i) If  $f \in \mathbb{R}(\alpha)$  and  $g \in \mathbb{R}(\alpha)$  on  $[a, b]$  then prove that  $fg \in \mathbb{R}(\alpha)$  on  $[a, b]$  then prove that  $fg \in \mathbb{R}(\alpha)$ .

ii) Let  $f$  be defined on  $[a, b]$  as follows

$$\begin{aligned} f(x) &= 0 && \text{if } x \text{ is irrational} \\ &= 1 && \text{if } x \text{ is rational} \end{aligned}$$

Prove that  $f$  is not Riemann integrable on  $[a, b]$

[5]

**Q8) a)** Let  $f_n(x) = n^2 x(1-x^2)^n, 0 \leq x \leq 1, n = 1, 2, 3, \dots$ . [5]

i) Find  $\lim_{n \rightarrow \infty} f_n(x)$ .

ii) Show that  $\lim_{n \rightarrow \infty} \int_0^1 f_n(x) dx \neq \int_0^1 \left[ \lim_{n \rightarrow \infty} f_n(x) \right] dx$ .

b) Suppose  $\{f_n\}$  converges  $f$  uniformly on a set  $E$  in a metric space. Let  $x$  be a limit point of  $E$  and suppose that  $\lim_{t \rightarrow x} f_n(t) = A_n, n = 1, 2, \dots$ . Then prove that  $\{A_n\}$  is convergent and  $\lim_{t \rightarrow x} f(t) = \lim_{n \rightarrow \infty} A_n$ . [5]



Total No. of Questions :8]

SEAT No. :

**P2694**

**[5039]-102**

[Total No. of Pages :3

**M.Sc.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-102: Linear Algebra and Computational Geometry**

**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non programmable scientific calculator is allowed.*

**Q1) a)** Define inner product space. **[2]**

b) Let  $V = \mathbb{R}^3$ , the vector space of ordered triple of real numbers. If  $W = \{(x, y, z) \in \mathbb{R}^3 \mid 2x + 3y + 4z = 0\}$ , show that W is a subspace of V. **[4]**

c) Determine whether the set of vectors  $\vec{v}_1 = (2, 1, 0, 3)$ ,  $\vec{v}_2 = (3, -1, 5, 2)$  and  $\vec{v}_3 = (-1, 0, 2, 1)$  is independent. **[4]**

**Q2) a)** Prove that the intersection of any two subspaces  $W_1$  &  $W_2$  of a vector space V is also a subspace of V. **[4]**

b) If a vector space V has a basis of  $n$  vectors, then prove that every basis of V must consist of exactly  $n$  vectors. **[4]**

c) State Cayley Hamilton theorem. **[2]**

**P.T.O.**

- Q3)** a) Let  $T : \mathbb{R}^2 \rightarrow \mathbb{R}^3$  be defined by  $T(x, y) = (x, x + y, y)$ . Find the range and kernel of T. [4]
- b) Find the eigen values and eigen vectors of the matrix  $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ . [4]
- c) Let  $\mathbb{R}^4$  have the Euclidean inner product. Find the cosine of the angle between the vectors  $\vec{u} = (-1, 2, 3, 4)$  and  $\vec{v} = (4, 1, 2, 1)$ . [2]
- Q4)** a) State and prove the Rank Nullity theorem. [5]
- b) State and prove Cauchy-Schwarz Inequality. [5]
- Q5)** a) Suppose a  $2 \times 2$  transformation matrix  $[T] = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$  is used to transform the line segment PQ to the line segment P\*Q\*. If slope of the line segment PQ is m, then prove that the slope of the line segment P\*Q\* is  $m^* = \frac{b + dm}{a + cm}$ . [4]
- b) Find the concatenated transformation matrix for the following: first shearing in x and y directions, respectively by  $-2.4$  and  $1.1$  units followed by a rotation about the origin through an angle  $20^\circ$ . Apply this on to the point P $[-1, 3]$ . [4]
- c) If the transformation matrix  $[T] = \begin{bmatrix} 2 & -1 \\ -2 & 1 \end{bmatrix}$  is used to transform the intersecting lines  $x + 2y = 2$  and  $x - y = 4$ , then find the point of intersection of the transformed lines. [2]
- Q6)** a) Describe an algorithm to rotate an object through an angle  $\theta$ , about the local axis passing through a point A. [4]
- b) Consider the line with direction ratios  $1, -2, 2$  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. [4]
- c) Determine if the transformation  $[T] = \begin{bmatrix} -3/5 & 4/5 \\ -4/5 & -3/5 \end{bmatrix}$  is a solid body transformation. [2]

- Q7)** a) Determine the four diametric projections, if a foreshortening factor along the Z-axis is  $\frac{1}{3}$ . [4]
- b) An object is translated by 2, 3, 4 units along X, Y and Z axis respectively and then a single point perspective projection on the plane  $Z = 0$  from the centre of projection on Z axis at  $Z_c = 50$  is performed. Obtain the concatenated matrix of transformation. [4]
- c) State any two properties of Bezier curves. [2]
- Q8)** a) Describe an algorithm to generate 36 uniformly spaced points on the circle  $(x - 2)^2 + (y - 2)^2 = 25$ . [5]
- b) Find the parametric equation of the Bezier curve for the control points  $B_0[2, 1]$ ,  $B_1[4, 4]$ ,  $B_2[5, 3]$  and  $B_3[5, 1]$ . Calculate the position vector of the points on the curve for parameter values  $t = 0.1$  and  $t = 0.2$ . [5]

*EEE*

Total No. of Questions :8]

SEAT No. :

P2695

[5039]-103

[Total No. of Pages :4

M.Sc.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-103: Discrete Mathematical Structures -I

(2013 Pattern) (Semester - I)

Time : 3 Hours]

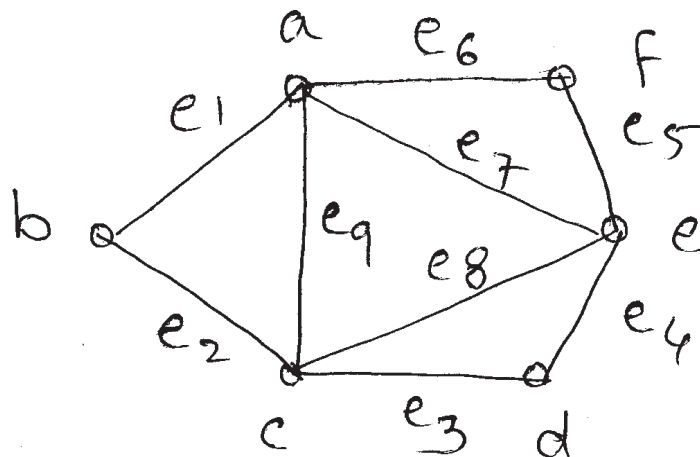
[Max. Marks :50

Instructions to the candidates:

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

Q1) a) Prove that every tree on  $n$  vertices has  $n - 1$  edges. [5]

b) Using Fleury's algorithm, find Euler line in following graph G. [5]



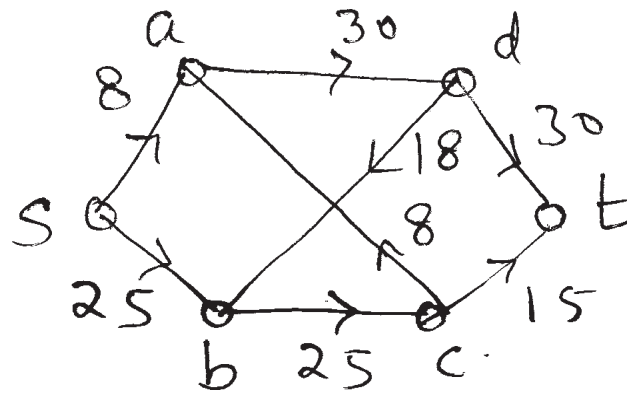
Q2) a) Test the validity of the following argument. [5]

If it rains then I carry an umbrella. If it shines then I do not need a sweater. Either it rains or it shines. I do need a sweater. Hence I carry an umbrella.

b) State and prove Euler's theorem for planar graphs. [5]

P.T.O.

Q3) a) Find the maximum flow using Ford Fulkerson algorithm. [5]



b) How many integers between 1 and 1000 are divisible by 2 or 5 or 7. [3]

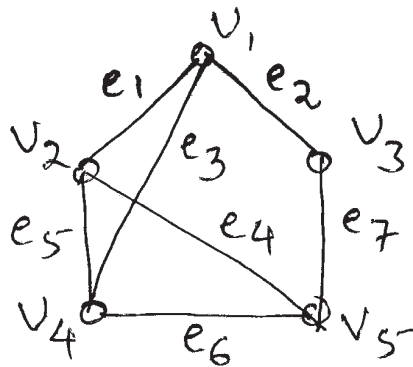
c) Define: [2]

Isolated vertex,

Pendant vertex.

Q4) a) Prove that a graph is bipartite if and only if all circuits of G are of even length. [5]

b) Find the incidence and adjacency matrix for the following graph. [3]

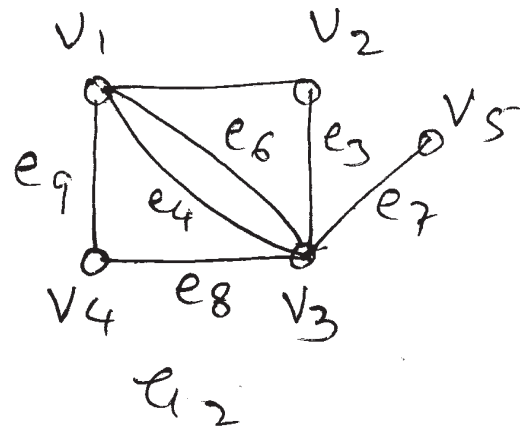
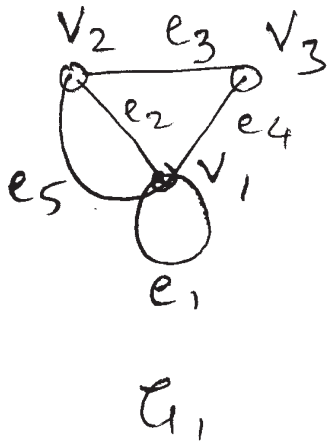


c) Prove that  $(p \rightarrow q) \wedge p$  logically imply  $q$ . [2]

Q5) a) If G is a self complementary graph on  $n$  vertices. Prove that  $n$  is of the type  $4K$  or  $4K + 1$  for some integer 'K'. [4]



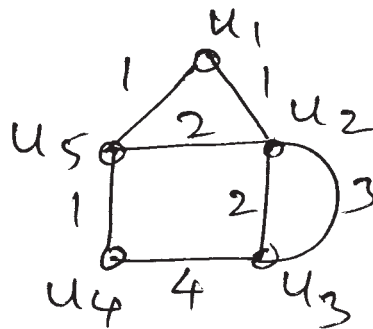
- b) Find  $G_1 \cup G_2$  and  $G_1 \oplus G_2$  for the following graphs  $G_1$  and  $G_2$ . [4]



- c) Define: Arborescence and complete symmetric digraph. [2]

- Q6) a) Prove that if  $G$  is a simple graph with  $n$  vertices and  $m$  edges and  $k$  components then  $m \leq \frac{(n-k)(n-k+1)}{2}$ . [5]

- b) Using Kruskal's algorithm find minimum spanning tree for following weighted graph  $G$ . [3]

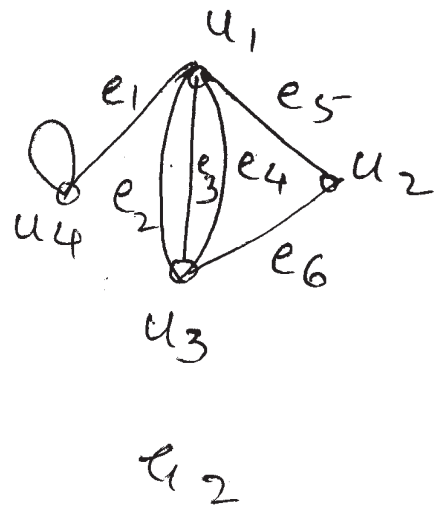
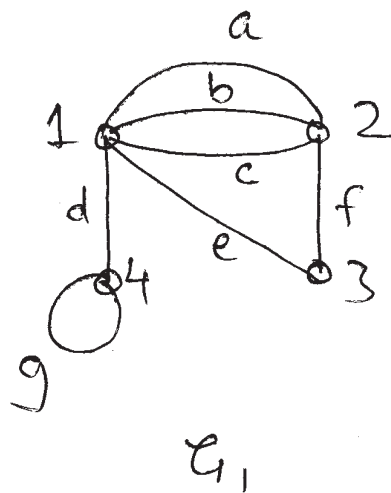


- c) Write down negation of following: [2]

i)  $\forall x, (x^2 > 0)$

ii)  $\exists x, (x \cdot 2 = 1)$

Q7) a) Show that following 2 graphs are isomorphic. [5]



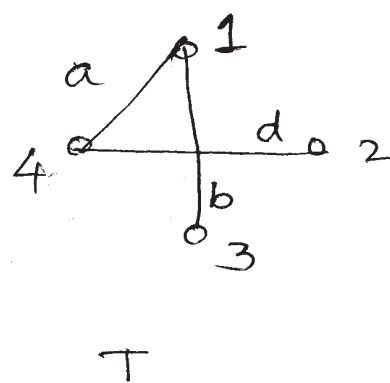
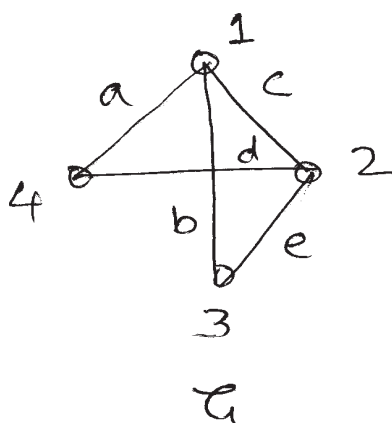
b) Give direct proof for  $p \rightarrow r, \sim q \rightarrow p, \sim r \vdash q$ . [3]

c) State Pigeonhole principle. Give one example. [2]

Q8) a) Prove that  $G$  is an Euler graph if and only if all vertices are of even degree. [4]

b) Write down Dijkstra's algorithm for finding shortest path from source to destination. [4]

c) Find all fundamental circuits of following graph  $G$  with respect to  $T$ . [2]



EEE

Total No. of Questions :8]

SEAT No. :

**P2696**

**[5039]-104**

[Total No. of Pages :3

**M.Sc. Tech. - I**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-104: 'C' Programming  
(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Answer the following:

**[4+4+2=10]**

- a) What is a file? State any four operations on file.
- b) Write a C program to print 'n' terms of Fibonacci series using recursion  
1, 1, 2, 3, 5, 8.
- c) Give any two rules to declare variable.

**Q2)** Answer the following:

**[4+4+2=10]**

- a) Write different standard library functions accept string from the user.
- b) Write the difference between while and do-while loop.
- c) Justify the output:

```
#include <stdio.h>

main ( )
{
static int a[] = {10, 20, 30};
static int * mess [ ] = {a, a + 1, a + 2};
printf(“%d%d”, size of (a), size of(mess),
size of (mess[1]));
}
```

**P.T.O.**

**Q3)** Answer the following: **[4+4+2=10]**

- a) Explain the difference between structure and union.
- b) Write a program to accept the string and count the occurrence of character in a string using pointer and function.
- c) What is DMA? Give syntax and use of malloc ( ) function.

**Q4)** Answer the following: **[4+4+2=10]**

- a) Define array. How to declare an array. What are different types of array? Give suitable example.
- b) What is the difference between if-Else and switch statement.
- c) What are command Line Argument?  
Give any one advantage of command line argument

**Q5)** Answer the following: **[4+4+2=10]**

- a) Explain increment and decrement operator in C.
- b) Write a note on storage classes.
- c) State True /False and justify “C is middle level language”.

**Q6)** Answer the following: **[4+4+2=10]**

- a) What are different operations that can be performed on pointers?
- b) Write a program to store information of player (name, no\_of\_inning, total\_score, avg). Calculate the average score for each player and display information of all players.

c) Write the output of the following:

- i) 

```
# define square (x) x * x;
main ()
{
printf (“\n%d”, square (4 + 2));
}
```
- ii) 

```
main ()
{
int a = 5;
do
{
printf (“%d”, a);
a = -1;
} while (a > 0);
}
```

**Q7)** Answer the following:

**[5+5=10]**

- a) Explain:
  - i) Passing pointer to function
  - ii) Function returning pointer
- b) Write a program to accept the number and find sum of digit of a number till it reduces to a single digit number [961 → 16 → 7].

**Q8)** Answer the following:

**[5+5=10]**

- a) Explain:
  - i) Call by value
  - ii) Call by reference
- b) Write a program to accept 'n' integer store them in an array and print reverse of an array.

*EEE*

Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

**P2697**

**[5039]-105**

**M.Sc. (Tech.)**

**INDUSTRIAL MATHEMATIC WITH COMPUTER APPLICATIONS**

**MIM-105: Elements of Information Technology (Part- I)**

**(2013 Pattern) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Attempt the following:

- a) Explain working of plotters. **[4]**
- b) Convert following numbers to decimal **[4]**
  - i)  $(2A3B)_{16}$
  - ii)  $(110110)_2$
- c) What is Cache memory. **[2]**

**Q2)** Attempt the following:

- a) Explain physical devices used to construct memory. **[4]**
- b) Discuss processor to memory communication. **[4]**
- c) Define ROM. State different types of ROM. **[2]**

**Q3)** Attempt the following:

- a) Explain concept of Information Technology. Discuss any four applications of IT. **[4]**
- b) Write a short note on ASCII code. **[4]**
- c) List out different input devices. **[2]**

**P.T.O.**

**Q4)** Attempt the following:

- a) Discuss any two types of processors in detail. [4]
- b) With the help of suitable diagram  
Explain: How data is organized on magnetic hard disk. [4]
- c) Solve:  $(216)_{10} = (?)_2$ . [2]

**Q5)** Attempt the following:

- a) Discuss with necessary diagram: OCR. [4]
- b) Explain any 4 types of registers used in memory. [4]
- c) What is binary system for data representation? [2]

**Q6)** Attempt the following:

- a) What is memory cell? List and explain properties of memory cell. [5]
- b) What are different types of printer? Explain any one in detail. [5]

**Q7)** Attempt the following:

- a) With the neat diagram explain the operation of VDU. [5]
- b) Give comparison between magnetic and optical storage devices. Explain one device for optical storage type. [5]

**Q8)** Attempt the following:

- a) Solve:
  - i)  $(F A B)_{16} = (?)_8$  [3]
  - ii)  $(10110001100)_2 = (?)_{16}$  [2]
- b) With neat labelled diagram explain basic structure of computer. [5]



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SEAT No. :

**P2698**

**[5039]-201**

[Total No. of Pages :2

**M.Sc.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-201: Complex Analysis**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1) a)** State and prove Cauchy-residue theorem. **[4]**

b) Show that  $u(x, y) = \sinh x \sin y$  is harmonic in some domain and find a harmonic conjugate  $v(x, y)$  of  $u$ . **[4]**

c) Evaluate  $\int_C \frac{z+2}{z} dz$ , where  $C$  is the semicircle  $z = 2e^{i\theta}$  ( $0 \leq \theta \leq \pi$ ). **[2]**

**Q2) a)** Evaluate  $\int_C \frac{1}{z^2 + 4} dz$ , where  $C$  is the circle  $|z - i| = 2$  in the positive sense. **[4]**

b) Find all values of  $z$  such that  $e^z = -2$ . **[4]**

c) State Cauchy - Riemann equations in polar form. **[2]**

**Q3) a)** Prove that the real and imaginary parts of an analytic function  $f(z) = u + iv$  are harmonic functions. **[4]**

b) Give two Laurent series expansion in powers of  $z$  for the function  $f(z) = \frac{1}{z^2(1-z)}$  and specify the regions in which those expansions are valid. **[4]**

c) Show that  $f(z) = |z|^2$  is not differentiable at  $z = 1 + 2i$ . **[2]**

**P.T.O.**



- Q4)** a) Prove that when a limit of a function  $f(z)$  exists at a point  $z_0$ , it is unique. [4]  
 b) Prove that a composition of continuous functions is itself continuous. [4]  
 c) Sketch the following set and determine whether it is a domain in the complex plane.  $S = \{z \in \mathbb{C} \mid |z + 3| > 4\}$ . [2]

- Q5)** a) State and prove Taylor's theorem. [5]  
 b) State and prove the fundamental theorem of algebra. [5]

- Q6)** a) State and prove Liouville's theorem. [5]  
 b) Let  $f$  be analytic everywhere inside and on a simple closed contour  $C$ , taken in the positive sense. If  $z_0$  is any point inside to  $C$ , then prove that

$$f(z_0) = \frac{1}{2\pi i} \int_C \frac{f(z)}{z - z_0} dz. \quad [5]$$

- Q7)** a) Evaluate the integral  $\int_0^{\infty} \frac{x^2}{x^6 + 1} dx$ . [5]

- b) Find the residue of the function  $f(z) = \frac{\tanh z}{z^2}$  at a simple pole  $z = \frac{\pi i}{2}$ . [3]  
 c) State Cauchy-Goursat theorem. [2]

- Q8)** a) Let  $C$  be the unit circle  $z = e^{i\theta}$  ( $-\pi \leq \theta \leq \pi$ ). First show that, for any real constant  $a$ ,  $\int_C \frac{e^{az}}{z} dz = 2\pi i$ . Then write the integral in terms of  $\theta$  to

derive the integration formula  $\int_0^{\pi} e^{a \cos \theta} \cos(a \sin \theta) d\theta = \pi$ . [5]

- b) Let  $C$  be the arc of the circle  $|z| = 2$  from  $z = 2$  to  $z = 2i$ ; that lies in the first quadrant. Without evaluating the integral, show that [3]

$$\left| \int_C \frac{dz}{z^2 - 1} \right| \leq \frac{\pi}{3}.$$

- c) Define essential singularity. Also give an example of essential singularity. [2]



Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

**P2699**

**[5039]-202**

**M.Sc. (IMCA)**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**Mathematics**

**MIM-202: Algebra- I**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

- Q1)** a) Define order of an element in a group G. [2]
- b) State and prove Lagrange theorem for finite groups. [4]
- c) Let G be a group and H a non empty subset of G. Prove that H is a subgroup of G if  $ab^{-1}$  is in H whenever  $a$  &  $b$  are in H. [4]
- Q2)** a) Is union of two subgroups a subgroup? Justify. [2]
- b) Let  $G = \langle a \rangle$  be a cyclic group of order  $n$ . Prove that  $G = \langle a^k \rangle$  if and only if  $\gcd(k, n) = 1$ . [4]
- c) Prove that if H has index 2 in G, then H is normal in G. [4]
- Q3)** a) Give an example of a non cyclic group, all of whose proper subgroups are cyclic. [2]
- b) Let  $\langle a \rangle = 30$ . How many left cosets of  $\langle a^4 \rangle$  in  $\langle a \rangle$  are there? List them. [4]
- c) Define transposition. Also prove that  $A_n$  is a subgroup of  $S_n$ . [4]
- Q4)** a) State and prove Cayley's theorem. [5]
- b) Let G be a group and let  $Z(G)$  be the center of G. If  $G/Z(G)$  is cyclic, then prove that G is abelian. [5]

**P.T.O.**

- Q5)** a) State and prove the First Isomorphism theorem for rings. [5]  
 b) Prove that  $R/A$  is a field if and only if  $A$  is maximal. [5]
- Q6)** a) Prove that the characteristic of an integral domain is 0 or a prime. [4]  
 b) Show that every non zero element of  $\mathbb{Z}_n$  is a unit or a zero divisor. [4]  
 c) Define simple group. [2]
- Q7)** a) Define prime ideal of a ring  $R$ . [2]  
 b) Let  $\mathbb{Z}[\sqrt{2}] = \{a + b\sqrt{2} \mid a, b \in \mathbb{Z}\}$ . Prove that  $\mathbb{Z}[\sqrt{2}]$  is a ring under the ordinary addition and multiplication of real numbers. [4]  
 c) Prove that a finite integral domain is a field. [4]
- Q8)** a) Define divisors of zero in a ring  $R$ . [2]  
 b) Prove that if  $D$  is an integral domain, then  $D[x]$  is an integral domain. [4]  
 c) For any prime  $P$ , prove that the  $P^{\text{th}}$  cyclotomic polynomial  $\phi_p(x) = x^{p-1} + x^{p-2} + \dots + x + 1$  is irreducible over  $\mathbb{Q}$ . [4]

*EEE*

Total No. of Questions :8]

SEAT No. :

**P2700**

**[5039]-203**

[Total No. of Pages :3

**M.Sc.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-203: Numerical analysis**

**(2013 Pattern) (Credit System) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five of the following.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non-programmable scientific calculator is allowed.*

**Q1)** Attempt the following:

- a) Use false position method to determine the roots of the equation  $e^{-x} - x = 0$ . Two initial guess values being  $x_0 = 0$  and  $x_1 = 1$ .

Compute first TWO iterations. **[4]**

- 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  $k = 1, 2, \dots$  **[4]**

- c) Find a root of equation ' $x^3 - x - 4 = 0$ ' using bisection method which lies in  $[1, 2]$  correct upto 2 - places of decimal. **[2]**

**Q2)** Attempt the following:

- a) Obtain the Newton - Raphson formula to find the root of the equation  $f(x) = 0$ . **[4]**

- b) Construct the difference table from the following data to obtain  $f(50.5)$ ;  
 $f(50) = 39.1961$ ,  $f(51) = 39.7981$ ,  $f(52) = 40.3942$ ,  $f(53) = 40.9843$   
 $f(54) = 41.5687$  **[4]**

- c) Discuss ill conditioned system. **[2]**

**P.T.O.**

**Q3)** Attempt the following:

- a) Assume that  $f \in C^3[a,b]$  and that  $x-h, x, x+h \in [a,b]$ . Prove that

$$f'(x) \approx \frac{f(x+h) - f(x-h)}{2h}. \quad [4]$$

- b) State and prove 'Composite Trapezoidal Rule'. [4]

- c) Find fixed point if any of  $g(x) = -4 + 4x - \frac{x^2}{2}$ . [2]

**Q4)** Attempt the following:

- a) Use numerical differentiation formula

$$f''(x) = \frac{f(x+h) - 2f(x) + f(x-h)}{h^2}$$

to approximate '  $f(x) = \cos(x)$  ' at  $x = 0.8$ , with  $h = 0.01$ . Compare your result with the true value of  $f''(0.8)$ . [4]

- b) From the following data, find  $\sqrt{1.1}$  using Lagrange's interpolation. Determine the accuracy of interpolation. [4]

$x$	1	1.2	1.3	1.4
$\sqrt{x}$	1	1.095	1.140	1.183

- c) Find the absolute error and relative error in the approximation of [2]

$$x = 2.71828182 \text{ by}$$

$$\bar{x} = 2.7182$$

**Q5)** Attempt the following:

- a) Find the parabola  $y = A + Bx + Cx^2$  that passes through the three points (1, 1), (2, -1), (3, 1). [4]

- b) Find the Jacobian matrix  $J(x, y, z)$  of order  $3 \times 3$  at the point (1, 3, 3) for the three functions. [4]

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

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

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

- c) State Simpson's  $\frac{3}{8}$  rule. [2]

**Q6)** Attempt the following:

a) Using Euler's method, obtain the solution of  $y' = x - y$ , given:  
 $x_0 = 0, y_0 = 1$  at  $x = 0.6$  by taking step size  $h = 0.2$ . [4]

b) Solve the following system of linear equations using Gauss seidel iterative method. [Perform 2 - iterations]. [4]

$$9x_1 + 2x_2 + 4x_3 = 20$$

$$2x_1 - 4x_2 + 10x_3 = -15$$

$$x_1 + 10x_2 + 4x_3 = 6$$

c) Let  $\lambda, v$  be an eigen pair of a matrix  $A$ . If  $\alpha$  is any constant, show that  $\lambda - \alpha, v$  is an eigen pair of matrix  $A - \alpha I$ . [2]

**Q7)** Attempt the following:

a) Derive Newton's Forward difference formula. [5]

b) Using Modified Euler's method, solve the following differential equation,

$$y' = 1 + xy \text{ with } y = 1 \text{ at } x = 0. \text{ Find value of } y \text{ at } x = 0.1. [5]$$

**Q8)** Attempt the following:

a) Use Runge - Kutta method of fourth order to solve the initial value problem  $y' = x + y$  when  $y = 1$  at  $x = 0$ .

Find solution for  $x = 0.1$ . [5]

b) Solve the following system of linear equations using L-U decomposition. [5]

$$3x + 2y + 4z = 7$$

$$2x + y + z = 7$$

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



Total No. of Questions :8]

SEAT No. :

P2701

[5039]-204

[Total No. of Pages :3

M.Sc.(Tech.)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204 : C++

(2013 Pattern) (Credit System) (Semester-II)

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Attempt the following:

- a) Write a note on polymorphism. [4]
- b) Explain the following with example.
  - i) Parameterized constructors
  - ii) Constructors with default parameters. [4]
- c) What does 'this' pointer points to ? [2]

**Q2)** Attempt the following:

- a) Write a note on Exception Handling. [4]
- b) Explain any two types of Inheritance. [4]
- c) State True/False.
  - i) A file pointer always contains the address of a file.
  - ii) A pointer to a base class cannot be made to point to objects of derived class. [2]

**Q3)** Attempt the following:

- a) What do you mean by friend function? Give syntax to declare friend function. What are the features of the friend function? [4]
- b) Explain the concepts of objects and classes. [4]
- c) Define the following
  - i) Identifiers
  - ii) Keywords [2]

**P.T.O.**

**Q4)** Attempt the following:

- a) What do you mean by Inline function? Differentiate between Inline function and macro? [4]
- b) Write a note on operator overloading. [4]
- c) What do you mean by pure virtual function? [2]

**Q5)** Attempt the following:

- a) Explain the two ways of passing objects as function arguments. [4]
- b) Write a note on structure of C++ program. [4]
- c) What do you mean by destructors? [2]

**Q6)** Attempt the following:

- a) State any four benefits of OOP. [4]
- b) Identify errors if any
  - i) 

```
# include (iostream-h)
Void main ( )
{
    int num[]={1,2,3,4,5,6};
    num [1] = = [1]num? cout <<"Success": Cout <<" Error";
}

```
  - ii) 

```
# include (iostream.h)
# include ( malloc-h)
char * allocatmemory ( );
Void main ( )
{
    char * str;
    str=allocatmemory ( );
    cout << str;
    delete str,
    str = " ";
    cout << str;
}
char * allocatmemory ( )
{
    str = " Memory allocation test,";
    return str;
}

```
  - iii) Char \* CP = Vp; [4]
- c) Explain access rights in derived class for public, private and protected inheritance. [2]



**Q7)** Attempt the following:

- a) State any five rules for Virtual Function [5]
- b) Write a C++ program that reads a text file and creates another file that is identical except that every sequence of consecutive blank spaces is replaced by a single space. [5]

**Q8)** Attempt the following:

- a) What is generic programming? How it is implemented in C++? [5]
- b) Write a C++ program to add two matrices. [5]



Total No. of Questions :8]

SEAT No. :

**P2702**

**[5039]-205**

[Total No. of Pages :2

**M.Sc.Tech. (Part-I)**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-205:Data Structures Using C.**

**(2013 Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Attempt all of the following

- a) Explain linear and non-linear data structures with suitable examples. [4]
- b) Write a short note on: Array as ADT. [4]
- c) Define linked list. Explain the node structure. [2]

**Q2)** Attempt all of the following

- a) Write a function to add a node at the beginning of a singly linked list.[4]
- b) Write a short note on: Binary search method. [4]
- c) What is the best case and worst case complexity of insertion sort. [2]

**Q3)** Attempt all of the following

- a) Give the postfix and prefix forms of the infix expression given below.[4]
  - i)  $(a+b*c) / (x+y/z)$
  - ii)  $A/B \wedge C+D * E-A*C$
- b) Explain how stack is used in recursion? [4]
- c) Define [2]
  - i) Priority Queue.
  - ii) Double ended Quene.

**Q4)** Attempt all of the following

- a) Write a function for adding and deleting elements from a circular queue.[4]
- b) Construct a binary search tree for the following. [4]  
11, 7, 15, 25, 18, 5, 12, 20,
- c) Write any two applications of trees. [2]

**P.T.O.**

**Q5)** Attempt all of the following

- a) Write a C function to check whether two singly linked lists of integers are equal. [4]
- b) Compare the data structures: Stack and Quene. [4]
- c) Represent the following array in terms of Binary tree. [2]

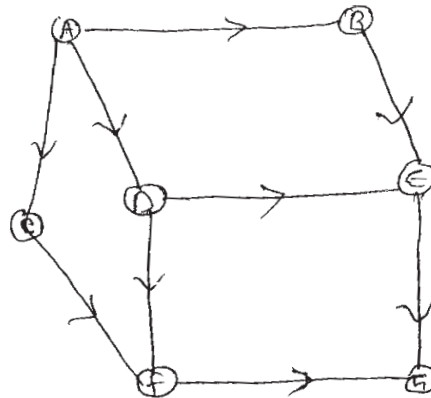
A	B	C		D	E		F	
0	1	2	3	4	5	6	7	8

**Q6)** Attempt all of the following

- a) Write a 'C' program to accept two sorted lists and print merging of these two lists. [5]
- b) Write an algorithm to implement depth first search (DFS) [5]

**Q7)** Attempt all of the following

- a) Consider the following graph



Traverse the graph using DFS and BFS. [4]

- b) Discuss inorder and preorder traversal techniques with example. [4]
- c) Define : [2]
  - i) Right skewed binary tree.
  - ii) Left skewed binary tree.

- Q8)**
- a) Explain static implementation of binary tree using arrays. Give its disadvantages. [5]
  - b) Write a note on doubly linked list. [5]



Total No. of Questions :8]

P2703

SEAT No. :

[Total No. of Pages :2

[5039]-301

M.Sc.

MATHEMATICS

Industrial Mathematics With Computer Applications

MIM-301: Topology

(2013 Pattern) (Semester-III)

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicates full marks.*

**Q1)** a) Let  $X$  be a non-empty set and  $\tau_c$  be the collection of subsets  $U$  of  $X$  such that  $X-U$  either is countable or is all of  $X$ . Is  $\tau_c$  a topology on  $X$ ? Justify. [4]

b) Show that the lower limit topology on  $\mathbb{R}$  is strictly finer than the standard topology on  $\mathbb{R}$ . [4]

c) Describe finite complement topology on a finite set. [2]

**Q2)** a) Let  $Y$  be a subspace of  $X$ . Let  $A$  be a subset of  $Y$ . Let  $\bar{A}$  denote the closure of  $A$  in  $X$ . Show that the closure of  $A$  in  $Y$  equals  $\bar{A} \cap Y$ . [4]

b) Let  $X$  and  $Y$  be topological spaces. If  $A$  is a subspace of  $X$  and  $B$  is a subspace of  $Y$ , then prove that product topology on  $A \times B$  is the same as the topology  $A \times B$  inherits as a subspace of  $X \times Y$ . [4]

c) Let  $g: \mathbb{R} \rightarrow \mathbb{R}_c$  be the identity map. Is  $g$  continuous? Justify.  
( Here  $\mathbb{R}$  and  $\mathbb{R}_c$  denotes set of real numbers with standard topology and lower limit topology respectively.) [2]

**Q3)** a) Show that any simply ordered set  $X$  with order topology is a Hausdorff space. [4]

b) Find the boundary and the interior of the subset  $A = \{(x,y) \mid x > 0 \text{ and } y > 0\}$  of  $\mathbb{R}^2$ . [4]

c) Let  $X = \{a,b,c\}$  and  $S = \{\{a,b\}, \{b,c\}\}$ .  
Find the topology generated by the subbasis  $S$ . [2]

*P.T.O.*

- Q4)** a) Prove that every second countable space is first countable. [4]  
 b) Show that a product of Lindelöf spaces need not be Lindelöf. [4]  
 c) Give an example of a topological space which is not separable. [2]
- Q5)** a) Prove that a subspace of a regular space is regular. [4]  
 b) Show that the space  $\mathbb{R}_1$  is normal. [4]  
 c) Define completely regular space. [2]
- Q6)** a) Let  $f: X \rightarrow Y$  be a bijective continuous function. If  $X$  is a compact space and  $Y$  is a Hausdorff space, then prove that  $f$  is a homeomorphism. [4]  
 b) Show that the set  $S = \left\{ x \times \sin\left(\frac{1}{x}\right) \mid 0 < x \leq 1 \right\}$  is connected. [4]  
 c) Define Locally connected space. [2]
- Q7)** a) Prove that every path connected space is connected but not conversely. [5]  
 b) Prove that a compact subspace of a Hausdorff space is closed. [5]
- Q8)** a) Show that a space  $X$  is Hausdorff if and only if the diagonal  $\Delta = \{x \times x \mid x \in X\}$  is closed in  $X \times X$ . [5]  
 b) Let  $f, g : X \rightarrow Y$  be continuous functions and  $Y$  is a Hausdorff space. Show that the set  $\{x \in X \mid f(x) = g(x)\}$  is closed in  $X$ . [5]



Total No. of Questions :12]

SEAT No. :

P2704

[5039]-302

[Total No. of Pages :3

M.Sc.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM 302 : Design and Analysis of Algorithms

(2013 Pattern) (Semester-III)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

1) Attempt any five questions out of eight.

Q1) a) Write down dijkstra's algorithm to find shortest path from source to destination. [5]

b) Rank following functions in their increasing order of growth rates.  
 $4^n, n^n, 30n^2, 2n, 10gn^2,$  [5]

Q2) a) What is Huffman codings? Construct Huffman coding tree for following table. [5]

Character	a	b	c	d	e	f
Frequency in thousands	45	13	12	16	9	5

b) Write an algorithm for matrix chain multiplication problem. [5]

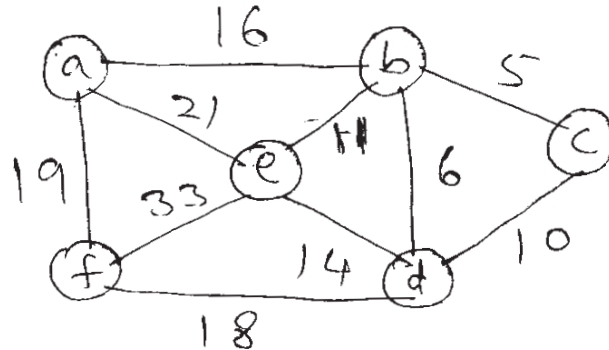
Q3) a) What is topological sorting? Give an algorithm for topological sort. [5]

b) Apply merge sort to sort the following set  
{ 20, 121, 4, 3, 9, 320, 10, 51} [3]

c) Show that  $5n^2 + 4n \in O(n^2)$  [2]

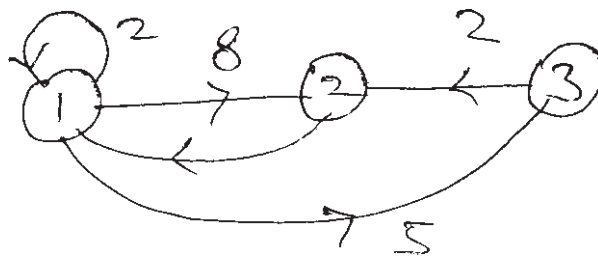
P.T.O.

- Q4)** a) What is Heap property? Write an algorithm to sort given array using Heapsort. [5]  
 b) Using kruskal's algorithm find minimum spanning tree for following graph. [3]



- c) State "Principle of optimality". [2]

- Q5)** a) Find all pairs shortest path using ford war shall algorithm for following directed graph. [5]



- b) Write a note on polynomial time verification. [3]  
 c) What is time complexity of quick sort algorithm? [2]

- Q6)** a) Write an note on "Greedy algorithm" [5]  
 b) Explain "NP completeness" [3]  
 c) What are growth functions? [2]

- Q7)** a) Explain “Depth First search” (D.F.S.) Write an algorithm for D.F.S. [5]  
b) What is longest common subsequence problem? [3]  
c) Explain: Reducibility in NP complete problem. [2]
- Q8)** a) Write prims algorithm for finding minimum spanning tree. [5]  
b) Sort following array using quick sort technique. [3]  
{65, 70, 75, 80, 85 60 55, 50, 45}  
c) What are different types of heap? [2]





Total No. of Questions :8]

SEAT No. :

**P2705**

**[5039]-303**

[Total No. of Pages :2

**M.Sc. (IMCA)**

**COMPUTER SCIENCE**

**MIM 303: Object Oriented Software Engineering  
(2013 Pattern) (Semester-III)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever applicable.*

**Q1)** Attempt all questions.

- a) Explain spiral development process model. [4]
- b) Write a note on socio technical systems. [4]
- c) Define system dependability. [2]

**Q2)** Attempt all questions.

- a) Explain functional and non-functional requirements in software requirements. [4]
- b) What are the key aspects of behavioral model? [4]
- c) Give any two key challenges facing software engineering. [2]

**Q3)** Attempt all questions.

- a) Explain briefly the four main phases of requirements engineering process. [4]
- b) Consider an Automatic water level control system, which is used for controlling the water flow. Identify the different states and draw a state transition diagram. [4]
- c) Define critical systems. [2]

**Q4)** Attempt all questions.

- a) Explain verification and validation. [4]
- b) Explain briefly the Agile principles. [4]
- c) Define : [2]
  - i) Fat client
  - ii) Thin client

**P.T.O.**

**Q5)** Attempt all questions.

- a) Write a short note on distributed object Architecture. [4]
- b) Briefly explain the stages of object oriented design. [4]
- c) Write two advantages of inspection over testing. [2]

**Q6)** Attempt all questions.

- a) Consider a system for processing results of the students. The student fills in the examination form giving details about subject and centre etc, which is an input to the system. Student pay examination fees and is given a fee receipt and the admit card. Examination is conducted at various centers. Centres provide the absentee report. The evaluation department provides marks of the students in each subject. The marksheet and the merit list are the outputs of the system. Draw a Data flow diagram for the above description. [4]
- b) Prepare a class diagram showing at least 6 relationship amongst the following classes. Include associations, aggregation and generalization. Show multiplicity. Also add at least two attributes to each class.  
Classes: Play ground, school, Principal, classroom, student, book, teacher, schoolboard, computer, desk, chair, door. [4]
- c) List the attributes of a good software. [2]

**Q7)** Attempt all questions.

- a) Write a note on integration testing. [5]
- b) Explain the various relationships supported in Unified Modeling Language(UML). [5]

**Q8)** Attempt all questions.

- a) Explain Rapid Application development. [5]
- b) Explain the Waterfall model. [5]



Total No. of Questions :8]

SEAT No. :

**P2706**

**[5039]-304**

[Total No. of Pages :3

**M.Sc.(Tech)**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-304 : Operating Systems**

**(2013 Pattern) (Semester-III)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Attempt the following.

- a) Write a note on PCB. **[5]**
- b) Write a note on caching. **[3]**
- c) Define the terms: User thread and kernel thread. **[2]**

**Q2)** Attempt following.

- a) How many page faults occur using OPT page replacement algorithm and FIFO page replacement algorithm for the following page reference string with five page frames? 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1 **[5]**
- b) A system has three processes ( $P_1, P_2, P_3$ ) and three reusable resources ( $R_1, R_2, R_3$ ). There is one instance of  $R_1$ , two instances of  $R_2$  and three instances of  $R_3$ .  $P_1$  holds an  $R_1$  and  $R_3$  and is requesting an  $R_2$ .  $P_2$  holds an  $R_3$  and is requesting an  $R_1$  and an  $R_2$ .  $P_3$  holds two  $R_2$  and an  $R_3$  and is requesting an  $R_1$  **[3]**
  - i) Draw the resource allocation graph for this situation.
  - ii) Write all the cycle (s) in the graph
  - iii) Does a deadlock exist? Why?
- c) Define wait ( ) and signal ( ) atomic operations of semaphore access. **[2]**

**Q3)** Attempt the following.

- a) Write a note on Readers writers, problem. **[5]**
- b) What is system call? Explain use of any two system call. **[3]**
- c) Explain the working of SCAN algorithm. **[2]**

**P.T.O.**

**Q4)** Attempt the following.

- a) Explain process state diagram. [5]  
 b) Consider the following snapshot of a system. [3]

Job	Arrival Time	Burst Time
J1	2	2
J2	0	3
J3	1	7
J4	3	2

Calculate Average turnaround time and average waiting time using SJF (Preemptive) CPU Scheduling algorithm.

- c) What is race condition? How to guard against race condition? [2]

**Q5)** Attempt the following.

- a) Write a note on Bounded-Buffer problem. [5]  
 b) Write a note on demand Paging. [3]  
 c) What is interrupt? [2]

**Q6)** Attempt the following.

- a) Suppose that a disk drive have 200 cylinders, numbered 0 to 199. The drive is currently serving at cylinder 67, and the pending request queue is : 86, 64, 14, 16, 122, 124, 180, and 90. 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?  
 i) FCFS [5]  
 ii) SCAN  
 b) Write a note on virtual Memory [5]

**Q7)** Attempt the following.

- a) Given the following state for the Banker's Algorithm.  
 • 5 processes  $P_0$  through  $P_4$   
 • 3 resource types A (6 instances), B (9 instances) and C (5 instances)  
 • Snapshot at time  $T_0$ :

	<i>Max</i>	<i>Allocation</i>
	<i>A B C</i>	<i>A B C</i>
$P_0$	6 7 3	1 1 1
$P_1$	2 2 2	1 1 2
$P_2$	2 6 3	0 3 0
$P_3$	2 2 2	2 1 1
$P_4$	4 6 3	1 1 1

- 1) Calculate the available vector [1]
- 2) Calculate the Need matrix [1]
- 3) Given the request (1, 2, 0) from Process  $P_2$ . Should this request be granted? Why or why not? Show your computation step-by step [3]
- b) What is deadlock? Explain deadlock prevention. [5]

**Q8)** Attempt the following.

- a) Explain different scheduler used for process scheduling. [5]
- b) Discuss the concept of internal and external fragmentation with diagram. [3]
- c) Write a difference between process and thread. [2]



Total No. of Questions :8]

SEAT No. :

P2707

[5039]-305

[Total No. of Pages :3

M.Sc.(Tech)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-305 : Database Fundamentals

(2013 Pattern) (Credit System) (Semester-III)

Time : 3 Hours]

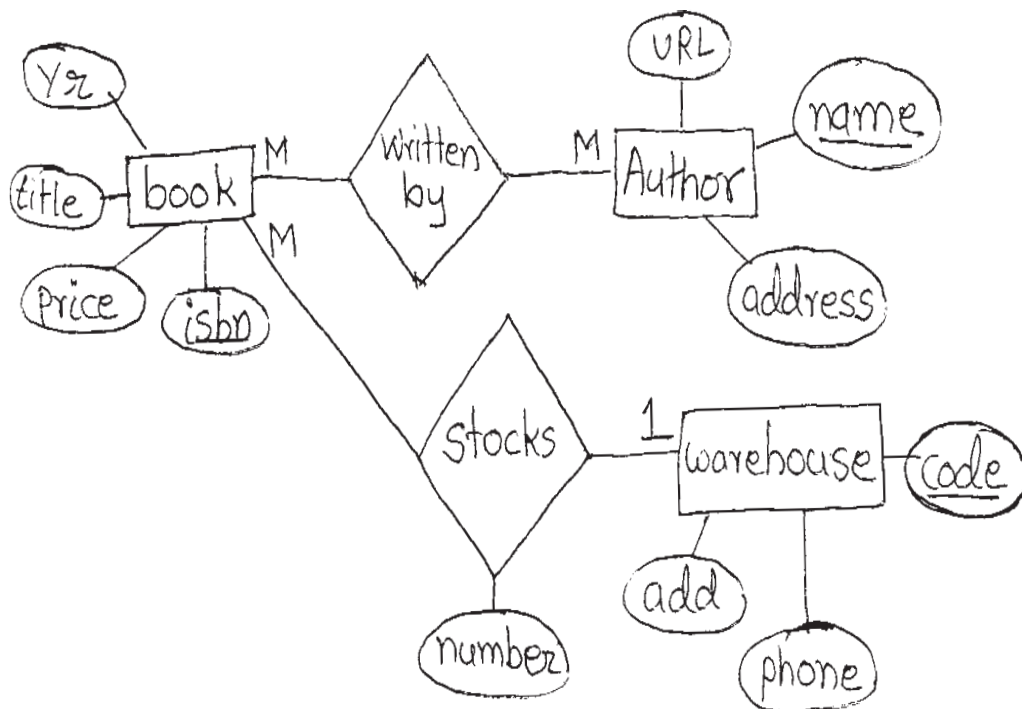
[Max. Marks :50

Instructions to the candidates:

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

Q1) Attempt the following.

- a) Convert the following E-R model to corresponding Relational model.



[4]

b) State four transaction properties and explain them.

[4]

c) What is the difference between data and information?

[2]

P.T.O.

**Q2)** Attempt the following.

- a) Consider following database  
Person (driver-id, name, address)  
Car (license, model, year)  
accident (report-no, data, location)  
owns(driver-id, license)  
Participated (driver-id, car report-no, damage-amt)  
Give expression in SQL query for
- i) Find the person name who has participated in accident with minimum damage amount.
  - ii) Find the person name and car model involved in accident held at 'pune' location. **[4]**
- b) consider the database from Q.2) a) and give expressions in relational algebra for.
- i) Find the total number of people who owned cars that were involved in accident in 1989
  - ii) Find the number of accidents in which the cars belonging to 'John smith' were involved. **[4]**
- c) Consider Relation schema R(A,B,C,G,H,I) and set  $F = \{A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H\}$  of functional dependencies on R. Check (AG) is candidate key or not? **[2]**

**Q3)** Attempt the following.

- a) Explain the concept of lossless- join decomposition. **[4]**
- b) Explain : Two phase locking protocol. **[4]**
- c) Define: Triggers. **[2]**

**Q4)** Attempt the following.

- a) Write a note on conflict serializability. **[4]**
- b) Explain any two RAID levels. **[4]**
- c) State: Boyce-codd normal form (BCNF) **[2]**

**Q5)** Attempt the following.

- a) State any four functions of DBMS. **[4]**
- b) What do you mean by redundant functional dependency? Consider relation schema R(A, B, C, D) and set  $F = \{A \rightarrow B, B \rightarrow C, AD \rightarrow C\}$  Check whether  $AD \rightarrow C$  is redundant or not. **[4]**
- c) What is the basic structure of SQL query? **[2]**

**Q6)** Attempt the following.

- a) Explain following deadlock prevention schemes.
  - i) Wait-die scheme
  - ii) Wound-wait scheme. **[4]**
- b) Write a note on primary and secondary storage devices. **[4]**
- c) What do you mean by complete schedule? **[2]**

**Q7)** Attempt the following.

- a) What are different stages of transaction? **[5]**
- b) Write a note on multiple granularity **[5]**

**Q8)** Attempt the following.

- a) Write a note on structure of a DBMS. **[5]**
- b) Define the following.
  - i) Disruptive Attribute.
  - ii) Data Dictionary.
  - iii) Exclusive-lock.
  - iv) Normalization.
  - v) Logical-data independence





Total No. of Questions :8]

SEAT No. :

P2708

[5039]-401

[Total No. of Pages :3

M.Sc.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-401 : Differential Equations

(2013 Pattern)(Semester-IV)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any five questions.
- 2) Figures to the right indicate full marks.

**Q1)** a) Show that if  $y_1$  and  $y_2$  are two solutions of  $y'' + P(x)y' + Q(x)y = 0$  on  $[a, b]$  then they are linearly dependent on this interval if and only if the Wronskian  $W(y_1, y_2) = y_1 y_2' - y_2 y_1'$  is identically zero. [4]

b) Verify that  $\log(1+x) = x F(1, 1, 2, -x)$  where  $F(a, b, c, x)$  denotes the hypergeometric function. [4]

c) Find the general solution to the differential equation  $y'' - 3y' + 2y = 0$  [2]

**Q2)** a) Discuss the nature of the point  $x=0$  for each of the following equations.

i)  $y'' + (\sin x)y = 0$

ii)  $x^3 y'' + (\sin x)y = 0$  [4]

b) Let  $y(x)$  be a nontrivial solution of  $y'' + q(x)y = 0$  on a closed interval  $[a, b]$  where  $q(x)$  is a positive function. Then prove that  $y(x)$  has at most finite number of zeros on the interval  $[a, b]$ . [4]

c) Find the general solution to the system of equations given by

$$\frac{dx}{dt} = 4x - 2y$$

$$\frac{dy}{dt} = 5x + 2y. \quad [2]$$

P.T.O.

**Q3) a)** Find the general solution to the Euler's equation  $x^2 y'' + 2xy' - 6y = 0$  using the change of the independent variable given by the transform  $x = e^z$  [4]

b) Let  $u(x)$  be any non trivial solution  $u'' + q(x)u = 0$  where  $q(x) > 0$  for all

$x > 0$ . If  $\int_1^{\infty} q(x) dx = \infty$  then prove that  $u(x)$  has infinitely many zeros on positive X axis. [4]

c) Determine whether the function is positive definite, negative definite or neither. [2]

**Q4) a)** Find the critical points of the differential equations given by

$$\frac{d^2x}{dt^2} + \frac{dx}{dt} - (x^3 + x^2 - 2x) = 0 \quad [4]$$

b) Find the indicial equation and its roots for the differential equation given by [4]

$$x^3 y'' + (\cos 2x - 1) y' + 2xy = 0$$

c) State Picard's theorem. [2]

**Q5) a)** Determine the nature and the stability of critical point (0,0) for the system of equations given by [4]

$$\frac{dx}{dt} = -2xy, \frac{dy}{dt} = x^2 - y^3$$

b) Find the general solution to the system of equations given by

$$\frac{dx}{dt} = x + y$$

$$\frac{dy}{dt} = 4x - 2y \quad [4]$$

c) Use the Geometric series expansion to show that log

$$(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots \quad [2]$$

**Q6) a)** Show that the function  $f(x,y) = y^{1/2}$  [4]

i) does not satisfy a Lipschitz condition on the rectangle  $|x| \leq 1$  and  $0 \leq y \leq 1$ .

ii) does satisfy the Lipschitz condition on the rectangle  $|x| \leq 1$  and  $c \leq y \leq d$  where  $0 < c < d$ .

- b) Determine the nature and stability properties of the critical point (0,0) for the linear autonomous system given by

$$\frac{dx}{dt} = -4x - 2y$$

$$\frac{dy}{dt} = x - 2y \quad [4]$$

- c) Show that  $x=2e^{4t}$ ,  $y=3e^{4t}$  and  $x=e^{-t}$ ,  $y=-e^{-t}$  are solutions to the homogeneous system [2]

$$\frac{dx}{dt} = x + 2y$$

$$\frac{dy}{dt} = 3x + 2y$$

- Q7)** a) Use method of undetermined co-efficients to find the general solution of the equation  $y''-2y'+5y=25x^2+12$  [5]  
 b) Verify that  $y_1=x$  is a solution to the equation  $x^2y''+xy'-y=0$ . Hence find the general solution to the differential equation. [5]
- Q8)** a) Write a short note on Volterra's prey predator problem. [5]  
 b) Find the roots of the indicial equation to the differential equation  $2x^2y''+x(2x+1)y'-y=0$  [5]



Total No. of Questions :8]

P2709

SEAT No. :

[Total No. of Pages :2

[5039]-402

M.Sc.

MATHEMATICS

Industrial Mathematics With Computer Applications

MIM-402 : Coding Theory

(2013 Pattern) (Semester-IV)

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

- Q1)** a) Prove that a code  $C$  is  $u$ -error detecting if and only if  $d(C) \geq u+1$ . [5]  
b) Let  $C$  be a linear code and let  $H$  be a Parity check matrix for  $C$ . Prove that  $C$  has distance  $\geq d$  if and only if any  $d-1$  columns of  $H$  are linearly independent. [5]
- Q2)** a) Define distance of a code. Find the distance of the code  $C=\{0000, 0011,0101,0010\}$ . [2]  
b) For the binary code  $C= \{01101, 00011, 10110, 11000\}$ , use NND rule to decode the received word 01111, where NND denotes nearest neighbour decoding. [4]  
c) Construct the Incomplete maximum likelihood decoding table for the binary code  $C=\{101,111,011\}$ . [4]
- Q3)** a) Define self dual code. Show that the code  $C=\{0000, 1010, 0101,1111\}$  is self dual. [4]  
b) Discuss the main coding theory problem. [4]  
c) Show that  $f(x)= 1+2x+x^3$  is irreducible over  $\mathbb{F}_3$ . [2]
- Q4)** a) Find all the cyclotomic cosets of 2 modulo 15. [2]  
b) What is maximum likelihood decoding? Explain. [4]

*P.T.O.*

- c) Find the dimension of a narrow sense 4-ary BCH code of length 63 with designed distance 3. [4]

**Q5) a)** Prove that each monic divisor of  $x^n-1$  is the generator polynomial of some cyclic code in  $\mathbb{F}_q^n$ . [4]

b) State and prove sphere- packing bound. [4]

c) Let  $C$  be a  $[n,k,d]$  linear code and  $H$  be a parity check matrix for  $C$ . Let  $u,v \in \mathbb{F}_q$ . Prove that  $S(u+v) = S(u)+S(v)$ , where  $S(w)$  denote syndrome of the word  $w$ . [2]

**Q6) a)** Let  $\alpha$  be a root of  $2+x+x^2 \in \mathbb{F}_3[x]$ . Obtain the minimal polynomial of  $\alpha^2$ . [4]

b) Prove that a non-zero element  $r$  of  $\mathbb{F}_p$  is a non- zero quadratic residue modulo  $p$ , if and only if  $r \equiv a^2 \pmod{p}$  for some  $a \in \mathbb{F}_p^*$ . [4]

c) If the code  $S=\{000, 012, 201\}$  a cyclic code? Justify. [2]

**Q7) a)** Consider a Hamming code of length 7 with a parity check matrix

$$H = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix} \quad [4]$$

Construct a syndrome look up table. Hence use it to decode  $W=1001001$ .

b) For a linear code  $C$  over  $\mathbb{F}_q$ , prove that  $d(C) = wt(C)$ . [2]

c) Factorize  $X^7-1$  over  $\mathbb{F}_2$ . [4]

**Q8) a)** Let  $\pi$  be a linear map defined by  $\pi : \mathbb{F}_q^n \rightarrow \mathbb{F}_q[x]/(x^n-1)$  as

$\pi(a_0, \dots, a_{n-1}) = a_0 + a_1x + \dots + a_{n-1}x^{n-1}$ . Prove that a non-empty subset  $C$  of  $\mathbb{F}_q^n$  is a cyclic code if and only if  $\pi(C)$  is an ideal of  $\mathbb{F}_q[x]/(x^n-1)$ . [5]

b) What is generator matrix  $G$  and parity matrix  $H$  for a 7-ary Reed Solomon code of length 6 with generator polynomial  $g(x) = 6+x+3x^2+x^3$ . [5]



Total No. of Questions :8]

SEAT No. :

P2710

[5039]-403

[Total No. of Pages :2

M.Sc.(Tech)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-403 : Computer Networks

(2013 Pattern) (Credit System) (Semester-IV)

Time : 3 Hours]

[Max. Marks :50

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) Write a note on parallel transmission. [4]
- b) What is the remainder obtained by dividing  $x^7+x^5+1$  by the generator polynomial  $x^3+1$ ? [4]
- c) Discuss various functions of network layer. [2]

**Q2)** Attempt the following:

- a) Write a note on Go-Back-N protocol. [4]
- b) Explain the following terms: [4]
  - i) Continuous time.
  - ii) Slotted time.
  - iii) Carrier sense.
  - iv) No carrier sense.
- c) Find the error, if any, in the following IPv4 addresses. [2]
  - i) 111.56.045.78
  - ii) 221.34.7.8.20
  - iii) 75.45.301.14
  - iv) 111.20.20.2

**Q3)** Attempt the following:

- a) Discuss various steps involved in an ARP process. [4]
- b) Explain sequence number, Acknowledgement number fields of TCP segment header. [4]
- c) What is the role of packet filtering router and application gateway in Firewall? [2]

**P.T.O.**

**Q4)** Attempt the following:

- a) Explain any two persistence methods of CSMA. [4]
- b) Write a note on Flag bytes with byte stuffing. [4]
- c) Match the following. [2]

SIDE A

- 1) Physical layer
- 2) Transport layer
- 3) Session layer
- 4) Presentation layer

SIDE B

- a) Dialog control
- b) Encryption
- c) Transmission mode
- d) Service-point address

Write correct match.

**Q5)** Attempt the following:

- a) Write a note on piconet and Scatterednet architecture. [4]
- b) Explain multimode step-index fiber and multimode graded-index fiber. [4]
- c) Write a note on organization of the layers in OSI reference model. [2]

**Q6)** Attempt the following:

- a) Write a note on Reservation, controlled access method. [4]
- b) Encode the bit patteen-11000110011 using RZ and Manchester line coding scheme. [4]
- c) Explain single bit error and burst error using suitable diagram. [2]

**Q7)** Attempt the following:

- a) Write a note on virtual private network. [5]
- b) Explain "inner product of two equal sequences " and "inner product of two different sequences" properties of orthogonal sequences in CDMA. [5]

**Q8)** Attempt the following:

- a) Explain different transport service primitives. [5]
- b) Compare virtual circuit and Datagram subnets. [5]



Total No. of Questions : 8]

SEAT No. :

**P2711**

**[5039]-404**

[Total No. of Pages : 2

**M.Sc. Tech.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM - 404 : Programming in PHP**

**(2013 Pattern) (Semester - IV)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** What is associative array? What is the way to loop over elements of an array? Explain with proper example. **[5]**

b) Accept file name and directory name from user. Change the directory and delete given file. If file is not present given proper error message. **[5]**

**Q2) a)** Explain constructor and destructor with suitable example. **[4]**

b) Explain following string searching functions: **[4]**

i) Strpos ( )

ii) Stristr

iii) Strrchr ( )

iv) Strchr

c) Will comparison of string "15" and integer 15 work in PHP. Which operator allows such comparison? **[2]**

**Q3) a)** Write PHP script to check whether given string is palindrome or not. **[4]**

b) Explain different datatypes available in PHP. **[4]**

c) How to define multiline strings in PHP? **[2]**

**Q4) a)** What is regular expression? Explain with suitable example. **[4]**

b) Write PHP script to read the contents of table customer (cust\_no, cust\_name) from database. Show all the records in tabular form. **[4]**

c) Find output **[2]**

```
< ? php
```

```
for ( $ i = 3; $ i <= 4; $ i ++)
```

```
echo "PHP is case sensitive".
```

```
? >
```

**P.T.O.**



- Q5)** a) Explain Anonymous function? Write an anonymous function to find largest of 2 numbers. [5]  
 b) Write PHP script to create a form that accepts two strings compare these 2 strings and display message on submit button click. [5]
- Q6)** a) Explain XML document structure. [4]  
 b) `<? php`  
`if (! print (" I love PHP"))`  
`echo "cannot print"; $ name = "Rohan"`  
`print "My name is", $ name. "I love PHP";`  
`?>`. Write output of above code. [2]  
 c) Write short note on cookies. [4]
- Q7)** a) Explain different functions available in PHP to extract values from the array. [4]  
 b) What is the output of following code?  
`<? php`  
`$ str = "I love PHP";`  
`$ strarray = split (" ", $ str);`  
`print_r ($ strarray);`  
`?>` [2]  
 c) Explain various techniques used to maintain state in PHP. [4]
- Q8)** a) Explain the use of interfaces with example. [4]  
 b) Explain any four introspective functions. [4]  
 c) What is difference between GET & POST method? [2]



Total No. of Questions : 8]

SEAT No. :

**P2712**

**[5039]-405**

[Total No. of Pages : 2

**M.Sc. Tech.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM - 405 : Java Programming**

**(2013 Pattern) (Credit System)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Attempt the following:

- a) Explain any four components of AWT. [4]
- b) Write a short note on Resultsets. [4]
- c) What is the difference between a JDK & JVM? [2]

**Q2)** Attempt the following:

- a) Describe in brief various access specifiers in Java. [4]
- b) Differentiate between checked exceptions and unchecked exceptions. [4]
- c) What is constructor chaining & how is it achieved in Java? [2]

**Q3)** Attempt the following:

- a) What is the purpose of toString ( ) method? Give suitable example. [4]
- b) Define the following:
  - i) Final class
  - ii) Bytecode
  - iii) Super Keyword
  - iv) Throw [4]
- c) What is the difference between inner class and nested class? [2]

**Q4)** Attempt the following:

- a) Differentiate between ArrayList & linked list. [4]
- b) Write a short note on Event Delegation model. Draw a suitable diagram. [4]
- c) To print "Hello" even before main ( ) is executed. How to achieve this? [2]

**P.T.O.**

**Q5)** Attempt the following:

- a) What are Java Packages? What is the significance of packages? [4]
- b) Explain in brief command line Arguments in Java? Give a code as an example. [4]
- c) Answer the following:
  - i) Which object oriented concept is achieved by using overloading and overriding? [1]
  - ii) What modifiers are allowed for methods in an interface? [1]

**Q6)** Attempt the following:

- a) Write a short note on wrapper classes in Java. [4]
- b) Differentiate between AWT and swing. [4]
- c) Answer the following:
  - i) What value does read return when it has reached end of a file? [1]
  - ii) Does a class inherit the constructors of its superclass? State Yes/No? [1]

**Q7)** Attempt the following:

- a) Write a Java program to accept details of a person name, address, age, Throw the exception if
  - i) Age is less than zero. "Negative not allowed".
  - ii) Age is between zero to eighteen "You are minor". [5]
- b) Create a GUI based program containing List box, Text box and Label. List any 5 city names in the list box. when any name in the list box will be selected, show its reverse in the text box. [5]

**Q8)** Attempt the following:

- a) Write a program to establish a connection to the database using JDBC-ODBC bridge and create a table student with fields studno, studname, Address. Insert records into student table and fetch all the records from the table. [5]
- b) Write a program to create a collection of ArrayList. Add elements in that collection. Traverse the collection using Iterator. [5]

**x x x**

Total No. of Questions :8]

SEAT No. :

P2713

[Total No. of Pages :4

[5039] - 501

M.Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 501: Digital Image Processing

(2013 Pattern) (Credit System) (Semester - V)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any FIVE questions of the following:
- 2) Figures to the right indicate full marks.
- 3) Use of non-scientific/non - programmable calculator is allowed.

Q1) Attempt the following:

- a) Define the following terms: [4]
  - i) Noise
  - ii) Luminance
  - iii) Radiance
  - iv) Saturation
- b) Explain the method of image acquisition using a single sensor. [3]
- c) Consider the image segment shown below.

Let  $V = \{2, 3, 4\}$ , compute the lengths of shortest 4 - path and 8 - path between 'p' and 'q'. If a particular path does not exist between these two points, explain why. [3]

	3	4	1	2	0
	0	1	0	4	2 = (q)
I:	2	2	3	1	4
(p) =	3	0	4	2	1
	1	2	0	3	4

P.T.O.

**Q2)** Attempt the following:

- a) Why do we process images? Explain with suitable examples. [4]
- b) Consider two image subsets,  $S_1$  and  $S_2$  shown in the following figure. For  $V = \{1\}$ , determine whether these two subsets are
  - i) 4 - adjacent
  - ii) 8 - adjacent

0	0	0	0	0	0	0	1	1	0	[3]
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	
$\underbrace{\hspace{10em}}_{S_1}$				$\underbrace{\hspace{10em}}_{S_2}$						

- c) Write a note on Image Negative. [3]

**Q3)** Attempt the following:

- a) Consider a 3 - bit image ( $L = 8$ ) of size  $64 \times 64$ , has intensity distribution shown in the following table. [4]
  - Draw: i) Histogram for 3 - bit image
  - ii) Equalized histogram.

$r_k$ : Intensity	$n_k$ : No. of Pixels
$r_0 = 0$	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) If all the pixels in an image are shuffled, will there be any change in histogram? [3]
- c) Obtain the convolution and correlation of the 1 - D image 'I' with the filter 'W'. [3]

I : 0 0 1 0 0 0 0

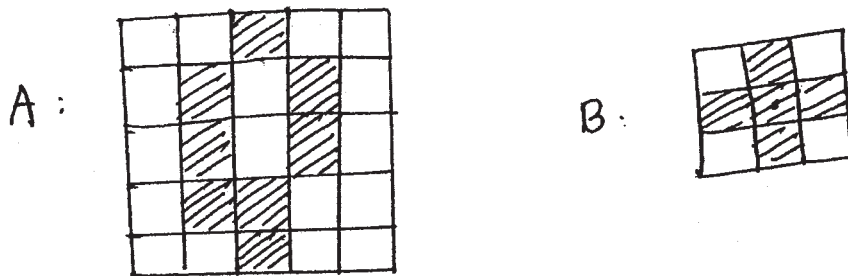
W : 1 2 3 1

**Q4)** Attempt the following:

- a) Explain unsharp masking and high boost filtering with suitable example. [4]
- b) Explain the following terms: [3]
  - i) Unit impulse
  - ii) Aliasing
- c) Explain coding Redundency. [3]

**Q5)** Attempt the following:

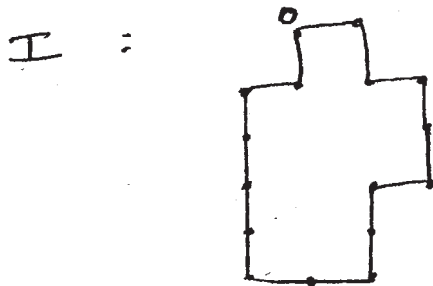
- a) Obtain morphological hole filling algorithm on image set 'A' with structuring element 'B' [4]



- b) Show that Erosion and dilation are duals of each other. [3]
- c) What is threshold? Explain how to obtain the threshold for image segmentation. [3]

**Q6)** Attempt the following:

- a) Explain basic principles of detecting following in the images. [4]
  - i) Points
  - ii) Lines
- b) Obtain shape number for the following image: [3]



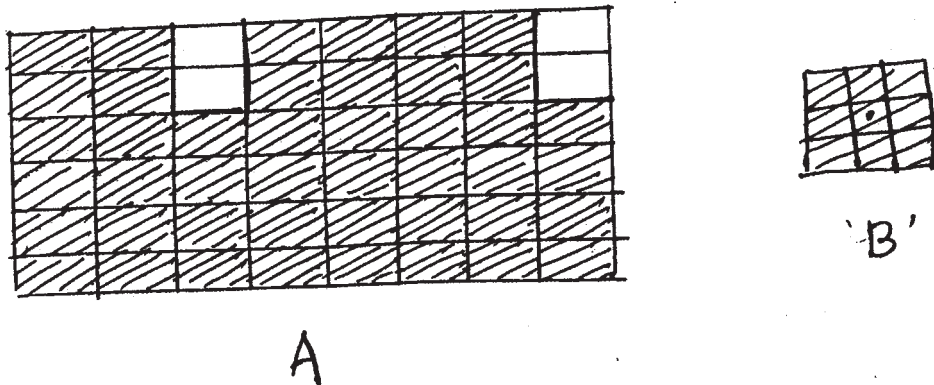
- c) Define the following regional descriptors: [3]
- i) Area of Region.
  - ii) Perimeter of region.

**Q7)** Attempt the following:

- a) Explain the morphological operation opening with suitable example. [5]
- b) Explain the RGB model of the colour image. [5]

**Q8)** Attempt the following:

- a) With the help of neat diagram, illustrate and explain various steps in image processing. [5]
- b) Extract the boundary of the following image segment 'A' with the structuring element 'B'. [5]



Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :3

**P2714**

**[5039] - 502**

**M.Sc. (Tech.)**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM - 502: DOT NET Technologies**

**(2013 Pattern) (Credit System) (Semester - V)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Attempt the following:

- a) Explain in brief: ASP·NET MVC Architecture with a suitable diagram.[4]
- b) Explain the concept of Delegate with a suitable example. [4]
- c) How is it possible for .NET to support many languages? [2]

**Q2)** Attempt the following:

- a) Give a brief description of properties in C# and the advantages obtained by using them in programs with a suitable example. [4]
- b) Describe two major categories that distinctly classify the variables of C# program. Give example of each. [4]
- c) What is the role of the Dataset object in ADO·NET? [2]

**Q3)** Attempt the following:

- a) Differentiate between private assembly and shared assembly. [4]
- b) Write a short note on Garbage collection in C#. [4]
- c) Answer the following:
  - i) In which name space, all·NET collection classes are contained?[1]
  - ii) To test a web service you must create a windows application or web application to consume this service. True/False? [1]

**P.T.O.**



**Q4)** Attempt the following:

- a) Explain the XML validating techniques. **[4]**
  - i) DTD's
  - ii) Schemas
- b) What events are fired when a page loads in ASP·NET ? Explain in brief.**[4]**
- c) Answer the following:
  - i) Do events have return type in C#? **[1]**
  - ii) What is the syntax to inherit from a class in C#? **[1]**

**Q5)** Attempt the following:

- a) Write a short note on access specifiers in C#. **[4]**
- b) Explain the concepts boxing and unboxing in C# with suitable example for each. **[4]**
- c) What are the different types of session state management options available with ASP·NET ? **[2]**

**Q6)** Attempt the following:

- a) Write a short note on SOAP. **[4]**
- b) What is CLR? Explain the working of CLR. **[4]**
- c) Answer the following:
  - i) How to display an icon or bitmap Image on the Button control on windows form? **[1]**
  - ii) Which method provides the functionality to display a dialog box at runtime? **[1]**

**Q7)** Attempt the following:

- a) Write a .NET program to implement stack operations using collections. **[5]**
- b) Write a .NET program using ADO.NET to insert, update & delete records from database. **[5]**

**Q8)** Attempt the following:

- a) Write a .NET program to demonstrate the user defined exception “Divide By Zero”. **[5]**
- b) Write a ASP.NET program to implement form - based authentication of a user if a user is valid, then the user should navigate to “welcome” page. **[5]**



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

**P2715**

**[5039]-503**

**M.Sc. (Tech.)**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM - 503: Unix**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Attempt the following.

- a) What are the two parts of Buffer and what is use of each part? [2]
- b) What is Shell? What are different Shells available in UNIX? [3]
- c) What is Super Block? What are the contents of Super Block? [5]

**Q2)** Attempt the following.

- a) What is Interrupt? Explain different types of Interrupt. [2]
- b) Explain Context Switch. [3]
- c) Describe the **getblk** algorithm. [5]

**Q3)** Attempt the following.

- a) What is Virtual address and Physical Address. [2]
- b) Differentiate between named and unnamed pipes. [3]
- c) Explain architecture of UNIX Operating System with suitable diagram. [5]

**Q4)** Attempt the following.

- a) What is Process? Explain Zombie process. [2]
- b) What is Signal? What are the different cases of Handling Signals. [3]
- c) Write a note on **link** system call. [5]

**P.T.O.**

**Q5)** Attempt the following.

- a) State any two characteristics of UNIX File System. [2]
- b) What is use of **mount** system call? Explain the contents of mount table. [5]
- c) What is Buffer Cache? [3]

**Q6)** Attempt the following.

- a) Write a note on init process. [5]
- b) Write a note on Process State Transitions. [5]

**Q7)** Attempt the following.

- a) Explain **fork** system call. [5]
- b) Explain **open** system call with suitable example. [5]

**Q8)** Attempt the following.

- a) Explain **read** system call. [5]
- b) Explain **chdir** system call. [5]

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Total No. of Questions : 8]

SEAT No. :

**P2716**

**[5039]-504**

[Total No. of Pages : 3

**M.Sc. Tech.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM - 504 : Statistical Methods**

**(2013 Pattern) (Semester - V)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Attempt any FIVE questions.*
- 3) *Use of non-programmable scientific calculator is allowed.*
- 4) *Statistical tables will be provided on request.*

**Q1) a)** Give the classical definition of probability. Also state the axioms of probability. **[4]**

b) A card is drawn from a well shuffled pack of 52 playing cards. What is the probability of getting.

i) A black queen

ii) A queen, a king, a jack of any suit

iii) A red card

iv) An ace of diamonds. **[4]**

c) Define independence of two events A and B on  $\Omega$ . **[2]**

**Q2) a)** Suppose a random variable X takes values -2, -1, 0, 2 with probabilities  $(k+2)/10$ ,  $(2k-3)/10$ ,  $(3k-4)/10$ ,  $(k+1)/10$  respectively. Find probability distribution and distribution function of X. **[4]**

b) State the pmf of Binomial distribution with parameters n and p.

State its mean and variance. **[4]**

c) Let  $X \rightarrow P(\lambda)$ . If  $P(X=0) = 0.2$ , find  $\lambda$ . **[2]**

**P.T.O.**

- Q3)** a) For a continuous random variable  $X$ , define the following: [4]
- probability density function.
  - distribution function.
- b) Define exponential random variable with mean  $\theta$ . State its variance. Also state the lack of memory property of exponential distribution. [4]
- c) Let  $X \rightarrow N(15,4)$ , find  $P(14 \leq X \leq 16)$ . [2]
- Q4)** a) Let  $X \rightarrow U(10,20)$ . Find mean and variance of  $X$ . [4]
- b) If  $X$  and  $Y$  are independent normal variables with means  $\mu_1, \mu_2$  and variances  $\sigma_1^2, \sigma_2^2$  respectively, state the probability distribution of ,
- $X + Y$
  - $aX + bY$ , where  $a$  and  $b$  are constants. [4]
- c) State the Normal approximation to Binomial distribution. [2]
- Q5)** a) For 10 pairs of observations on the variables  $X$  and  $Y$  the following data were obtained:  $\Sigma X = 130, \Sigma Y = 220, \Sigma X^2 = 2288, \Sigma Y^2 = 5506, \Sigma XY = 3467$ . Obtain the line of regression of  $Y$  on  $X$ . [4]
- b) Write a note on scatter diagram. [4]
- c) Define Karl Person's coefficient of correlation. [2]
- Q6)** a) State whether the following statements are true or false. Justify your answer.
- If  $b_{yx}$  and  $b_{xy}$  are negative then  $r_{xy}$  is positive.
  - $b_{xy} = 2.04, b_{yx} = 3.2$  [4]
- b) State the equation of multiple regression plane of  $X_1$  on  $X_2$  and  $X_3$ . Also state formulae of partial regression coefficients used in it. [4]
- c) For a trivariate data if,  $r_{12} = 0.6, r_{13} = 0.7, r_{23} = 0.65$ , compute partial correlation coefficient  $r_{12.3}$ . [2]

**Q7) a)** Explain the test procedure for testing  $H_0: P = P_0$  against  $H_1: P \neq P_0$  at level of significance  $\alpha$ . Assume that sample size  $n$  is large and  $P_0$  is the population proportion. [5]

b) A die is rolled 48 times. The number of times each face landed up is given in a table below:

Face up	1	2	3	4	5	6
frequency	6	9	8	12	7	6

At 5% level, can we conclude that the die is a balanced die? [5]

**Q8) a)** A gas station repair shop claims that it can do a lubrication job and oil change in less than 30 minutes. The consumer protection department wants to test this claim. A sample of six cars were sent to the station for oil change and lubrication. The job took an average of 28 minutes with a standard deviation of 4 minutes. Can we accept the claim of the gas station at 1% level of significance? [5]

b) Explain in brief chi square test for independence of attributes. [5]

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Total No. of Questions : 4]

SEAT No. :

**P2717**

**[5039]-505**

[Total No. of Pages : 3

**M.Tech.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-505: Cryptography**

**( 2013 Pattern) (Semester - V)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five of the following.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non-programmable scientific calculator is allowed.*

**Q1)** Attempt the following.

- a) Find gcd (1547,560) and express it as a linear combination of these two numbers. **[4]**
- b) Using Chinese Remainder theorem, solve the following system of linear congruences. **[4]**  
$$x \equiv 2 \pmod{3}$$
$$x \equiv 3 \pmod{5}$$
$$x \equiv 4 \pmod{11}$$
- c) Find Euler's  $\phi$  function 900. **[2]**

**Q2)** Attempt the following.

- a) Construct a finite field of order 'g' (Nine). **[4]**
- b) Suppose that Meena received an encrypted message 'M' from Seema, which has been encrypted using an additive monoalphabetic substitution ciphering scheme with key  $K = 3$ . Obtain decryption of the message M. Where M: PHH WPH DWW KHX VXD OSO DFH DWH LJK WRF ORF N. **[4]**
- c) What are the valid choices for 'a' and thus the size of the key space for an affine cipher  $c = ap + b$ , that is based on the English language and associated lowercase alphabet? **[2]**

**P.T.O.**



**Q3)** Attempt the following:

- a) Consider the English language and associated uppercase alphabet with  $A = 0, B = 1 \dots Z = 25$ , with a key  $K = (a = 5, b = 9)$ . Encrypt the plaintext using affine cipher.

Plain text : MATHEMATICS. [4]

- b) Compute the affine cipher key  $K = (a,b)$  if the letter A, represented as 0, maps to the letter J, represented as 9, and the letter B, represented as 1, maps to the letter 'O' represented as 14. [4]

- c) Define : Vigenere Cipher. [2]

**Q4)** Attempt the following:

- a) Suppose  $m = 6$  and the key is the following permutation  $\pi$ .

$$\pi = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 5 & 1 & 6 & 4 & 2 \end{pmatrix}$$

Decrypt the ciphertext:

EESLSH SALSSES LSHBLE HSYEET HRAEOS. [4]

- b) Write a note on 'stream ciphers'. [4]

- c) Find inverse of the matrix

$$A = \begin{bmatrix} 2 & 3 \\ 7 & 8 \end{bmatrix} \text{ (modulo 26)} \quad [2]$$

**Q5)** Attempt the following.

- a) Working with 26 - letter alphabet, and using enciphering matrix 'A',

encipher the message 'NO'.  $A = \begin{bmatrix} 2 & 1 \\ 3 & 5 \end{bmatrix}$  [4]

- b) Write a note on public key cryptosystem. [4]

- c) Define the term 'Polyalphabetic substitution cipher'. [2]

**Q6)** Attempt the following:

- a) Encipher the message 'Cryptography is a branch of applied Mathematics'. Ignoring punctuations and capitalization, using a key word cipher with  
Key word : Communist  
Key letter : Z [4]
- b) Write a note on crypt analysis. [4]
- c) Define : Primitive root modulo 'p'. [2]

**Q7)** Attempt the following:

- a) Explain the Diffie - Hellman key Agreement protocol key establishment stage in  $\mathbb{Z}p^*$ . [5]
- b) Solve the following:
  - i) Define : Discrete Logarithm.
  - ii) The Elliptic curve cryptosystem defined as  
$$y^2 \equiv x^3 + x + 6 \pmod{11}$$
has total 13 points, the order of the Elliptic curve  $\# E = 13$ . Is the point (7,9) a point on Elliptic curve?
  - iii) Define : Point of infinity of Elliptic curve. [5]

**Q8)** Attempt the following:

- a) Obtain the pseudo - random sequence generated by the function.  
$$f(x_i) = (x_i^2 + 9) \pmod{19}$$
Identify the  $\mu$  - tail and  $\lambda$  - cycle and  $x_\mu$  where the collision occurs if  $x_0 = 3$ . [5]
- b) Explain the encryption and decryption working of RSA public key cryptosystem. [5]

