

Total No. of Questions : 8]

SEAT No. :

**P2927**

**[4839]-101**

[Total No. of Pages : 3

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

**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 if  $p$  is a limit point of  $E$ , then every neighborhood of  $p$  contains infinitely many points of  $E$ . **[4]**

b) Let  $E$  be a non empty set of real numbers which is bounded above. Let  $y = \sup E$ . Prove that  $y \in \bar{E}$ . **[4]**

c) For  $x \in \mathbb{R}$  and  $y \in \mathbb{R}$ , define  $d(x, y) = |x^2 - y^2|$ . Determine whether  $d$  is a metric or not. **[2]**

**Q2)** a) Prove that compact subsets of metric spaces are closed. **[4]**

b) Let  $\{p_n\}$  be a sequence in a metric space  $X$ . Prove that  $\{p_n\}$  converges to  $p \in X$  if and only if every neighborhood of  $p$  contains all but finitely many of the terms of  $\{p_n\}$ . **[4]**

c) Is the set of integers a closed subset of  $\mathbb{R}$ ? Justify. **[2]**

**Q3)** a) If  $\bar{E}$  is the closure of a set  $E$  in a metric space  $X$ , then prove that  $\text{diam } \bar{E} = \text{diam } E$ . **[4]**

b) Prove that  $\lim_{n \rightarrow \infty} \sqrt[n]{n} = 1$ . **[4]**

c) Does the convergence of  $\{|s_n|\}_{n=1}^{\infty}$  imply the convergence of  $\{s_n\}_{n=1}^{\infty}$ ? Justify. **[2]**

**P.T.O.**

**Q4) a)** Let  $\sum_{n=1}^{\infty} a_n$  be a series of non-zero real numbers. If  $\limsup_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| < 1$ , then show that the series  $\sum_{n=1}^{\infty} a_n$  converges. [4]

b) Prove that for any collection  $\{F_\alpha\}$  of closed sets,  $\bigcap_\alpha F_\alpha$  is closed. [4]

c) Give an example of a compact subset of  $\mathbb{R}$  which is not connected. [2]

**Q5) a)** Suppose  $F$  is a continuous mapping of a compact metric space  $X$  into a metric space  $Y$ . Then prove that  $f(x)$  is compact. [4]

b) If  $P^*$  is a refinement of  $p$  then prove that  $U(p^*, f, \alpha) \leq U(p, f, \alpha)$ . [4]

c) If  $f(x) = x^3$  and  $\alpha(x) = x^2 + 1$ , then evaluate  $\int_0^1 f d\alpha$ . [2]

**Q6) a)** Let  $f_n(x) = \frac{\sin nx}{\sqrt{n}}$  where  $x$  is real and  $n \in \mathbb{N}$ . Show that  $\{f_n\}_{n=1}^{\infty}$  does not converge to  $F'$ . [4]

b) Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be defined as

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

Discuss the differentiability of  $f$  at every point  $x \in \mathbb{R}$ . [4]

c) Let  $f$  be a continuous real valued function on a metric space  $X$ . Let  $Z(f)$  be the set of all  $p \in X$  at which  $F(p) = 0$ . Prove that  $Z(f)$  is closed. [2]

**Q7) a)** Prove that a mapping  $f$  of a metric space  $X$  into a metric space  $Y$  is continuous on  $X$  if and only if  $f^{-1}(v)$  is open in  $X$  for every open set  $V$  in  $Y$ . [5]

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

**Q8) a)** Prove that if  $f$  and  $g$  are continuous real valued functions on  $[a,b]$  which are differentiable in  $(a,b)$ , then there is a point  $x \in (a,b)$  at which  $[f(b) - f(a)]g'(x) = [g(b) - g(a)]f'(x)$ , [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  $c_0 + c_1x + \dots + c_{n-1}x^{n-1} + c_nx^n = 0$  has atleast one real root between 0 and 1. [5]



Total No. of Questions :8]

SEAT No. :

**P2928**

**[4839]-102**

[Total No. of Pages :3

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

**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.*

**Q1) a)** Let  $V_1 = (1, 2, 1)$ ,  $V_2 = (2, 9, 0)$ ,  $V_3 = (3, 3, 4)$ . Show that  $S = \{ V_1, V_2, V_3 \}$  is a basis for  $\mathbb{R}^3$ . **[5]**

b) Write a note on orthographic projection. **[5]**

**Q2) a)** Write an algorithm for reflection through an arbitrary line in 2D. **[5]**

b) Let  $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be the linear operator defined by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right) = \begin{bmatrix} x_1 + x_2 \\ -2x_1 + 4x_2 \end{bmatrix}. \text{ Find the matrix for } T \text{ with respect to the basis } B \\ = \{u_1, u_2\} \text{ where } u_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, u_2 = \begin{bmatrix} 1 \\ 2 \end{bmatrix}. \quad \text{[5]}$$

**Q3) a)** State and prove Cauchy Schwarz inequality in an inner product space. **[5]**

b) Find the standard matrix for the transformation  $T : \mathbb{R}^3 \rightarrow \mathbb{R}^4$  defined by

$$T\left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}\right) = \begin{bmatrix} x_1 + x_2 \\ x_1 - x_2 \\ x_3 \\ x_1 \end{bmatrix}. \quad \text{[3]}$$

c) What is determinant of a rotation matrix in 2D? **[2]**

**P.T.O.**

**Q4) a)** Write an algorithm to generate  $n$  points in the first quadrant of parabola  $y^2 = 4ax$ . [5]

b) If  $B_0, B_1, B_2, B_3$  be control points given by  $B_0 [2 \ 1]$   $B_1 [4 \ 4]$   $B_2 [5 \ 3]$  and  $B_3 [5 \ 1]$ . Find parametric equation of Bezier curve. [3]

c) Let  $T: P_2 \rightarrow P_3$  be the linear transformation defined by  $T(P(x)) = xP(x)$ . Which of the following are in  $\ker(T)$ ? [2]

- i)  $0$     ii)  $1 + x$

**Q5) a)** Determine a matrix  $P$  which diagonalizes the following matrix  $A$  where

$$A = \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix}. \quad [5]$$

b) Obtain transformation matrix for Cavalier projection for  $\alpha = 45^\circ$ . [3]

c) Define subspace of a vector space  $V$ . Give one example. [2]

**Q6) a)** Obtain concatenated matrix for the following transformations in order [5]

i) Translation in  $x, y, z$  direction by  $-1, 2, 1$  respectively.

ii) Rotation about  $z$  axis by  $90^\circ$ .

iii) Reflection in  $xy$  plane.

Hence find the transformed position vector of the point  $A [3 \ 2 \ 1]$ .

b) If  $S = \{V_1, V_2, \dots, V_r\}$  be a set of vectors in  $\mathbb{R}^n$ . Prove that if  $r > n$  then  $S$  is linearly dependent. [3]

c) Show that matrices  $A$  and  $A^t$  have same eigen values. [2]

- Q7)** a) Consider the Euclidean inner product space  $\mathbb{R}^2$ . Transform the basis  $\{u_1, u_2\}$  into an orthonormal basis where  $u_1 = (4, -3)$ ,  $u_2 = (1, -1)$ . [5]
- b) Obtain isometric projection of line segment between the points  $A = [1 \ -2 \ 1]$  and  $B = [3 \ 1 \ 6]$ . [3]
- c) Apply the following transformation on the point  $P = [-1 \ 2]$  “shearing in  $x$  direction by 3 units”. [2]
- Q8)** a) Generate 8 distinct uniformly spaced points on the ellipse  $\frac{x^2}{4} + \frac{y^2}{1} = 1$ . [5]
- b) Suppose  $T : V \rightarrow W$  is a linear transformation. Prove that range of  $T$ ,  $R(T)$  is a subspace of  $W$ . [3]
- c) Define: [2]
- i) Orthonormal basis.
  - ii) Homogeneous coordinate.

*EEE*

**INDUSCTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM- 103: Discrete Mathematics Structures -I**

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

*Time : 3 Hours]*

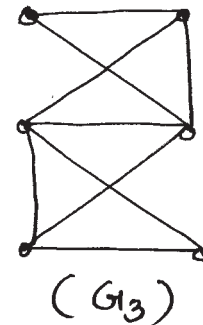
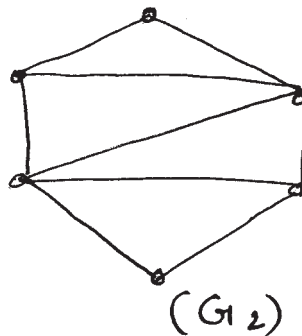
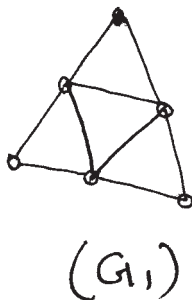
*[Max. Marks :50*

*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)** Attempt the following:

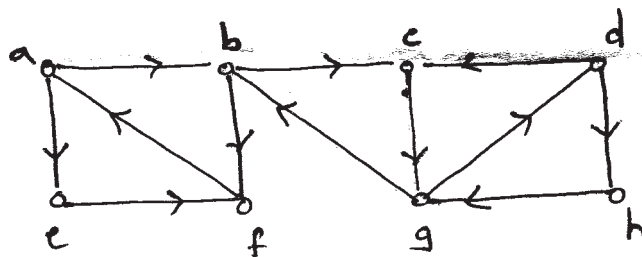
- a) Find the odd one out from the following graphs: [4]



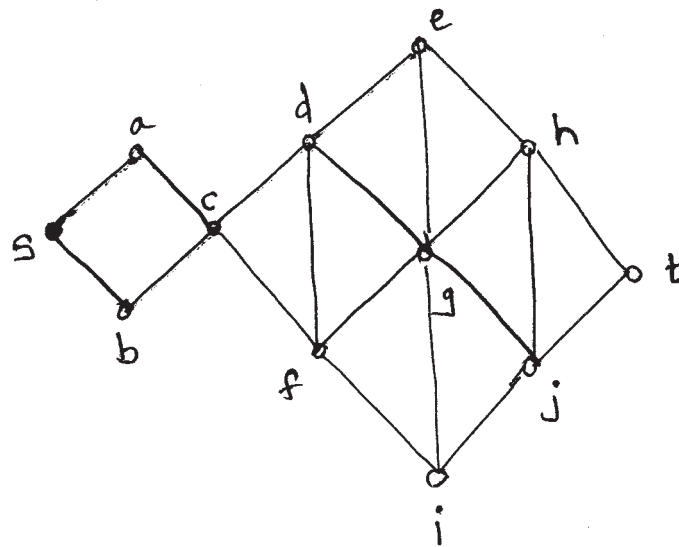
- b) Let  $G$  be an a cyclic graph with  $n$ -vertices and  $k$  - connected components i.e.  $\omega(G) = k$ . Then prove that  $G$  has  $n-k$  edges. [4]
- c) Prove that ‘If  $n$  is an integer and  $3n + 2$  is odd, then  $n$  is odd.’ Using contraposition. [2]

**Q2)** Attempt the following:

- a) Let  $D$  be a digraph given below: [4]

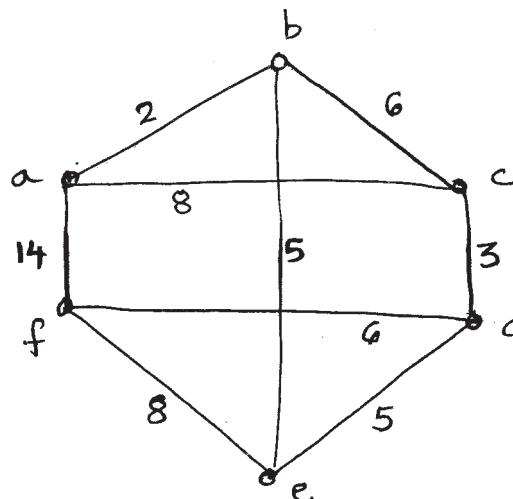


- i) Find a directed trail in  $D$  of length 10.
- ii) Find a directed cycle in  $D$  of longest possible length.
- b) Let  $G$  be a non-empty graph. Then prove that the chromatic index  $X(G)=2$  if and only if  $G$  is bipartite. [4]
- c) Carry out Breadth First search (BFS) algorithm on the following graph to find out the length of a shortest path from vertex 'S' to a vertex 't'. [2]



Q3) Attempt the following :

- a) Using truth table, show that the following logical compound proposition is a tautology.  $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$ . [4]
- b) Use Kruskal's Algorithm on the connected weighted graphs to find a minimal weighted spanning tree. [4]

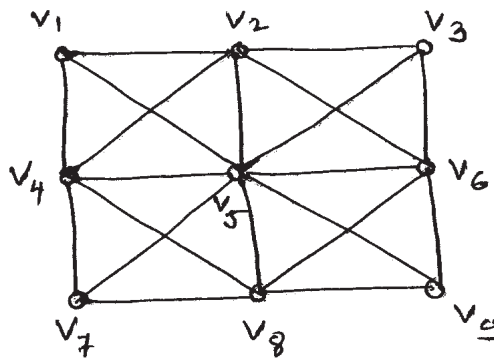


- c) prove that there is no simple graph with 7 vertices, one of which has degree 2, 2 have degree 3, three have degree 4 and the remaining vertex has degree 5. [2]

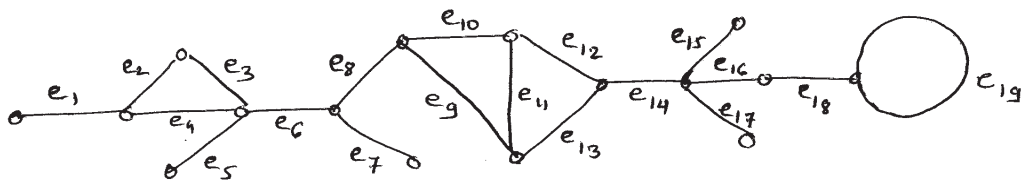


**Q4)** Attempt the following:

- a) A total of 1232 students have taken a course in Discrete Mathematics, 879 have taken a course in algebra, 114 have taken a course in analysis. Further, 103 have taken courses in both Discrete Mathematics and Algebra, 23 have taken courses in both Discrete Mathematics and analysis and 14 have taken courses in both Algebra and analysis. If 2092 students have taken atleast one of the Discrete Mathematics, algebra and analysis, how many students have taken a course in all three languages courses. [4]
- b) Consider the following graph: [4]

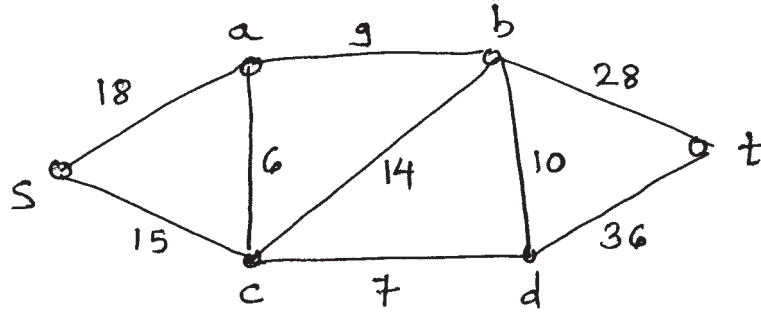


- i) Find vertex deleted subgraph  $G - U$  where  $U = \{ V_1, V_3, V_5 \}$
- ii) Find an induced subgraph  $G[V]$  where  $V = \{ V_2, V_4, V_6, V_8 \}$
- c) Define : Bridge and find all the bridges in the following graph. [2]



**Q5)** Attempt the following:

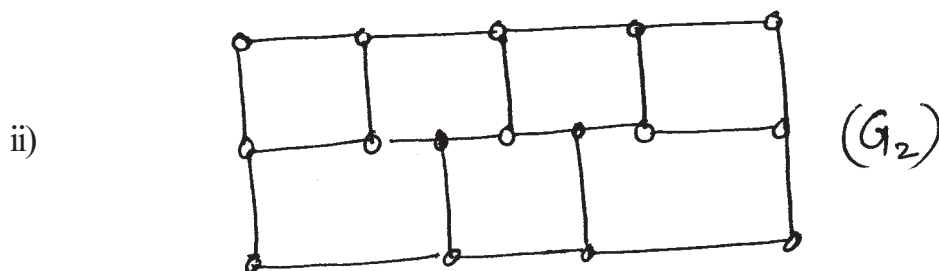
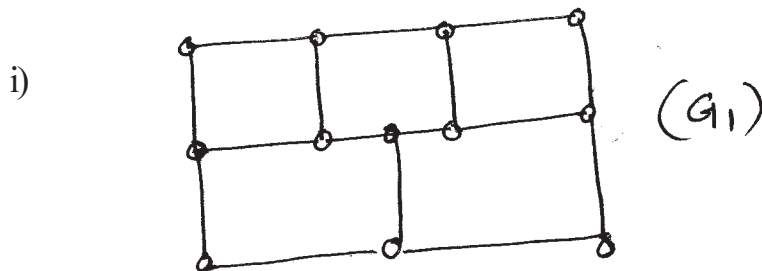
- a) Write a note on Chinese postman problem. [4]
- b) Use Dijkstra's algorithm on the connected weighted graphs to find the length of shortest path from the vertex 'S' to a vertex 't'. [3]



- c) How many different license plates are available if each plate contains a sequence of three letters  $\in (A, B, \dots, Z)$  followed by three digits. (and no sequence of letters are prohibited, even if they are obscene)? [2]

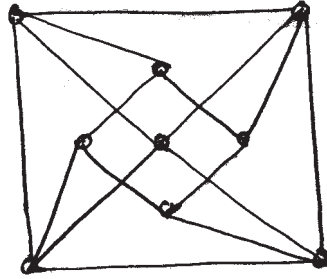
Q6) Attempt the following:

- a) Check whether the following graphs are Hamiltonian or not. [4]

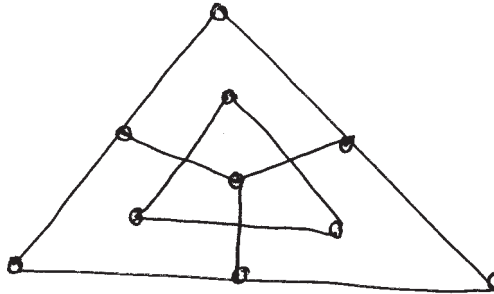


- b) Identify which of the following graphs are planar graphs? If it is planar, re-draw it. [4]

i)



ii)



- c) Define: A flow in a network  $N$ . [2]

**Q7)** Attempt the following:

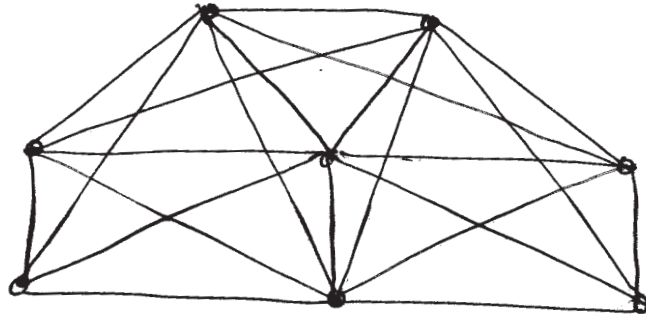
- a) If  $T$  is a tree with  $n$ - vertices then prove that it has precisely  $n-1$  edges. [5]
- b) Let  $v$  be a vertex of a connected graph  $G$ . Then  $v$  is cut vertex of  $G$  if and only if there are two vertices  $u$  and  $w$  of  $G$ , both different from  $v$ , such that  $v$  is on every  $u$ - $w$  path in  $G$ . [5]

**Q8)** Attempt the following:

- a) Let  $G$  be a graph in which the degree of every vertex is atleast two. Then prove that  $G$  contains a cycle. [5]

b) Solve the following: [3]

i) Find chromatic index for the following graph.



ii) Determine the truth values of each of these statements if the domain for all variables consists of all integers.

1)  $\forall_n \exists_m (n + m = 0)$  [1]

2)  $\exists_n \forall_m (n \cdot m = m)$  [1]

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P2930**

**[4839]-104**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-104 : C-Programming**

**(2013 Pattern)**

*Time : 3 Hours]*

*[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) Define the following term and give it's example. [2]
  - i) Keyword
  - ii) Variable
- b) Explain different data types used in C language with example. [4]
- c) Explain the difference between '=' and '==' operator with example. [4]

**Q2)** Attempt the following:

- a) Write equivalent code using a while loop:  
for ( i = 0; i<10; i + + )  
{  
do something ( );  
}  
[2]
- b) Explain any two bitwise operator with suitable example. [4]
- C) Explain switch control statement with the help of example. [4]

**Q3)** Attempt the following:

- a) If a=8, b=15, c=0 Find the values of the following expression:
  - i)  $a != 6 \& \& b > 15$
  - ii)  $5 \& \& c != 8 || !c$  [2]

**P.T.O.**

- b) Explain two dimensional array with an example. [4]  
 c) Write a note on dynamic memory allocation in C programming. [4]

**Q4)** Attempt the following: [2]

- a) Trace the output of the following program:

```
i) # include < stdio.h >
    int main ( ) {
        for ( ; NULL ; )
            printf ( “ Cquestion” ) ;
        return 0 ;
    }
```

```
ii) # include < stdio.h >
     int main ( ) {
         int x ;
         x = -z + 11 - 7 * 9% 6/12;
         printf ( “ % d”,x) ;
         return 0 ;
     }
```

- b) What is structure? Explain the syntax for structure declaration with example. [4]  
 c) Explain any two string function with the suitable example. [4]

**Q5)** Attempt the following:

- a) What is type casting in ‘C’? [2]  
 b) Explain break and continue statements. [4]  
 c) Write a recursive function to find the gcd of two numbers. [4]

**Q6)** Attempt the following:

- a) Explain pointer to function in detail. [4]  
 b) Write a C program to find 2<sup>nd</sup> largest number from on array of 10 elements. [6]

**Q7)** Attempt the following:

- a) Write a C program to compute the following series summation correct up to five decimal places.

$$S = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$$

where  $0 < x < 1$  [5]

- b) Write a user define function in C that concatenates two strings. [5]

**Q8)** Attempt the following:

a) Write a C program to print the sum of its five digits.

(Note: you are given a five digit integer)

**[5]**

b) Write a C program to copy contents of one file to another file.

**[5]**



Total No. of Questions : 8]

SEAT No. :

**P2931**

**[4839]-105**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-105 : Elements of Information Technology**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Attempt the following:

- a) Write a note on “ Need for binary system”. [4]
- b) Explain the working of a plotter. [4]
- c) What is computer? [2]

**Q2)** Attempt the following:

- a) Explain any 2 physical devices used to construct memory. [4]
- b) Explain any 2 types of processors. [4]
- c) Solve :  $(216)_{10} = ( )_2$ ? [2]

**Q3)** Attempt the following:

- a) Explain EBCDIC code representation of characters. [4]
- b) Explain working of CD-ROM drive. [4]
- c) Explain “Access Time” of a memory. [2]

**Q4)** Attempt the following:

- a) What are different types of memory chips. [4]
- b) Explain the basic structure of a computer. [4]
- c) State any 4 storage evaluation criteria. [2]

**P.T.O.**



**Q5)** Attempt the following:

- a) Solve:  $(321)_4 = ( )_7$ ? [4]
- b) Explain OMR Input method. [4]
- c) What do you mean by multi core processor. [2]

**Q6)** Attempt the following:

- a) Write a note on working of a printer. [4]
- b) Explain the working of a Magnetic Hard Disk. [4]
- c) What do you mean by Instruction set. [2]

**Q7)** Attempt the following:

- a) Explain any 5 types of registers used in CPU. [5]
- b) Comment on I/O to processor communication. [5]

**Q8)** Attempt the following:

- a) Solve:
  - i)  $(110110)_2 = ( )_{10}$ ? [2]
  - ii)  $(AC2)_{16} = ( )_8$ ? [3]
- b) i) Comment on processors speed. [2]
- ii) Write a note on “Cache Memory”. [3]



Total No. of Questions : 5]

SEAT No. :

**P2904**

**[4839]-11**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-101 : Real Analysis**

**(2008 Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 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)** Attempt Any Eight of the following:

**[16]**

- a) Give an example of a subset of  $\mathbb{R}$  which is neither open nor closed.
- b) Construct a bounded set of real numbers with exactly three limit points.
- c) Define a complete metric space.
- d) Define a compact subset of a metric space.
- e) Find the radius of convergence of the following power series:  $\sum_{n=1}^{\infty} n^2 Z^n$ .
- f) Let  $f: [0, 1] \rightarrow \mathbb{R}$  where  $f(x) = x^2 + x + 1$ . Is  $f(x)$  uniformly continuous on  $[0, 1]$ ? Justify.
- g) State the fundamental theorem of calculus.
- h) Define a dense subset of a metric space.
- i) If  $f(x) = x^2$  and  $\alpha(x) = x^3 + 5$ , then evaluate  $\int_0^1 f d\alpha$ .
- j) Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  where  $f(x) = x|x|$ . Compute  $f'(0)$  if it exists.

**P.T.O.**

- Q2) a)** Attempt Any One of the following: [6]
- i) Prove that every neighborhood of a point 'P' is an open set.
  - ii) If  $X$  is a metric space and  $E \subset X$ , then prove that  $\bar{E}$  is closed.
- b)** Attempt Any Two of the following: [10]
- i) Prove that closed subsets of compact sets are compact.
  - ii) Let  $\{s_n\}$  be a sequence in a metric space  $X$ . Prove that if  $\{s_n\}$  converges, then  $\{s_n\}$  is bounded.
  - iii) Prove that a subset  $E$  of the real line  $\mathbb{R}^1$  is connected if and only if it has the following property: If  $x \in E$ ,  $y \in E$  and  $x < z < y$ , then  $z \in E$ .
- Q3) a)** Attempt Any One of the following: [6]
- i) Prove that for any collection  $\{G_\alpha\}$  of open sets,  $\bigcup_\alpha G_\alpha$  is open.
  - ii) If  $\bar{E}$  is the closure of a set  $E$  in a metric space  $X$ , then prove that  $\text{diam } \bar{E} = \text{diam } E$ .
- b)** Attempt Any Two of the following: [10]
- i) Investigate the convergence or divergence of  $\sum_{n=1}^{\infty} a_n$ , if 
$$a_n = \frac{\sqrt{n+1} - \sqrt{n}}{n}.$$
  - ii) If  $p > 0$ , then prove that  $\lim_{n \rightarrow \infty} \sqrt[n]{p} = 1$ .
  - iii) Prove that if  $\sum_{n=1}^{\infty} a_n$  converges absolutely, then  $\sum_{n=1}^{\infty} a_n$  converges.
- Q4) a)** Attempt Any One of the following: [6]
- i) Suppose  $f$  is a continuous mapping of a compact metric space  $X$  into a compact metric space  $Y$ . Then prove that  $f(X)$  is compact.
  - ii) 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  $f'(x) = 0$ .

b) Attempt Any Two of the following: [10]

i) Suppose  $d : \mathbb{R}^2 \times \mathbb{R}^2 \rightarrow \mathbb{R}$  defined by  $d(x, y) = |x_1 - y_1| + |x_2 - y_2|$  where  $x = (x_1, x_2), y = (y_1, y_2) \in \mathbb{R}^2$ , then show that  $d$  is a metric.

ii) If  $f$  is a continuous mapping of a metric space  $X$  into a metric space  $Y$ , and if  $E$  is a connected subset of  $X$ , then prove that  $f(E)$  is connected.

iii) Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be defined as  $f(x) = \begin{cases} x^2 \sin \frac{1}{x} & \text{if } (x \neq 0) \\ 0 & \text{if } (x = 0) \end{cases}$ .

Discuss the differentiability of  $f$  at every point  $x \in \mathbb{R}$ .

**Q5)** a) Attempt Any One of the following: [6]

i) Prove that if  $f$  and  $g$  are continuous real valued functions on  $[a, b]$  which are differentiable in  $(a, b)$ , then there is a point  $x \in (a, b)$  at which  $[f(b) - f(a)]g'(x) = [g(b) - g(a)]f'(x)$ .

ii) If  $P^*$  is a refinement of  $P$ , then prove that  $L(P, f, \alpha) \leq L(P^*, f, \alpha)$ .

b) Attempt Any Two of the following: [10]

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

ii) Let  $f_n(x) = \frac{x^2}{(1+x^2)^n}$  where  $x \in \mathbb{R}$  and  $n \in \mathbb{N} \cup \{0\}$ .

Find  $f(x) = \sum_{n=0}^{\infty} f_n(x)$ . Discuss the continuity of  $f(x)$ .

iii) Let  $S_{m,n} = \frac{m-n}{m+n}$  where  $m, n \in \mathbb{N}$ .

Find  $\lim_{n \rightarrow \infty} \lim_{m \rightarrow \infty} S_{m,n}$  and  $\lim_{m \rightarrow \infty} \lim_{n \rightarrow \infty} S_{m,n}$ .



Total No. of Questions : 5]

SEAT No. :

**P2905**

[4839]-12

[Total No. of Pages : 3

M.Sc. (Tech.)

MATHEMATICS

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-102 : Algebra-I

(2008 Pattern) (Semester-I)

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate maximum marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Let  $*$  be defined on  $2\mathbb{Z} = \{2n \mid n \in \mathbb{Z}\}$  by  $a*b = a+b$ . Determine whether  $\langle 2\mathbb{Z}, * \rangle$  is a group. Justify.
- b) Show that  $\langle n\mathbb{Z}, + \rangle \cong \langle \mathbb{Z}, + \rangle$ .
- c) Compute the product  $(1, 3, 6)(2, 8)(4, 7, 5)$  in  $S_8$ .
- d) Show that intersection of any two subgroups of a group is a subgroup.
- e) Show that the set of all idempotent elements of a commutative ring is closed under multiplication.
- f) Is every integral domain a field? Justify.
- g) Define prime ideal of a ring.
- h) List all maximal ideals in a ring  $\mathbb{Z}$ .
- i) Show that  $\mathbb{Z} \times \mathbb{Z}$  is not an integral domain.
- j) Let  $R$  be a ring with 1. Show that the map  $\phi: \mathbb{Z} \rightarrow R$  defined by  $\phi(n) = n.1$  is a homomorphism.

**P.T.O.**

- Q2) a)** Attempt Any One of the following: [6]
- i) Show that a non-empty subset  $H$  of a group  $G$  is a subgroup of  $G$  if and only if  $ab^{-1} \in H \quad \forall a, b \in H$ .
  - ii) Let  $G$  be a group. Show that a group homomorphism  $\phi: G \rightarrow G'$  is a one-to-one map if and only if  $\ker \phi = \{e\}$ .
- b)** Attempt Any Two of the following: [10]
- i) Show that a subgroup of a cyclic group is cyclic.
  - ii) Let  $G$  be a group. Show that the relation ' $\sim$ ' defined on  $G$  by  $a \sim b$  if and only if ' $a$  is a conjugate of  $b$ ' is an equivalence relation on  $G$ .
  - iii) Let  $H$  be a normal subgroup of  $G$ . Show that  $G/H$  under the binary operation  $(aH)(bH) = (ab)H$  forms a group.
- Q3) a)** Attempt Any One of the following: [6]
- i) Show that every subgroup of an abelian group is normal. Show that the center  $Z(G)$  is a normal subgroup of  $G$ , irrespective of  $G$  is abelian or not.
  - ii) Let  $\phi: G \rightarrow \bar{G}$  be a homomorphism of a group  $G$  onto a group  $\bar{G}$  with kernel  $K$ . Prove that  $\frac{G}{K} \cong \bar{G}$ .
- b)** Attempt Any Two of the following: [10]
- i) Let  $M$  be a maximal normal subgroup of  $G$ . Prove that  $\frac{G}{M}$  is a simple group.
  - ii) Prove that a group of order 20 is not simple.
  - iii) Prove that the center of finite nontrivial  $p$ -group  $G$  is nontrivial.
- Q4) a)** Attempt Any One of the following: [6]
- i) Show that every finite integral domain is a field.
  - ii) Prove that the characteristic of an integral domain is either 0 or a prime.

- b) Attempt Any Two of the following: [10]
- i) If  $R$  is a ring with unity and  $N$  is an ideal of  $R$  containing a unit then prove that  $N=R$ .
  - ii) Let  $R$  be a commutative ring with unity. Prove that every maximal ideal is prime.
  - iii) Let  $R$  be a commutative ring with unity and  $I, J$  be ideals of  $R$ . Show that  $I + J = \{a + b \mid a \in I, b \in J\}$  is an ideal of  $R$ .

- Q5) a) Attempt Any One of the following: [6]
- i) Prove that a nonzero ideal  $\langle p(x) \rangle$  of  $F[x]$  is maximal then  $p(x)$  is irreducible over  $F$ , where  $F$  is a field.
  - ii) Prove that the product of two primitive polynomials is a primitive polynomial.

- b) Attempt Any Two of the following: [10]
- i) Let  $f(x) \in F[x]$  be a polynomial of degree 2 or 3, where  $F$  be a field. Prove that  $f(x)$  is irreducible over  $F$  if and only if it has a zero in  $F$ .
  - ii) Show that the polynomial  $x^{p-1} + x^{p-2} + \dots + x + 1$  is irreducible over  $\mathbb{Q}$  for any prime  $p$ .
  - iii) Prove that  $\frac{\mathbb{Z}_5[x]}{\langle x^3 + 3x + 2 \rangle}$  is a field.



Total No. of Questions : 5]

SEAT No. :

**P2906**

**[4839]-13**

[Total No. of Pages : 3

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

**MATHEMATICS**

**Industrial Mathematics with Computer Applications**

**MIM-103 : Discrete Mathematical Structures-I**

**(2008 Pattern) (Semester-I) (Old Course)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Determine whether  $\neg p \rightarrow q$  and  $p \vee q$  are logically equivalent.
- b) Determine whether  $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$  is a tautology.
- c) Write the negation of  $\forall x \exists y (xy = 1)$ .
- d) Use a table to express the values of  $F(x, y) = x + xy$ .
- e) Construct a circuit that produce the output of  $(x + y) \bar{x}$ .
- f) "Every non-empty subset of a chain is a sublattice". Justify!
- g) Define maximal element of the poset.
- h) How many bit strings with length eight are there?
- i) How many numbers must be selected from the set  $\{1, 2, 3, 4, 5, 6\}$  to guarantee that at least one pair of these numbers add up to 7?
- j) Is  $(\mathbb{N}, +)$  a monoid? Justify!

**P.T.O.**



- Q2) a)** Attempt Any One of the following: [6]
- i) Prove that  $\sqrt{2}$  is irrational by giving a proof by contradiction.
  - ii) Use rules of inference to show that the hypothesis “Randy works hard”, “If Randy works hard, then he is a dull boy”, and “If Randy is a dull boy, then he will not get the job” imply the conclusion “Randy will not get the job”.
- b)** Attempt Any Two of the following: [10]
- i) Show that  $\neg\forall x(P(x) \rightarrow Q(x))$  and  $\exists x(P(x) \wedge \neg Q(x))$  are logically equivalent.
  - ii) Prove that if  $n = ab$ , where  $a, b, n$  are positive integers; then either  $a \leq \sqrt{n}$  or  $b \leq \sqrt{n}$ .
  - iii) State any five rules of inference.
- Q3) a)** Attempt Any One of the following: [6]
- i) Prove that if two lattices  $L$  and  $M$  are modular then  $L \times M$  is modular.
  - ii) Explain the Quine - McCluskey method.
- b)** Attempt Any Two of the following: [10]
- i) Use K-maps to minimize the sum of products expansion:
 
$$xyz + \bar{x}yz + x\bar{y}z + xy\bar{z} + x\bar{y}\bar{z}$$
  - ii) Prove that homomorphic image of a relatively complemented lattice is relatively complemented.
  - iii) Show that the pentagonal lattice is not modular.
- Q4) a)** Attempt Any One of the following: [6]
- i) Prove that any two Boolean algebras having  $n$  elements each, are isomorphic.
  - ii) Show that the direct product of two semigroups is also a semigroup.

b) Attempt Any Two of the following: [10]

- i) Show that  $(M_{2 \times 2}(\mathbb{R}), +)$  is a monoid.
- ii) Prove that in a lattice  $L$ , for all  $a, b, c \in L$ ;  $a \wedge (b \vee c) \geq (a \wedge b) \vee (a \wedge c)$ .
- iii) Define a Boolean algebra. Show that in a Boolean algebra if  $x \wedge y = 1$  then  $x = 1$  and  $y = 1$ .

Q5) a) Attempt Any One of the following: [6]

- i) How many solutions does  $x_1 + x_2 + x_3 = 15$  have, where  $x_1, x_2$  and  $x_3$  are non negative integers with  $x_2 \geq 3, x_3 \geq 2$ ?
- ii) Let  $T$  be the set of all even integers. Show that the semigroups  $(\mathbb{Z}, +)$  and  $(T, +)$  are isomorphic.

b) Attempt Any Two of the following: [10]

- i) How many positive integers less than 100 are divisible by either 3 or 5?
- ii) How many functions are there from a set with  $m$  elements to a set with  $n$  elements? How many of these are one-to-one?
- iii) Let  $A = \{0, 1\}$  and consider the free semigroup  $(A^*, \cdot)$  generated by  $A$ . Define the relation on  $A$  by  $\alpha R_\beta$  if and only if  $\alpha$  and  $\beta$  have the same number of 1's.

Show that  $R$  is a congruence relation on  $(A^*, \cdot)$ .



Total No. of Questions : 5]

SEAT No. :

**P2907**

**[4839]-14**

[Total No. of Pages : 4

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-104 : 'C' Programming**

**(2008 Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[8 × 2 = 16]**

- a) What is a preprocessor?
- b) Write the output of the following # define SQUARE(X) (x\*x)  
main ()  
{  
    Printf ("%d", SQUARE (4+4));  
}
- c) 12 ab is a valid C identifier? State True | False. Justify.
- d) Write syntax and use of fseek() function.
- e) What is the difference between Logical And (&&) and Bitwise And (&) operator?
- f) Write output of the following  
Main ()  
{  
    int x=0, y=0, z=1;  
    Z=X++ && ++y || ++z;  
    Printf ("%d %d %d", x, y, z);  
}

**P.T.O.**

- g) What is the use of goto statement?
- h) State different types of Escape sequences.
- i) Write any two difference between break and continue.
- j) State the different DMA functions used to allocate memory.

**Q2) Attempt Any Two of the following: [2 × 8 = 16]**

- a) Write a 'C' program to find transpose of matrix.
- b) Write a 'C' program to define a structure for a student (roll-no, name). Accept n records of students from the user and display all records.
- c) Write a 'C' program to find length of string using pointers.

**Q3) Attempt Any Four of the following: [4 × 4 = 16]**

- a) Explain call by value and call by reference with suitable example.
- b) Write a 'C' program to accept filename through command line and count no of characters in a file.
- c) Write the difference between structure and Union.
- d) Write a 'C' program to accept n integer array element from the user. Print the array in reverse order.
- e) Write the comparison between if-else and switch statement.

**Q4) Attempt Any Eight of the following: [8 × 2 = 16]**

- a) Write output of the following

```

Main()
{
    char * p = "a b c d";
    printf ("%c", *p++);
    printf ("%C", *p);
}

```

- b) What is Assembly Language? Give one advantage of Assembly Language.

c) What is the use of type def ( ) operator.

d) Write output of the following.

```
Main ()
{
    int i=5;
    while(i)
    {
        i--;
        if(i==3)
            break;
        printf ("%d", i);
    }
}
```

e) What is a Nested Macros?

f) What do you mean by Precedence and Associativity rule.

g) Write the output of the following

```
Main ()
{
    int x=1;
    switch (x)
    {
        case 0: x=1;
        case 1: x=3;
        case 2: x+=4;
        case 3: x=2;
        default: x+=2;
    }
    printf ("%d", x);
}
```

h) What is a void pointer?

i) Write the syntax and use of fscanf ( ) function.

j) State the different type of string standard library function.

**Q5)** Attempt Any Four of the following:

**[4 × 4 = 16]**

- a) Explain various file opening mode in C.
- b) Explain how pointers are passed to function. Give example.
- c) Write a short note on storage classes.
- d) Write the difference between while and do-while loop.
- e) Write a recursive function to calculate factorial of a number.



Total No. of Questions : 5]

SEAT No. :

**P2908**

**[4839]-15**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-105 : Elements of Information Technology**

**(2008 Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Define: Operating System.
- b) What is computer?
- c) What do you mean by cache memory?
- d) Convert  $(522)_{10}$  to binary.
- e) State any two output devices.
- f) Define: Software.
- g) Define: Protocol.
- h) Give any two features of operating system.
- i) What do you mean by ROM?
- j) State functions of LAN.

**Q2)** Attempt Any Four of the following:

**[16]**

- a) State any 4 characteristics of computer.
- b) Why are binary digits used to code data to be stored in a computer?

***P.T.O.***

- c) Explain any 4 types of printers.
- d) Convert the following to decimal
  - i)  $(2057)_8$
  - ii)  $(0.7)_8$
- e) Explain any two Network topologies.

**Q3) Attempt Any Four of the following: [16]**

- a) What are the applications of Information Technology.
- b) Write a note on:
  - i) Time sharing system.
  - ii) Real time system.
- c) Convert the following to decimal.
  - i)  $(110110)_2$
  - ii)  $(111.001)_2$
- d) Write a note on types of software.
- e) State disadvantages of sequential files.

**Q4) Attempt Any Four of the following: [16]**

- a) Distinguish between MAN and LAN.
- b) Explain any four file types.
- c) Explain any two data transmission mode.
- d) State any four roles of communication protocol.
- e) What do you mean by Dense Index and Sparse Index?

**Q5) Attempt Any Two of the following: [16]**

- a) State different types of storage devices. Explain any one of them.
- b) Write a note on secondary storage devices.
- c) What are advantages and limitations of optical Disks?





Total No. of Questions :8]

SEAT No. :

**P2932**

**[4839]-201**

[Total No. of Pages :3

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

**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)** Prove that the limit  $\lim_{z \rightarrow 0} \frac{z}{\bar{z}}$  does not exist. **[4]**

b) Find all roots of the equation  $\sin z = 0$ . **[4]**

c) Sketch the closure of the set:  $-\pi < \arg z < \pi (z \neq 0)$ . **[2]**

**Q2) a)** Let  $f(z) = u(x, y) + i v(x, y)$ ,  $z_0 = x_0 + i y_0$ , and  $w_0 = u_0 + i v_0$ . Prove that if  $\lim_{z \rightarrow z_0} f(z) = w_0$  then  $\lim_{(x, y) \rightarrow (x_0, y_0)} u(x, y) = u_0$  and  $\lim_{(x, y) \rightarrow (x_0, y_0)} v(x, y) = v_0$ . **[4]**

b) Show that  $u(x, y)$  is harmonic in some domain and find a harmonic conjugate  $v(x, y)$  when  $u(x, y) = 2x - x^3 + 3x y^2$ . **[4]**

c) Show that  $\exp(z + \pi i) = -\exp z$ . **[2]**

**Q3) a)** Let  $f(z) = x^2 + i y^2$ , determine all  $z \in C$  where  $f'(z)$  exists and find its value. **[4]**

b) Find all values of  $i^{-2i}$ . **[4]**

c) Define contour integration. **[2]**

**P.T.O.**

**Q4) a)** If  $w_0$  is point in the  $w$  plane, then prove that  $\lim_{z \rightarrow \infty} f(z) = w_0$  if and only if

$$\lim_{z \rightarrow 0} f\left(\frac{1}{z}\right) = w_0. \quad [4]$$

b) Explain the method of evaluating the improper integral of a continuous function  $f(x)$  over the semi-infinite interval  $x \geq 0$ . [4]

c) Evaluate  $\int_C f(z) dz$  where the contour  $C$  is the positively oriented circle  $|z| = 1$ , and  $f(z) = z e^{-z}$ . [2]

**Q5) a)** Suppose that [4]

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  $\frac{p(z)}{q(z)}$  has a pole of order  $m$  at  $z_0$

b) Evaluate the integral of  $f(z) = \frac{5z-2}{z(z-1)}$  around the circle  $|z| = 2$ , described counter clockwise. [4]

c) Find the Maclaurin series expansion of the function  $f(z) = \frac{z}{z^4+9}$ . [2]

**Q6) a)** Derive the Laurent series representation [4]

$$\frac{e^z}{(z+1)^2} = \frac{1}{e} \left[ \sum_{n=0}^{\infty} \frac{(z+1)^n}{(n+2)!} + \frac{1}{z+1} + \frac{1}{(z+1)^2} \right] (0 < |z+1| < \infty).$$

b) Show that  $\text{Res}_{z=1} \frac{\log z}{(z^2+1)^2} = \frac{\pi+2}{8}$ . [4]

c) Define essential singularity. [2]

- Q7)** a) State and prove the fundamental theorem of algebra. [5]  
b) State and prove Cauchy's residue theorem. [5]
- Q8)** a) State and prove Liouville's theorem. [5]  
b) State and prove Laurent's theorem. [5]

*EEE*

Total No. of Questions :8]

SEAT No. :

**P2933**

**[4839]-202**

[Total No. of Pages :2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**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)** Prove that subgroup of a cyclic group is cyclic. **[5]**

b) Prepare multiplication table for  $\mathbb{Z}_8^*$ , set of all prime residue classes modulo 8. Is it a group? Justify. **[5]**

**Q2) a)** Prove that a subgroup H of a group G is a normal subgroup of G if and only if each left coset of H is a right coset of H in G. **[5]**

b) Prove that if F is a field then every ideal in  $F[x]$  is principal. **[5]**

**Q3) a)** State and prove Eisenstein's criterion for polynomial ring. **[5]**

b) Show that the groups  $G = \{1, -1, i, -i\}$  and  $(\mathbb{Z}_4, +4)$  are isomorphic. **[3]**

c) Find order of following permutation  $\sigma$  **[2]**

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

**Q4) a)** Prove that every group of prime order is cyclic and hence abelian. **[5]**

b) Find all solutions of  $x^3 + 2x + 4 = 0$  in  $\mathbb{Z}_6$ . **[3]**

c) Define prime ideal **[2]**

**P.T.O.**

- Q5)** a) Prove that every group of order  $P^2$  is abelian. [5]  
 b) prove that no group of order 30 is simple. [3]  
 c) Define Ring. [2]
- Q6)** a) State and prove division algorithm for  $F[x]$ . [5]  
 b) Find order of every element in  $(\mathbb{Z}_6 + 6)$ . [3]  
 c) Define cycle and transposition. [2]
- Q7)** a) If  $R$  is a ring with unity 1. Prove that the map  $\phi: \mathbb{Z} \rightarrow \mathbb{R}$  given by  $\phi(n) = n.1$  for  $n \in \mathbb{Z}$  is a homomorphism of  $\mathbb{Z}$ . [5]  
 b) Is  $A_n$  simple? Justify. [3]  
 c) State Cayley's theorem. [2]
- Q8)** a) Define: Class equation. What are conjugate classes of  $S_3$ . Verify class equation for  $S_3$ . [5]  
 b) Prove that  $F[x]$  is a Euclidean Ring. [3]  
 c) Define: Irreducible polynomial. [2]

EEE

Total No. of Questions :8]

SEAT No. :

**P2934**

**[4839]-203**

[Total No. of Pages :3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM- 203: Numerical Analysis**

**(2013 Pattern)**

*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 calculators is allowed.*

**Q1)** a) Assume that  $g \in C[a, b]$ . Show that if the range of the mapping  $y = g(x)$  satisfies  $y \in [a, b]$  for all  $x \in [a, b]$  then  $g$  has a fixed point in  $[a, b]$ . [4]

b) Let  $f(x) = x^2 - x + 2$  [4]

i) Find the Newton Raphson's formula  $P_k = 9(P_{k-1})$ .

ii) Start with  $P_0 = -1.5$  to find the next approximations  $P_1, P_2$ .

c) Define an ill conditioned system. [2]

**Q2)** a) Find the triangular factorization  $A = LU$  for the matrix  $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 2 \\ 3 & 1 & 2 \end{bmatrix}$ . [4]

b) Consider the initial value problem  $y' = f(t, y)$  over  $[t_0, t_m]$  with initial condition  $y(t_0) = y_0$ . Show that for a step size  $h$  the solution by the Euler's method is given by  $y_{k+1} = y_k + hf(t_k, y_k)$  where  $k = 0, 1, \dots, M-1$ . [4]

c) Is the matrix given below strictly diagonally dominant. Justify.  $\begin{bmatrix} -2 & 1 & 5 \\ 4 & -8 & 1 \\ 4 & -1 & 1 \end{bmatrix}$  [2]

**P.T.O.**

- Q3) a)** Find a Newtons cubic forward interpolating polynomial which takes the following values. [4]

$x$	0	1	2	3
$f(x)$	1	2	1	10

- b) Assume that  $x_k = x_0 + kh$  are equally spaced nodes and  $f_k = f(x_k)$ . Then the value of the integral. [4]

$$\int_{x_0}^{x_2} f(x) dx \approx \frac{h}{3}(f_0 + 4f_1 + f_2).$$

- c) If  $\Delta$  and  $\nabla$  denote the difference operators and E denotes the shift operator show that  $\Delta = E \nabla$ . [2]

- Q4) a)** Given the initial value problem  $\frac{dy}{dx} = x^2 + y^2$  with initial condition  $y(0)=0$  use  $h = 0.1$  to find the solution to the above problem at  $x = 0.4$ . [4]

- b) Apply Runge Kutta method of order 4 to find a solution to the Initial value problem  $\frac{dy}{dx} = x + y^2$  with  $y(0) = 1$  at  $x = 0.1$ . Use the value of  $h = 0.1$ . [4]

- c) If  $f \in C^3[a, b]$  and  $x-h, x, x+h \in [a, b]$  then state the centered formula for the first order derivative  $f'(x)$  of  $O(h^2)$ . [2]

- Q5) a)** Evaluate the value of the integral  $\int_0^6 \frac{dx}{1+x^2}$  by dividing the interval  $[0, 6]$  into six equal parts using Trapezoidal rule. [4]

- b) Consider the system of equations given by [4]

$$4x - y = 15$$

$$x + 5y = 9$$

- i) What is the exact solution to the system.  
 ii) Use the Gauss Seidel iterative method to find a solution the system given the initial approximation  $P_0 = (0, 0)$  to find  $P_1, P_2$ .  
 c) Find the first two approximation to the root of the equation  $x^3 - x - 1 = 0$  using Bisection method given that root lies between 1 and 2. [2]

- Q6) a)** Define a fixed point for a system of equations given by  $x = g_1(x, y)$  and  $y = g_2(x, y)$  and hence find a fixed point for the system [4]

$$x = g_1(x, y) = x - y^2$$

$$y = g_2(x, y) = -x + 6y$$

- b) Show that the equation of the Lagrangian polynomial passing through points  $(x_0, y_0)$  and  $(x_1, y_1)$  is given by [4]

$$L_1(x) = y_0 \frac{(x - x_1)}{(x_0 - x_1)} + y_1 \frac{(x - x_0)}{(x_1 - x_0)}$$

- c) Define the terms relative error and absolute error. [2]

- Q7) a)** Assume that  $f \in C^2[a, b]$  then show that the error term in the Lagrangian polynomial  $L_1(x)$  is given by  $E_1(x) = \frac{(x - x_0)(x - x_1)f^{(2)}(c)}{2!}$  where  $c \in [a, b]$ . [5]

- b) Consider the non linear system

$$0 = x^2 - 2x - y + 0.5$$

$$0 = x^2 + 4y^2 - 4$$

Use Newton's method for non-linear systems to find the approximate solution  $(p_1, q_1)$  using initial approximation  $(p_0, q_0) = (2, 0.25)$  [5]

- Q8) a)** Use House Holder's transform method reduce the matrix [5]

$$A = \begin{bmatrix} 1 & 4 & 3 \\ 4 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix} \text{ to a tridiagonal form.}$$

- b) Use the power method to find the dominant eigenvalue and eigenvector for the matrix

$$A = \begin{bmatrix} 0 & 11 & -5 \\ -2 & 17 & -7 \\ -4 & 26 & -10 \end{bmatrix} \text{ with initial approximation } X_0 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \quad [5]$$

EEE



Total No. of Questions : 8]

SEAT No. :

**P2935**

**[4839]-204**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-204 : Object Oriented Programming with C++**

**(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)** Attempt all of the following:

- a) What is Data Encapsulation. [2]
- b) What is a constructor? Explain its types with suitable example. [4]
- c) What is an inline function? What are its limitations? [4]

**Q2)** Attempt all of the following:

- a) Write advantages of object oriented programming. [2]
- b) Explain access specifiers in C++. [4]
- c) What are the functions provided by istream class? Explain any two. [4]

**Q3)** Attempt all of the following:

- a) Differentiate between virtual function & pure virtual function. [2]
- b) Explain an exception handling in C++. [4]
- c) Write a C ++ program for creating file with constructor function. [4]

**Q4)** Attempt the following:

- a) What is implicit and explicit type conversion? [2]
- b) Write a note on friend function. [4]
- c) Write a program in C++ to accept an email address & throw an exception if it does not contain @ a multiple @ symbols. [4]

**P.T.O.**

**Q5)** Attempt all of the following:

- a) “A function can be declared as private”, state true or false . Justify. [2]
- b) How operator overloading function is invoked if defined as
  - i) Member function
  - ii) Friend function [4]
- c) Describe the various approaches by which we can detect the end-of-file condition successfully, with example. [4]

**Q6)** Attempt all of the following:

- a) Define this pointer in C ++. [2]
- b) Write a C++ program to overload function concat ( ) which will concatenate .
  - i) Two strings
  - ii) String and int [4]
- c) Write a C ++ program to find factorial of number. [4]

**Q7)** Attempt all of the following:

- a) Explain single private inheritance with example. [5]
- b) Explain class template with multiple parameters with example. [5]

**Q8)** Attempt all of the following:

- a) There are 50 records present in a file, each record containing 6-characters for item-code, 20 characters for item-name and an integer price. Write a program to read these records arrange them in the descending order of price & write them in the same file overwriting the earlier records. [5]
- b) Explain getline ( ) and write ( ) functions with suitable example. [5]



Total No. of Questions :8]

SEAT No. :

**P2936**

**[4839]-205**

[Total No. of Pages :3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**COMPUTER SCIENCE**

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

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

*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.*
- 3) All questions carry equal marks.*

**Q1)** Attempt all of the following:

- a) Explain how a circular queue can be implemented using array. **[4]**
- b) Write a function to delete a node by its value from a singly linked list. **[4]**
- c) Define Abstract Data Type. **[2]**

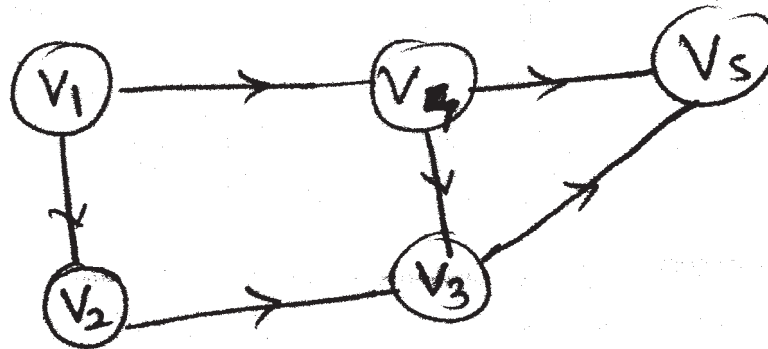
**Q2)** Attempt all of the following:

- a) Write a note on Round Robin CPU scheduling Algorithm. **[4]**
- b) Explain push and pop operations of stack using linked list. **[4]**
- c) Define: **[2]**
  - i) Strictly Binary Tree
  - ii) Complete Binary Tree

**P.T.O.**

**Q3)** Attempt all of the following:

- a) Draw adjacency Matrix, Adjacency list and calculate Indegree and outdegree of the following graph. [4]



- b) Write a note on Binary search method. [4]
- c) What is DEQUEUE? State two types of DEQUEUE. [2]

**Q4)** Attempt all of the following:

- a) Discuss inorder and preorder traversal technique with example. [4]
- b) Write a short note on multiple stack. [4]
- c) Match the following: [2]

<u>Side A</u>	<u>Side B</u>
i) Bubble sort	1) $O(\log n)$
ii) Merge sort	2) $O(n^2)$
iii) Linear search	3) $O(n \log n)$
iv) Binary search	4) $O(n)$

**Q5)** Attempt all of the following:

- a) Write a function to add ( ) and Remove ( ) element in linear queue using array. [4]
- b) Construct the Binary Tree from the following data and show all steps for creation.  
70 35 9 85 90 22 16 75 105 [4]
- c) What is best case and worst case complexity of quick sort. [2]

**Q6)** Attempt all of the following:

- a) Write a function to insert element in doubly linked list. **[4]**
- b) Explain how a queue can be used in scheduling algorithm. **[4]**
- c) Define: **[2]**
  - i) Time complexity
  - ii) Big oh(O) notation.

**Q7)** Attempt all of the following:

- a) Show the stack contents while converting the following infix string to postfix.  $A + B * C - D$  **[5]**
- b) Explain the static implementation of Binary Tree using arrays. Give its disadvantages. **[5]**

**Q8)** Attempt all of the following:

- a) Sort the following data using Insertion sort method and show all the passes. Also give the best case and worst case complexity for insertion sort. 94 10 6 39 40 125 55. **[5]**
- b) Write an algorithm to implement Depth First Search (DPS). **[5]**

*EEE*

Total No. of Questions : 5]

SEAT No. :

**P2909**

**[4839]-21**

[Total No. of Pages : 3

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

**MATHEMATICS**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-201 : Real and Complex Analysis**

**(2008 Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Define outer measure. Show that a set containing single element has outer measure is zero.
- b) Prove that if  $m^*A = 0$ , then  $m^*(A \cup B) = m^*B$ .
- c) Show that the set  $[0, 1]$  is not countable.
- d) Show that a continuous function is measurable.
- e) Let  $f(x) = \begin{cases} 0; & x \text{ is irrational} \\ 1; & x \text{ is rational} \end{cases}$   
then prove that  $\mathbb{R} \int_a^{\bar{b}} f(x) = b - a$ .
- f) Define analytic function. Show that  $f(z) = z$  is an entire function.
- g) Prove that  $f(z) = \sin z$  is not bounded function.
- h) State Cauchy-Riemann equations in polar form.
- i) Define removable singularity.
- j) State Rouché's theorem.

**P.T.O.**

**Q2) a) Attempt Any One of the following: [6]**

- i) Prove that the interval  $(a, \infty)$  is measurable.
- ii) Prove that any function defined on a set of measure zero is a measurable function.

**b) Attempt Any Two of the following: [10]**

- i) Let  $\langle E_n \rangle$  be a sequence of measurable sets, then prove that  $m(\cup E_i) \leq \sum mE_i$ .
- ii) Let  $f$  be a measurable function and  $f = g$  a.e. then prove that  $g$  is measurable.
- iii) Let  $f(x) = 1; x$  is rational in  $[0, 1]$   
 $= 0; x$  is irrational in  $[0, 1]$

show that  $f$  is measurable on  $[0, 1]$ .

**Q3) a) Attempt Any One of the following: [6]**

- i) If  $\langle f_n \rangle$  be a sequence of nonnegative measurable functions and  $f_n(x) \rightarrow f(x)$  almost everywhere on a set  $E$ , then prove that

$$\int_E f \leq \liminf_E \int_E f_n.$$

- ii) If  $f$  and  $g$  are two measurable functions defined on some domain, then prove that  $f + g$  is also measurable.

**b) Attempt Any Two of the following: [10]**

- i) Suppose that  $f$  is analytic in a domain  $D$ . If  $f'(z) = 0$  in  $D$  then prove that  $f$  is constant.

- ii) For each fixed  $z \neq 0$ , prove that  $\lim_{n \rightarrow \infty} |z|^{1/n} = 1$ .

- iii) Evaluate:  $I = \int_{\gamma} f(z) dz$

where  $f(z) = z^n$  and  $\gamma(t) = e^{it}, 0 \leq t \leq 2\pi, n$  is integer.

**Q4) a) Attempt Any One of the following: [6]**

- i) If  $f$  is analytic with  $f'$  is continuous inside and on a simple closed contour  $\gamma$  then prove that  $\int_{\gamma} f(z) dz = 0$ .
- ii) Prove that a bounded entire function is constant.

**b) Attempt Any Two of the following: [10]**

- i) Using Cauchy integral formula, evaluate:

$$\int_{|z|=1} \frac{\cos z}{z(z-4)} dz.$$

- ii) Show that a nonzero analytic function with constant modulus in a domain is constant.
- iii) Prove that every zero of a nonzero analytic function  $f$  is isolated.

**Q5) a) Attempt Any One of the following: [6]**

- i) Suppose that  $f$  is continuous in an open set  $D$  with the property that  $\int_C f(z) dz = 0$  for each closed contour  $C$  in  $D$ . Prove that  $f$  is analytic in  $D$ .
- ii) Prove that every non identity Möbius transformation  $T: \mathbb{C}_{\infty} \rightarrow \mathbb{C}_{\infty}$  has at most two fixed points in  $\mathbb{C}_{\infty}$ .

**b) Attempt Any Two of the following: [10]**

- i) Find the Möbius transformation which sends  $0$  to  $1$ ,  $i$  to  $0$  and  $\infty$  to  $-1$ .
- ii) Find  $\text{Res}[f(z); -i]$ , where  $f(z) = \frac{\log(1+z)}{(1+z^2)^{-2}}$ .
- iii) Prove that for every closed contour  $\gamma$  in  $\mathbb{C}$  and  $a \in \mathbb{C} - \{\gamma\}$ ,  $\eta(\gamma; a)$  is an integer.





Total No. of Questions : 5]

SEAT No. :

**P2910**

[4839]-22

[Total No. of Pages : 4

M.Sc. (Tech.)

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-202 : Algebra-II**

**(2008 Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[8 × 2 = 16]**

- a) Let  $V = \mathbb{R}^3$ ,  $W = \{(x, y, z) \in V \mid x^2 - y^2 = 0\}$ . Is  $W$  a subspace of  $V$ ? Why?
- b) Show that the set  $B = \{2, 1 + x, 1 + x^2\}$  is basis for  $P_2(x)$ .
- c) Find characteristic polynomial for the following matrix:  $A = \begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$ .
- d) If  $A$  is  $3 \times 4$  matrix and nullity of  $A$  is 2, then find rank of  $A$ .
- e) Determine whether the map  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  is linear transformation: if not give reason.  
$$T(x, y) = (y, x + 1).$$
- f) Construct a field containing four elements.
- g) Show that  $\alpha = \sqrt[3]{2} + 1$  is algebraic over the field of rationals.
- h) Let  $F = \frac{\mathbb{Z}}{2\mathbb{Z}}$ . Give an example of an irreducible polynomial of degree 3 over  $F$ .
- i) Show that  $\mathbb{Q}(\sqrt{3}, i) = \mathbb{Q}(\sqrt{3} + i)$ .
- j) Find a splitting field of  $X^3 - 1$  over  $\mathbb{Q}$ ; a field of rationals.

**P.T.O.**

**Q2) a)** Attempt Any One of the following: [6]

- i) Let  $V$  be a vector space which is spanned by a finite set of vectors  $\beta_1, \beta_2, \dots, \beta_m$ . Then show that any independent set of vectors in  $V$  is finite and contains no more than  $m$ -elements.
- ii) Let  $U$  and  $V$  be vector spaces over a field  $F$  and let  $T: U \rightarrow V$  be a linear transformation from  $U$  onto  $V$ ; let  $U$  be a finite dimensional vector space. Prove that,

$$\text{dimension}(U) = \text{Rank}(T) + \text{Nullity}(T).$$

**b)** Attempt Any Two of the following: [10]

- i) If ' $k$ ' is positive integer,  $\lambda$  is an eigen value of a matrix  $A$ ,  $X$  is a corresponding eigen vector, then  $\lambda^k$  is an eigen value of  $A^k$  and  $X$  is a corresponding eigen vector.
- ii) Find the rank and nullity of the matrix

$$A = \begin{bmatrix} 1 & 4 & 5 & 6 & 9 \\ 3 & -2 & 1 & 4 & -1 \\ -1 & 0 & -1 & -2 & -1 \\ 2 & 3 & 5 & 7 & 8 \end{bmatrix}.$$

- iii) Let  $P_2 = \{a_0 + a_1x + a_2x^2 \mid a_i \in \mathbb{R}\}$ , for  $i = 0, 1, 2$  be a vector space with inner product  $\langle p, q \rangle = \int_{-1}^1 p(x) \cdot q(x) dx$ .  
if  $p(x) = 1$  and  $q(x) = x$ , show that the vectors  $p$  and  $q$  are orthogonal in  $P_2$ .

**Q3) a)** Attempt Any One of the following: [6]

- i) Suppose  $T: V \rightarrow W$  is a linear transformation prove that  $\text{Ker}(T)$  is subspace of  $V$  and range of  $T$  is subspace of  $W$ .
- ii) State and prove Cauchy-Schwarz inequality.

b) Attempt Any Two of the following: [10]

i) Find a matrix 'P' that diagonalizes the matrix A, where

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

ii) Let  $u = (-1, 1, 2)$  and  $v = (2, -1, 2)$  then find  $\langle 2u - 3v, 3u + v \rangle$ .

iii) Determine  $a, b, c, d, e, f$ ; given that  $V_1 = (1, 1, 1)$ ,  $V_2 = (1, 0, -1)$  and  $V_3 = (1, -1, 0)$  are eigen vectors of matrix A, where

$$A = \begin{bmatrix} 1 & 1 & 1 \\ a & b & c \\ d & e & f \end{bmatrix}$$

**Q4)** a) Attempt Any One of the following: [6]

i) Prove that every finite extension is an algebraic extension. What about the converse? Justify your answer.

ii) Let 'K' be a field. Let G be the group of automorphisms of K. Define a fixed field of G. Prove that a fixed field of G is a subfield of K.

b) Attempt Any Two of the following: [10]

i) Show that the splitting field of  $x^5 - 1 \in \mathbb{Q}[X]$  is of degree 4.

ii) Find a degree of extension of  $\mathbb{Q}(\alpha)$  over  $\mathbb{Q}$ , where  $\alpha = \sqrt{2} + \sqrt{3}$ . Also find the irreducible polynomial satisfied by ' $\alpha$ ' over  $\mathbb{Q}$ .

iii) Find the degree and the basis for  $\mathbb{Q}(\sqrt{2}, \sqrt[3]{2}, \sqrt[4]{2})$  over  $\mathbb{Q}$ .

**Q5)** a) Attempt Any One of the following: [6]

i) Let E be a finite extension of a field F of degree 'm' and K is a finite extension of E of degree n, then prove that  $[K : F] = m \cdot n$ .

- ii) If  $E$  is a finite field of characteristic ' $p$ ', then prove that  $E$  contains exactly  $p^n$  elements for some positive integer  $n$ .
- b) Attempt Any Two of the following: [10]
- i) Let  $F$  be a finite field of characteristic  $p$ , define
- $$\phi: F \rightarrow F \text{ by}$$
- $$\phi(a) = a^p$$
- Show that  $\phi$  is an automorphism of  $F$ .
- ii) Prove that the non-zero elements of a finite field  $F$  is a cyclic group under multiplication.
- iii) Let ' $p$ ' denote a prime number and  $f(x) = x^p - 1$ . Let  $K$  denote the splitting field of  $f(x)$  over  $\mathbb{Q}$ .
- Find Galois Group of  $K$  over  $F$ .



Total No. of Questions : 5]

SEAT No. :

**P2911**

**[4839]-23**

[Total No. of Pages : 4

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-203 : Discrete Mathematical Structures-II**

**(2008 Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Define complete graph and give an example of a complete graph.
- b) Define planar graph.
- c) Define K-chromatic graph.
- d) Find edge connectivity of  $K_n$ .
- e) Define asymmetric diagraphs.
- f) Draw a simple 3 regular graph on 6 vertices.
- g) When is a diagraph G said to be an arborescence?
- h) Draw all simple non isomorphic unlabelled graphs on 3 vertices.
- i) Give an example of a self complementary graph.
- j) State true or false with justification: Every disconnected graph has an isolated vertex.

**Q2)** a) Attempt Any One of the following:

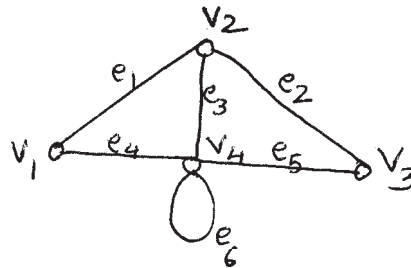
**[6]**

- i) Prove that a connected graph G is an Euler graph if and only if it can be decomposed into circuits.
- ii) Prove that every tree has either one or two centers.

**P.T.O.**

b) Attempt Any Two of the following: [10]

- i) Find the smallest integer  $n$  such that  $K_n$  has atleast 600 edges.
- ii) Write incidence and adjacency matrix of the following graph:



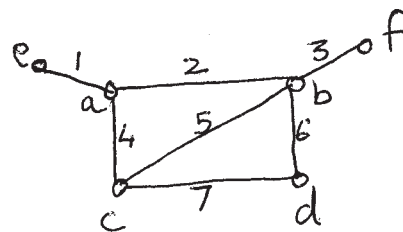
- iii) Find maximum and minimum height of a binary tree with 13 vertices. Draw such trees.

Q3) a) Attempt Any One of the following: [6]

- i) Prove that a tree with  $n$ -vertices has  $n-1$  edges.
- ii) Show that  $K_5$  is not planar.

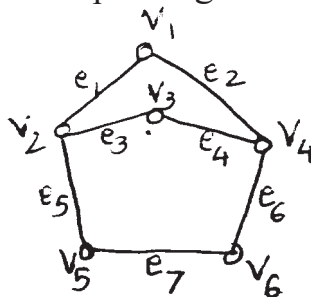
b) Attempt Any Two of the following: [10]

- i) The graph  $G$  is given below. Find the graph obtained if the vertices 'a' and 'b' in  $G$  are fused.



G

- ii) Write a short note on Chinese postman problem.
- iii) Find any two spanning trees of the graph  $G$  given below.



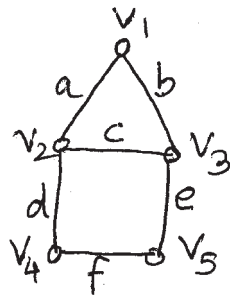
G 2

**Q4) a)** Attempt Any One of the following: [6]

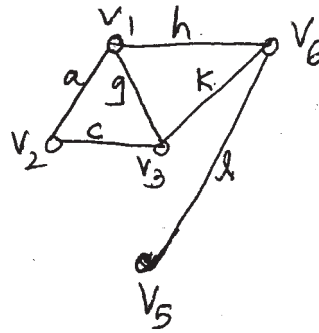
- i) Prove that a connected planar graph with ' $n$ ' vertices and ' $e$ ' edges has  $(e - n + 2)$  regions.
- ii) Explain depth first search (DFS) algorithm for a graph.

**b)** Attempt Any Two of the following: [10]

- i) Let  $T$  be a binary tree with ' $n$ ' vertices. Show that  $T$  has  $\frac{n+1}{2}$  pendant vertices.
- ii) Find  $G_1 \oplus G_2$  of the following graphs  $G_1$  and  $G_2$ .



$G_1$



$G_2$

- iii) The two graphs  $G_1$  and  $G_2$  are given below. Are  $G_1$  and  $G_2$  isomorphic? Justify.



$G_1$



$G_2$

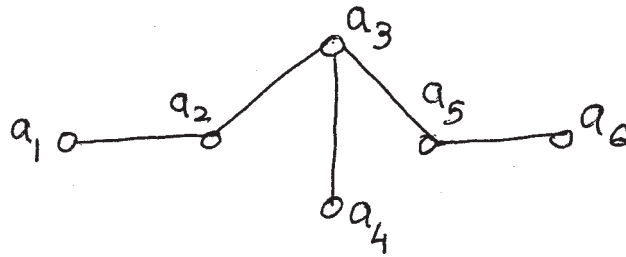
**Q5) a)** Attempt Any One of the following: [6]

- i) Prove that if in a graph  $G$  there is one and only one path between every pair of vertices, then  $G$  is a tree.
- ii) Prove that a simple graph with  $n$ -vertices and  $k$ -components can have at most  $\frac{(n-k)(n-k+1)}{2}$  edges.

**b)** Attempt Any Two of the following: [10]

- i) Explain simple sequential colouring algorithm for colouring a graph  $G$ .

- ii) Find eccentricity of each vertex in the following tree. Hence find centre of the tree.



- iii) Prove that in any simple connected planar graph with  $f$  regions,  $n$  vertices and  $e$  edges ( $e > 2$ ), the following inequalities hold:

$$e \geq \frac{3}{2}f \text{ and } e \leq (3n - 6).$$





Total No. of Questions : 5]

SEAT No. :

**P2912**

**[4839]-24**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-204 : Database Fundamentals**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[8 × 2 = 16]**

- a) Define: Schema.
- b) What is candidate key?
- c) What is degree of relationship? Explain.
- d) Define: Hashing.
- e) What is derived attribute? Explain with example.
- f) State any two aggregate functions used in SQL.
- g) What is referential integrity? Explain.
- h) Define: Strong Entity Set.
- i) What are joins?
- j) Explain having clause, group by used in SQL.

**Q2)** Attempt Any Four of the following:

**[4 × 4 = 16]**

- a) Write a short note on data independence.
- b) Explain the architecture of DBMs.

***P.T.O.***

- c) Differentiate between specialization and generalization.
- d) What is meant by data model? Explain any one type.
- e) Write a short note on: Normalization and its forms.

**Q3)** Attempt Any Four of the following:

**[4 × 4 = 16]**

- a) What is functional dependency? Explain.
- b) Write a short note on: cursors.
- c) Explain various DML statements used in SQL.
- d) Explain lossless join decomposition.
- e) State the Role of DBA with respect to security.

**Q4)** Attempt Any Four of the following:

**[4 × 4 = 16]**

- a) Consider the following schema

Suppliers (sid, sname, address)

Parts (Pid, Pname, Color)

Catalog (Sid, Pid, Cost).

Write the following query in relational algebra.

- i) Find the names of suppliers who supply some red part.
- ii) Find the supplier id's of supplier who supply some red or green part.
- b) Explain following relational algebra operators with examples.
  - i) Rename                                      ii) Division
  - iii) Cartesian Product                      iv) Set difference
- c) Write a short note on: "Components of DBMs".
- d) Consider relation as follows:
 

Game (Gno, gname, no. of\_players, coach\_name, Captain)

Player (Pno, Pname)

Game and player are related with many\_to many relationship. Create RDB and solve following SQL queries.

- i) Count the total number of players whose coach name is “Mr. Joshi”.
  - ii) List the name of player playing ‘Cricket’ and ‘Hockey’.
- e) Write a note on Joins in SQL.

**Q5) a) Solve Any Two of the following: [2 × 4 = 8]**

- i) Explain different types of attributes with example.
- ii) “ABC” hospital admits many patients; patients may be outpatients or inpatients. If in-patients they are admitted in rooms, patients are provided with all facilities like lab-tests, medicines. Hospital runs its own lab and medical store. Doctor treats the patients.

Study the above case and do the following.

- A) Design an E-R diagram.
- b) Design the relation database.

- iii) Explain aggregation with proper example.

**b) Solve Any Two: [2 × 4 = 8]**

- i)  $F = \{A \rightarrow B, CD \rightarrow E, A \rightarrow C, B \rightarrow D, E \rightarrow A\}$

Compute closure of F i.e.  $F^+$ .

- ii) Explain integrity constraints.
- iii) Explain advantages of DBMs.



Total No. of Questions : 5]

SEAT No. :

P2913

[4839]-25

[Total No. of Pages : 3

M.Sc. (Tech.)

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-205 : Data Structures Using 'C'

(2008 Pattern) (Semester-II)

Time : 3 Hours]

[Max. Marks : 80

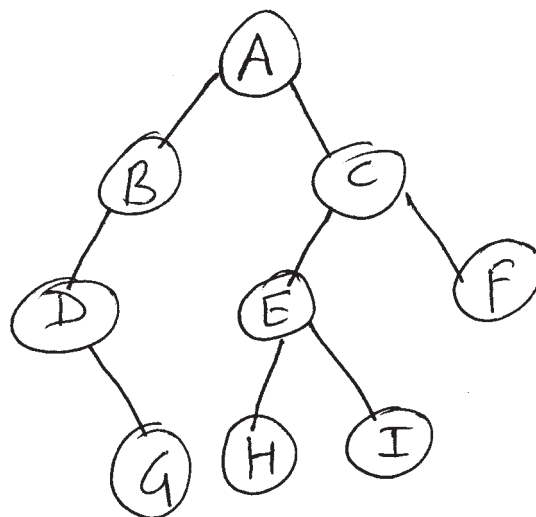
Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) All questions carry equal marks.

Q1) Attempt Any Eight of the following:

[8 × 2 = 16]

- a) Define:
  - i) Siblings
  - ii) Ancestors
- b) "The use of Data structures improves program efficiency". State True/False and justify.
- c) Give the Inorder, Preorder Traversal for the following Tree.



- d) Give the Best Case and Worst Case time Complexity of Quick sort with respect to Big oh(o) Notation.
- e) Discuss the C structure and definition for Doubly Linked List.

P.T.O.

- f) Define Graph and Isolated Vertex.
- g) What is the advantage of circular linked list over singly Linked list?
- h) Convert the following infix expression to prefix  $A + (B + C * D) / E - F / G$ .
- i) Define the term Data Structure.
- j) What is Dequeue? State two types of Dequeue.

**Q2)** Attempt Any Two of the following: **[2 × 8 = 16]**

- a) Write a C program to create a Binary Tree and Print its Contents Using inorder and Preorder traversals.
- b) Write a C Program to implement stack Using Linked List.
- c) Write a C Program to sort the n elements of an array using Quick Sort Method.

**Q3)** Attempt Any Four of the following: **[4 × 4 = 16]**

- a) Write a short note on Priority Queue.
- b) Write a function to insert a node in a singly linked list at the end.
- c) Explain Linear and non-linear data structures with suitable example.
- d) Write an algorithm to implement Breath First Search (BFS).
- e) Sort the following numbers Using Insertion Sort Method and show All the steps of Passes.

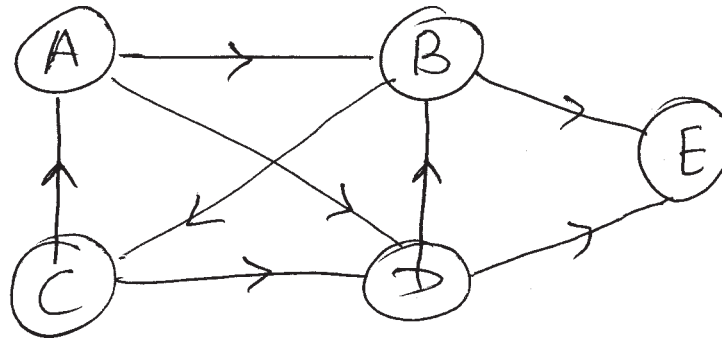
30 40 10 50 25 35 15

**Q4)** Attempt Any Four of the following: **[4 × 4 = 16]**

- a) Evaluate the following Postfix Expression using stack. Also give contents of stack.

$XY+Z-WU*/$  where  $X = 6$   $Y = 4$   $Z = 2$   $W = 3$   $U = 2$ .

- b) Write a function to search an element in a singly linked list.
- c) What is drawback of Linear queue? State the possible solution to overcome this drawback.
- d) Draw adjacency matrix, adjacency list and calculate indegree and outdegree of the following graph.



- e) Write a function to ADD( ) and Remove ( ) Elements in linear queue using array.

**Q5) Attempt Any Four of the following: [4 × 4 = 16]**

- a) Write a function to insert a node in Doubly Linked List.
- b) Discuss the efficiency of Merge Sort Algorithm in Best Case & Worst Case.
- c) Define Binary Search Tree. Show the steps to Create Binary Search Tree for following Data.  
25 60 10 15 35 40 70
- d) Write function to implement Add ( ) & Remove ( ) operations in Circular queue using arrays.
- e) Write short note on Binary Search Method.



Total No. of Questions : 8]

SEAT No. :

P2937

[4839]-301

[Total No. of Pages : 2

M.Sc. (Tech.)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-301 : General 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 indicate full marks.

- Q1)** a) Let  $A$  be a subset of a topological space  $X$  then show that  $x \in \bar{A}$  if and only if every open set  $U$  containing  $x$  intersects  $A$  [4]
- b) Consider the set  $X = \{a, b, c\}$ . Define a topology  $T$  on  $X$  given by  $T = \{\Phi, X, \{a, b\}, \{b\}, \{b, c\}\}$  [4]
- i) Show that  $T$  is Non Hausdroff.
  - ii) Show that the sequence  $x_n = b$  converges to point  $a, b$ , and  $c$  respectively.
- c) Give an example of a subset of a Topological space  $X$  with exactly three limit points. [2]
- Q2)** a) Show that the countable collection  $B = \{(a, b) \mid a < b \text{ } a, b \text{ are rationals}\}$  is a basis that generates standard topology on  $\mathbb{R}$ . [4]
- b) Give an example of a Topological space  $X$  which is connected but not path connected. [4]
- c) Determine the closure of the set  $A = \left\{ \frac{1}{n} \mid n \in \mathbb{Z}^+ \right\}$  considered as a subset of  $\mathbb{R}$ . [2]
- Q3)** a) Show that compactness implies limit point compactness. [4]
- b) Show that product of Hausdroff spaces is Hausdroff. [4]
- c) Define a Locally connected space  $X$ . [2]

P.T.O.

- Q4)** a) Show that continuous image of path connected space is path connected. [4]  
 b) Give an example of a Topological space which is Hausdroff but not regular. [4]  
 c) State Tychonoff theorem. [2]
- Q5)** a) Let  $f : A \rightarrow x \times y$  be given by the equation  $f(a) = ( f_1(a), f_2(a) )$ . Show that if  $f_1, f_2$  are continuous then  $f$  is continuous. [4]  
 b) Show that one point compactification of  $\mathbb{R}$  is homeomorphic to a unit circle  $S^1$ . [4]  
 c) State Tube Lemma. [2]
- Q6)** a) Show that a compact subspace of a Hausdroff space is closed. [4]  
 b) Consider the unit circle  $S^1 = \{ (x,y) / x^2 + y^2 = 1 \}$ . [4]  
 Let  $f : S^1 \rightarrow \mathbb{R}$  be continuous. Show that there exists a point  $X \in S^1$  such that  $f(x) = f(-x)$ .  
 c) State First countability Axiom. [2]
- Q7)** a) Show that every metric space is normal. [5]  
 b) i) Show that a subspace of a regular space is regular. [2]  
 ii) Show that the product of a regular space is regular. [3]
- Q8)** a) State and prove Intermediate Value theorem. [5]  
 b) State and prove pasting Lemma. [5]





Total No. of Questions :8]

SEAT No. :

P2938

[4839]-302

[Total No. of Pages :2

M.Sc. (Tech.)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM- 302: Design and Analysis of Algorithms

(2013 Pattern) (Semester - III)

Time : 3 Hours]

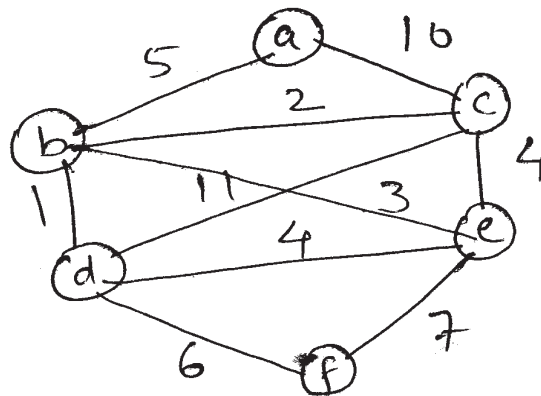
[Max. Marks :50

Instructions to the candidates:

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

Q1) a) Write a note on "Elements of Greedy strategy". [5]

b) Illustrate Kruskal's algorithm for following graph. [5]



Q2) a) Write an algorithm for "Merge sort". [5]

b) Sort the following array using quick sort algorithm.  
{1.30, 75, 80, 55, 135, 50, 40, 115, 90}. [5]

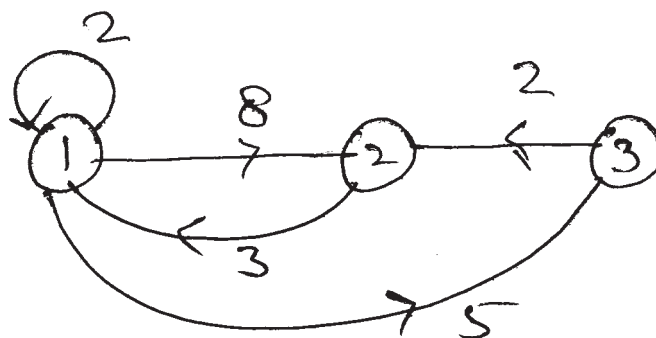
Q3) a) What is Heap property? Explain with an example what are uses of Heap. [5]

b) What is longest common subsequence problem? [3]

c) Define big O notation. [2]

P.T.O.

- Q4)** a) Construct Huffman coding tree for the following set of frequencies.  
 A : 0.08, B : 0.10, C : 0.12, D : 0.15, E : 0.20, F : 0.35. [5]
- b) What is dynamic programming? [3]
- c) Define directed a cyclic graph (DAG) [2]
- Q5)** a) Explain activity selection problem. Give an algorithm. [5]
- b) Discuss NP complete and reducibility. [3]
- c) Define space complexity and time complexity. [2]
- Q6)** a) Order in ascending order of growth rates  $n^2 \log n$ ,  $20n^2$ ,  $\log n^2$ ,  $2^n$ ,  $n^n$ ,  $n^5$ . [5]
- b) Explain knapsack problem. [3]
- c) Show that  $7n^2 + 2n \in \theta(n^2)$ . [2]
- Q7)** a) Find all pairs shortest path using Floyd Warshall's algorithm for following directed graph G. [5]



- b) Explain principle of optimality. [3]
- c) What is time complexity of Bellman Ford algorithm. [2]
- Q8)** a) Write an algorithm for matrix chain multiplication. [5]
- b) What is polynomial time verification? [3]
- c) Explain sorting in linear time. [2]

EEE

Total No. of Questions :8]

SEAT No. :

**P2939**

**[4839]-303**

[Total No. of Pages :3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM- 303: Object Oriented Software Engg.**

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

*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 all of the following:

- a) Explain the evolutionary development model. **[4]**
- b) Explain the activities involved in system design process. **[4]**
- c) What are the key challenges facing software engineering? **[2]**

**Q2)** Attempt all of the following:

- a) Explain briefly the requirements engineering process. **[4]**
- b) State True / false and justify. **[4]**
  - i) Associations are inherently bi-directional.
  - ii) Generalization is called 'a-part-of' relationship.
- c) What are the attributes of good software? **[2]**

**P.T.O.**

**Q3)** Attempt all of the following:

- a) Write a note on Data flow model. [4]
- b) Explain the client - server architecture. [4]
- c) Define system reliability and availability. [2]

**Q4)** Attempt all of the following:

- a) Explain the principles of Agile methods. [4]
- b) Explain software inspections and software testing briefly. [4]
- c) Define critical systems. [2]

**Q5)** Attempt all of the following:

- a) What is the goal of test case design process and discuss the various approaches to test case design process. [4]
- b) Draw a class diagram for a PLACEMENT Agency. Placement agencies help the candidates to get suitable jobs depending on various factors such as qualifications, experience and other skills (Typing, computer knowledge etc.) Clearly specify the assumptions made and also mention the attributes and operations of each class. [4]
- c) Give any two advantages of Waterfall' model. [2]

**Q6)** Attempt all of the following:

- a) Explain the tools included in Rapid Application Development. (RAD) environment. [4]
- b) Explain the non functional requirements of the system along with its types. [4]
- c) What are legacy systems? [2]

**Q7)** Attempt all of the following:

- a) Explain the cleanroom software development process. [5]
- b) A computerized authoring tool is to be developed so that several authors can write a book simultaneously over a network. A book has several chapters which can have sections and subsections. Authors can add paragraphs, to existing subsection or can add new subsection (section, chapter etc). One of the author is designated as editor who can add, modify, delete paragraphs added by any author. Authors can add or modify pages like preface foreword, index, references, contexts etc. Draw a use-case and a class diagram for the above description. [5]

**Q8)** Attempt all of the following:

- a) Explain integration testing. [5]
- b) Explain the distributed object architecture along with its advantages. [5]

*EEE*

Total No. of Questions :8]

SEAT No. :

**P2940**

**[4839]-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 questions.*
- 2) Figures to the right indicate full marks.*

**Q1)** Attempt all of the following:

- a) What is an Operating System? **[2]**
- b) List the system calls related with system accounting/information and explain any two. **[4]**
- c) Explain what is process scheduling? Discuss different types of schedulers. **[4]**

**Q2)** Attempt all of the following:

- a) How many page faults occur using Least Recently Used (LRU) page replacement algorithm for the following page reference string with three page frames? 0, 1, 2, 1, 4, 2, 3, 7, 2, 1, 3 **[2]**
- b) Write a note on dining philosophers problem. **[4]**
- c) Write a note on Process Context Switch. **[4]**

**P.T.O.**

**Q3)** Attempt all of the following:

- a) What is Internal and External fragmentation? [2]
- b) What is critical section? Explain requirements of critical section problem. [4]
- c) Write a difference between User level thread and Kernal level thread. [4]

**Q4)** Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process Burst Time Priority

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5 all at time 0.

- a) Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, non-preemptive priority (a smaller priority number implies a higher priority), and Round Robin (quantum = 2) scheduling. [4]
- b) What is the waiting time of each process for each of the scheduling algorithms of questions a? [4]
- c) Which of the scheduling algorithm gives the minimal average waiting time? [2]

**Q5)** Attempt all of the following:

- a) What is multithreading? [2]
- b) Explain PCB with suitable diagram [4]
- c) Write a note on file operations. [4]

**Q6)** Attempt all of the following:

- a) Define following term: [2]
  - i) Seek Time
  - ii) Rotational latency
- b) Suppose that a disk drive have 200 cylinders, numbered 0 to 199. the drive is currently serving at cylinder 53, and the pending request queue is: 98, 183, 37, 122, 14, 127, 65, and 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? [4]
  - i) FCFS
  - ii) Shortest Seek Time First (SSTF)
  - iii) SCAN
  - iv) CSCAN
- c) Explain the steps for handling the Page Fault. [4]

**Q7)** Attempt all of the following:

- a) Explain the difference between Paging and Segmentation. [5]
- b) What are different File Allocation methods? Explain in detail. [5]

**Q8)** Attempt the following:

- a) Which scheduler controls the degree of multiprogramming? How? [2]
- b) Write a note on bounded buffer problem using semaphore? [4]
- c) Draw & explain process state diagram. [4]

*EEE*



Total No. of Questions :8]

SEAT No. :

**P2941**

**[4839]-305**

[Total No. of Pages :4

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM- 305: Database Fundamentals**

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

*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 All the following:

- a) Explain the term 'relation' in relational data model. Explain different types of relationships with example. **[4]**
- b) What is functional dependency? Explain. **[4]**
- c) State the purpose of '6' operator. **[2]**

**Q2)** Attempt all of the following:

- a) What is deadlock state? Explain the schemes for deadlock prevention. **[4]**
- b) What is group by clause? Explain with examples. **[4]**
- c) What are multivalued attributes? **[2]**

**Q3)** Attempt All of the following:

- a) Write a short note on: cursors. **[4]**
- b) Describe the concept of transitive dependency and explain how this concepts is used to define 3NF. **[4]**
- c) Define: **[2]**
  - i) Strong entity set
  - ii) Weak entity set

**P.T.O.**

**Q4)** Attempt All of the following:

- a) Write a short note on: Database system users. [4]
- b) Explain specialization and Generalization. [4]
- c) “Unique constraint and primary key has same meaning” state true or false. Justify. [2]

**Q5)** Attempt All of the following:

- a) Write a short note on: Normalization and its forms. [4]
- b) Discuss naming conventions used for E-R schema. [4]
- c) Explain following aggregate functions with example. [2]
  - i) AVG
  - ii) COUNT (\*)

**Q6)** Attempt All of the following:

- a) Explain tuple relational calculus. [4]
- b) Write a note on joins in SQL. [4]
- c) Define: [2]
  - i) A transaction
  - ii) Foreign key

**Q7)** Attempt All of the following:

- a) An insurance agent sells policies to clients. Each policy is of particular type like vehicle insurance, life insurance, accident insurance etc. there can be many policies of a particular type. Each policy will have many monthly premiums and each premium is associated to only one type. [5]

- i) Draw E-R diagram for the given casestudy.
  - ii) Convert E-R diagram into relational database by specifying relational schema.
  - iii) Identify primary key four each entity set.
- b) Consider the following relational database [5]

river (r-code, rname, capacity, no. of. dams origin)

city (C-code, C-name, state, country)

flows (r-code, C-code, no-of-holy-plates)

Solve following relational algebra queries.

- i) List all the rivers which flow from 'Agro' city.
- ii) List all rivers with no of dams built on them from 'Maharashtra' state.

**Q8)** Attempt All of the following:

- a) The following is an interleaved execution of set of transactions  $T_1, T_2, T_3$  with 2 phase locking protocol. [5]

$T_1,$	$T_2,$	$T_3$
Lock(A,X)		
	Lock(B,S)	
		Lock(A,S)
Lock(C,X)		
	Lock(D,X)	
Lock(D,S)		
	Lock(C,S)	

Construct a wait for graph according to above schedule. Is there a deadlock at any instance.

b) Consider following relation.

[5]

Wholesales (wno, wname, address, city)

product (pno, pname)

Wholesales & product are related with many to many relationship create a RDB for above & solve following SQL queries.

- i) List the whole salers of product 'keyboard'
- ii) Count the number of wholesaler from city 'Mumbai'.

*EEE*

Total No. of Questions : 5]

SEAT No. :

**P2914**

**[4839]-31**

[Total No. of Pages : 4

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

**INDUSTRIAL MATHEMATICS WITH  
COMPUTER APPLICATION  
MIM-301 : Numerical Analysis  
(2008 Pattern) (Semester-III)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All the questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non-programmable calculators is allowed.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Define the terms absolute error and Relative error.
- b) Define the terms dominant Eigenvalue and dominant eigen vector.
- c) Define an ill conditioned system.
- d) Find the Jacobian Matrix of order  $3 \times 3$  for the function.

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

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

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

- e) Find analytically the fixed point for the system of Non-linear equations

$$x = g_1(x, y) = \sin(y)$$

$$y = g_2(x, y) = -6x + y$$

- f) Show that  $\nabla = I - E^{-1}$ .
- g) Consider the initial value problem

$$\frac{dy}{dt} = -k(y - A) \text{ with initial condition } y(0) = y_0$$

Find the solution curve to the above problem using direct method.

**P.T.O.**

- h) Define a strictly diagonally dominant matrix and is the matrix  $\begin{bmatrix} 4 & -1 & 1 \\ 4 & -8 & 1 \\ -2 & 1 & 5 \end{bmatrix}$

Strictly diagonally dominant.

- i) Find the first approximation to the root of the equation  $x^3 - 9x + 1 = 0$  by Regula Falsi method which lies between 2 and 3.
- j) If  $f(x) = e^{ax}$  evaluate  $\Delta^n f(x)$ .

**Q2) a)** Attempt any one of the following. **[6]**

- i) Show that the error term in the Newton's polynomial of degree

$$N=1 \text{ is given by } E_1(x) = \frac{(x-x_0)(x-x_1)f^{(2)}(c)}{2!} \text{ where } f \in C^2[a,b] \text{ and } x_k = x_0 + kh \text{ for } k=1$$

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

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

Further show that there exists a  $c \in [a,b]$  such that.

$$f'(x) = \frac{f(x+h) - f(x-h)}{2h} + \frac{-h^2 f^{(3)}(c)}{6}.$$

**b)** Attempt Any Two of the following: **[10]**

- i) Determine the degree of precision of Simpson's  $\frac{3^{\text{th}}}{8}$  rule.

- ii) Determine the triangular factorization  $A=LU$  of the matrix A given

$$\text{by } \begin{bmatrix} 2 & -3 & 10 \\ -1 & 4 & 2 \\ 5 & 2 & 1 \end{bmatrix}$$

- iii) Find a positive value of  $(17)^{1/3}$  correct upto four decimal places using Newton Raphson's method.

**Q3) a)** Attempt any one of the following. **[6]**

- i) Assume that  $f \in C^{N+1}[a, b]$  and  $x_k = x_0 + kh$  where  $k=1 \dots N$  are equally spaced nodes then show that the error bound in the Lagrangian interpolation is given by  $|E_1(x)| \leq \frac{h^2 M_2}{8}$  valid in  $x \in [x_0, x_1]$  where  $|f''(c)| \leq M_2$  for all  $c \in [x_0, x_1]$ .
- ii) Suppose that the interval  $[a, b]$  is subdivided into  $M$  subintervals  $[x_k, x_{k+1}]$  of width  $h = \frac{b-a}{M}$  by using equally spaced nodes  $x_k = a + kh$  for  $k=0, 1, 2, \dots, M$ . Then the composite Trapezoidal rule for  $M$  subintervals is given by  $T(f, h) = \frac{h}{2} \sum_{k=1}^M (f(x_{k-1}) + f(x_k))$ .

**b)** Attempt any two of the following. **[10]**

- i) Use Simpson's  $\frac{1^{rd}}{3}$  Rule to find  $\int_0^6 \frac{dx}{(1+x)^2}$ .
- ii) Find the unique Lagrangian interpolating polynomial passing through the points  $(1, 1)$ ,  $(3, 27)$  and  $(4, 64)$ .
- iii) Suppose that  $(\lambda, V)$  is an eigenpair of the matrix  $A$  and if  $\alpha$  is any constant then show that  $(\lambda - \alpha, V)$  is an eigenpair of  $(A - \alpha I)$ .

**Q4) a)** Attempt any one of the following: **[6]**

- i) Assume that  $f \in C^2[a, b]$  and there exists a number  $p \in [a, b]$  where  $f(p) = 0$ . If  $f'(p) \neq 0$  then show that the sequence  $\{p_k\}_{k=0}^{\infty}$  defined by  $p_k = g(p_{k-1}) = p_{k-1} - \frac{f(p_{k-1})}{f'(p_{k-1})}$  for  $k=1, 2, \dots$  converges to  $p$  for any initial approximation  $p_0 \in [p - \delta, p + \delta]$  where  $\delta > 0$ .
- ii) Determine the Gauss-Seidel Iterative formula and use it to solve the system of linear equations given by

$$\begin{aligned} 4x - y + z &= 7 \\ 4x - 8y + z &= 21 \\ -2x + y + 5z &= 15 \end{aligned}$$

Use initial approximation  $p_0 = (x_0, y_0, z_0) = (1, 2, 2)$

b) Attempt any two of the following: [10]

i) Use Runge-kutta method of order 4 to find the value of  $y$  at  $x=0.1$  for the given initial value problem  $\frac{dy}{dx} = x + y^2$  with initial condition  $y(0)=1$ .

ii) Consider the initial value problem  $\frac{dy}{dx} = x + y$  with the initial condition  $y(0)=0$ .

Find the solution to the above problem at  $x=1$  by Euler's method with the value of  $h=0.2$ .

iii) Given  $f(x) = \frac{1}{x}$  show that the divided difference  $f[p, q, r, s] = \frac{-1}{pqrs}$  for the nodes  $p, q, r, s$ .

**Q5)** Attempt any two of the following. [16]

a) Reduce the matrix given below to a triadiagonal form using House

Holder's transformation 
$$\begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & 2 \\ -1 & 2 & 1 \end{bmatrix}.$$

b) i) Apply Euler's method to solve the initial value problem  $\frac{dy}{dx} = \lambda y$  with initial condition  $y(x_0) = y_0$ .

ii) Determine its stability zone?

iii) What would be the range of the stability when  $\lambda = -1$ ?

c) Show that the equation  $f(x) = 1 - xe^{1-x} = 0$  has a double root at  $x=1$ . Then obtain the first three approximations to the root using Newton Raphson's method using initial approximation  $x_0=0$ .





Total No. of Questions : 5]

SEAT No. :

**P2915**

**[4839]-32**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH  
COMPUTER APPLICATIONS**

**MIM-302 : Object Oriented Software Engineering  
(2008 Pattern) (Semester-III)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) What are the key challenges facing software engineering?
- b) Give the attributes of good software.
- c) What is a software process? List any two process models.
- d) Define legacy systems.
- e) Define feasibility study.
- f) What is Ethnography?
- g) Give two main advantages of incremental software development approach.
- h) What is software inspection?
- i) Give two goals of software testing process.
- j) What is system reliability?

**Q2)** Attempt any four of the following.

**[16]**

- a) Explain the requirements elicitation and analysis process.
- b) Explain the 'waterfall model'.

**P.T.O.**

- c) Explain the various activities involved in the system design process.
- d) Write a short note on data-flow models.
- e) Write a note on distributed object architecture.

**Q3)** Attempt any two of the following. **[16]**

- a) Explain the 'cleanroom software' development approach.
- b) Attempt all questions.
  - i) A microprocessor controlled car dashboard is to be developed. Inputs are digital rotation signals from transducers and a keyed in value of the speed limit. The outputs will be given to a speedometer and an excess speed indicator. Prepare a data flow diagram for the above system.
  - ii) Prepare a state transition diagram for the control of a telephone answering machine. An incoming call is detected on the first ring and the machine answers the call with a pre-recorded announcement. When the announcement is complete, the caller's message is recorded. When the caller hangs up, the machine also hangs up and shuts off.
- c) What is a test case design? Explain its various approaches.

**Q4)** Attempt any two of the following: **[16]**

- a) What is a distributed system? Discuss its advantages and disadvantages to systems development.
- b) What are static analyzers? Explain the stages in static analysis.
- c) Solve all questions.
  - i) Consider an automatic water level control system, which is used for controlling the water flow. Identify different states and draw a state transition diagram.
  - ii) Draw a data flow diagram for preparing grade sheet of students of a course and finding the three scholars to be awarded scholarships. Input to the system is the choice made in an objective paper and the correct alternatives.

**Q5)** Attempt any four of the following.

**[16]**

- a) Explain the tools that are included in rapid application development environment.
- b) Explain the user Interface design process.
- c) Explain Integration testing.
- d) Explain the principles of Agile methods.
- e) Write a note on socio Technical systems.



Total No. of Questions : 5]

SEAT No. :

**P2916**

**[4839]-33**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-303 :Object Oriented Programming With Java**

**(2008 Pattern) (Semester-III)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) State the purpose of Wrapper classes.
- b) State the use of keyword 'super'.
- c) Can an interface be final? Justify.
- d) What is a final variable?
- e) What happens when an array is accessed beyond its range?
- f) What is bytecode?
- g) State the purpose of 'throws' keyword.
- h) Which method is used to get list of only files from the directory?
- i) List any four interfaces used for event handling.
- j) Which containers use a flowlayout as their default layout?

**Q2)** Attempt Any Four of the following:

**[16]**

- a) Write a note on resultsets.
- b) What is an exception? What are different types of exceptions?
- c) Explain the use of interfaces with suitable example.
- d) What is the purpose of to string ( ) method? Give suitable example.
- e) Explain how encapsulation and polymorphism is supported in Java.

***P.T.O.***

**Q3)** Attempt Any two of the following: [16]

- a) Write a program to accept mxn matrix of numbers. Print the addition of diagonal elements.
- b) Write a program to create a screen which contains three checkboxes (Apple, Samsung, Lenovo,). Display the selected items in a text box.
- c) Write a program to accept a file name as command line argument. Display the contents of file.

**Q4)** Attempt Any two of the following: [16]

- a) Write a program to accept user details as Name, city. Show the data sorted on city. Use suitable collection.
- b) Write a program to create an abstract class student having methods get-data( ) and show-data( ). And data members Name and subject. Derive one class pg-student with one member specialization-subject. Override get-data( ) and show-data( ) methods. Accept and display details of 'n' students.
- c) Write a program to accept two digit number. Add the digits and display the name of single digit number.

Example:

- i) Input : 15  
output : Six (1+5)
- ii) Input : 27  
Output : Nine (2+7)

**Q5)** Attempt Any four of the following: [16]

- a) Explain any five components of AWT.
- b) Explain any five features of Java language.
- c) What is a package? How it is used in Java?
- d) State the significance of following:
  - i) Static
  - ii) Finalize
- e) Write a note on final class.



Total No. of Questions : 5]

SEAT No. :

**P2917**

**[4839]-34**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-304 : OPERATING SYSTEMS(Old)**

**(2008 Pattern) (Semester-III)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*

**Q1)** Attempt Any Eight of the following:

**[8×2=16]**

- a) What is paging? State the contents of page table.
- b) Define the terms: Overlays and page faults.
- c) Explain the following terms:
  - i) Status register.
  - ii) Data- in register.
  - iii) Control register.
  - iv) Data - out register.
- d) Explain race condition. Also suggest the solution to avoid race condition.
- e) Write a short note on P Thread.
- f) Define:
  - i) Degree of Multiprogramming.
  - ii) Thrashing.
- g) List out the advantages of multiprocessor systems.
- h) Write a short note on sequential access method.
- i) Explain any two benefits of thread.
- j) What is interrupt?

***P.T.O.***

- Q2) a)** Attempt Any One of the following: **[1×6=6]**
- i) What is process? Explain the various states of process. Also draw the neat diagram for process state.
  - ii) What is wait for graph? How it is used to detect deadlock?
- b)** Attempt Any two of the following: **[2×5=10]**
- i) Write a note on PCB.
  - ii) Define:
    - 1) Dispatcher.
    - 2) Through put.
    - 3) Turnaround time.
    - 4) Waiting time.
    - 5) Response time.
  - iii) Explain with suitable diagram the concept of overlapped swapping.
- Q3) Attempt Any Four of the following:** **[4×4=16]**
- a) Explain any four benefits of multithreading model.
  - b) What is deadlock? Explain the necessary conditions for deadlock.
  - c) Consider five processes with their arrival time and burst - time as shown below:
 

processID	Arrival Time	Burst time
P1	0	2
P2	1	5
P3	4	4
P4	2	3
P5	3	8

Calculate the waiting time, turn around time, average waiting time and average turn around time for every process. Also show the contents of Gant chart. Using SJF algorithm.
  - d) Explain Internal and External fragmentation.
  - e) Consider the following page reference string: 1, 2, 3, 4, 5, 3, 4, 1, 6, 1, 3, 5, 8, 9, 6. How many page faults would occur for the following page replacement algorithms : OPT and FIFO Assume frame size=4.

**Q4)** Attempt Any Four of the following:

**[4×4=16]**

- a) Write a note on binary semaphore. Also explain the wait and signal operations using binary semaphore.
- b) List and explain any four services of operating system.
- c) Explain in detail any four file operations.
- d) Write a note on system call implementation.
- e) Consider the page reference string as: 1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5.  
Find out the Total page faults using:
  - i) LRU
  - ii) Second chance page replacement algorithms. Assume frame size=3.

**Q5)** Attempt Any four of the following:

**[4×4=16]**

- a) Write a note on inverted page table.
- b) Write a note on dining- philosopher problem.
- c) Write the difference between user level thread and kernel level thread.
- d) Explain steps for handling page fault.
- e) Write a note on file allocation method.





Total No. of Questions : 5]

SEAT No. :

**P2918**

**[4839]-35**

[Total No. of Pages : 4

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATION**

**MIM-305 : Theoretical Computer Science**

**(2008 Pattern) (Semester-III) (Old)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Define kleene closure and positive closure.
- b) Consider language  $L=\{aa,b\}^*$ . How many words does this language have of length 4 and 5? Justify.
- c) What is useless symbol?
- d) Write any two identities of regular expression.
- e) Define regular grammar. Give one example.
- f) What is ambiguous grammar? Is the grammar  $G = \left\{ \begin{array}{l} A \rightarrow AB \\ A \rightarrow a \end{array} , B \rightarrow BA/a \right\}$  ambiguous?
- g) Give all suffixes & prefixes of string abac.
- h) What is a two-way-tape turing machine?
- i) Give ID of turing machine.
- j) Comment "Every regular grammar is CFG".

**P.T.O.**

Q2) a) Attempt any one of the following. [6]

i) Define DFA formally. Construct DFA for a language containing strings starting with 1 and ending with 00 over alphabet  $\{0,1\}$ .

ii) Describe following set by regular expression.

a)  $L_1 = \{\text{set of all strings ending with } ba\}$

b)  $L_2 = \{\epsilon, 12, 1212, 121212, \dots\}$ .

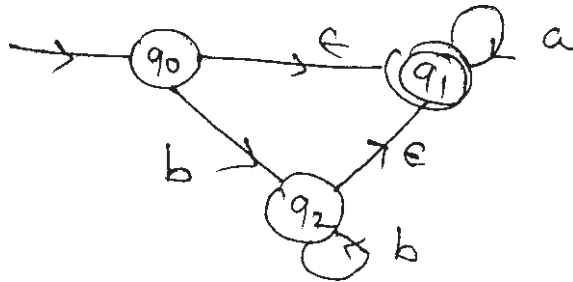
c)  $L_3 = \{\text{set of all strings starting with } 0 \text{ and ending with } 11\}$

b) Attempt any two of the following. [10]

i) Construct NFA for regular expression  $(0+1)^*00+1(0+1)^*$

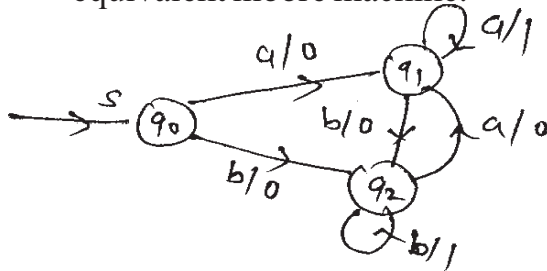
ii) Construct CFG (context free grammar) for language  $L = \{a^n b^m c^n / n \geq 1, m > 0\}$ .

iii) Construct DFA for following MFA

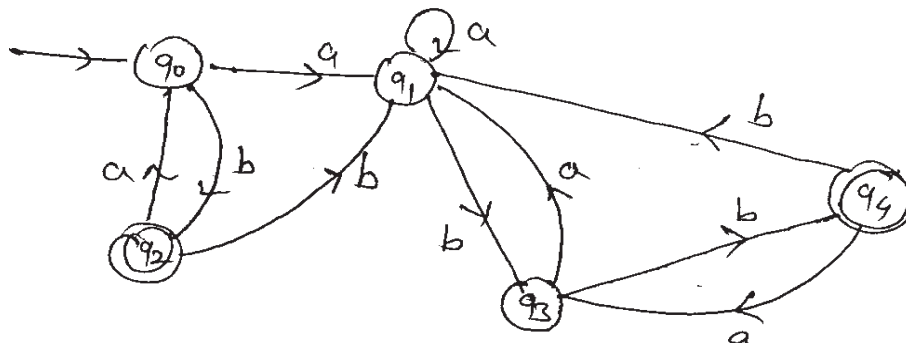


Q3) a) Attempt any one of the following: [6]

i) Define Mealy machine. Convert following mealy machine into equivalent moore machine.

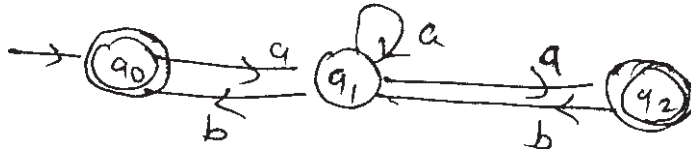


ii) Construct minimal DFA for following DFA



b) Attempt any two of the following: [10]

- i) Show that  $L = \{a^p/p \text{ is prime}\}$  is not regular.
- ii) Show that context free grammars are closed under union, concatenation and Kleene closure.
- iii) Construct regular grammar for following. FA and give regular expression.



Q4) a) Attempt any one of the following: [6]

- i) Construct CFG equivalent to PDA  $m = (\{q_0, q_1\}, \{0, 1\}, \{Z, B\}, \delta, q_0, Z, \phi)$  where

$$\delta(q_0, 0, Z) = (q_0, BZ) \quad \delta(q_0, 0, B) = (q_0, BB)$$

$$\delta(q_0, 1, B) = (q_1, B) \quad \delta(q_1, D, B) = (q, \epsilon)$$

$$\delta(q_1, \epsilon, Z) = (q_1, \epsilon)$$

- ii) Construct Turing Machine for the language  $L = \{0^n 1^m / m, n \geq 1\}$

b) Attempt any two of the following. [10]

- i) Explain chomsky heirarchy.
- ii) Construct PDA for the language  $L = \{WW^R / W \in (a+b)^*\}$

( $W^R$  is reverse of  $w$  if  $w = ab$   $w^R = ba$ )

- iii) Construct FA for regular grammar

$$S \rightarrow 01A$$

$$A \rightarrow 00B/1A/0A$$

$$B \rightarrow 0B/1B/\epsilon$$

**Q5) a)** Attempt any one of the following. **[6]**

i) Convert following grammar to GMF

$$S \rightarrow 0AB/A1B$$

$$A \rightarrow B10/1$$

$$B \rightarrow S0/0$$

ii) What is chomsky normal form (CNF) convert following grammar to CNF.

$$S \rightarrow S + S / S * S / (S) / id$$

**b)** Attempt any two of the following. **[10]**

i) Write note on universal turing machine.

ii) Write leftmost and right most derivation for string 000001100 for following grammar.

$$S \rightarrow 0AS / 0$$

$$A \rightarrow S1A / SS / 10$$

iii) Construct PDA (push down automata) equivalent to following CFG

$$S \rightarrow (B)$$

$$B \rightarrow B + B / B * B / a / b$$



Total No. of Questions : 8]

SEAT No. :

P2942

[4839]-401

[Total No. of Pages :3

M.Sc. (Tech.)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM:401- Ordinary 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  $y_1(x)$  and  $y_2(x)$  are two solutions of  $y'' + P(x)y' + Q(x)y = 0$  on  $[a,b]$  then their Wronskain  $W=W(y_1, y_2)$  is either identically zero or never zero on  $[a,b]$ . [4]

b) Show that  $y = C_1 \sin x + C_2 \cos x$  is the general solution of  $y'' + y = 0$  on any interval and find the particular solution for which  $y(0) = 2$  and  $y'(0) = 3$ . [4]

c) Show that  $e^x$  and  $e^{-x}$  are linearly independent solutions of  $y'' - y = 0$  on any interval. [2]

**Q2)** a) Consider the equation  $y'' + py' + qy = 0$  where  $p, q$  are constants. Show that if  $p^2 - 4q < 0$  then the general solution is given by

$$y = e^{ax}(C_1 \cos bx + C_2 \sin bx) \quad [4]$$

b) Verify that  $y_1 = x$  is a solution of  $x^2 y'' + xy' - y = 0$ . Use this solution to find the other solution and hence find the general solution of the equation. [4]

c) State Liapunov condition for autonomous system of equations given by

$$\frac{dx}{dt} = F(x, y) \quad \frac{dy}{dt} = G(x, y). \quad [2]$$

P.T.O.

**Q3)** a) Consider the differential equation  $(1+x)y' = py$  with  $y(0) = 1$ .

Where P is an arbitrary constant obtain a power series solution for the above initial value problem. [4]

b) Reduce the Bessel equation  $x^2y'' + xy' + (x^2 - p^2)y = 0$  to its normal form

and determine the nature of the zeros of  $y_p(x)$  when  $p = \frac{1}{2}$  where  $y_p(x)$  denotes a non-trivial solution to the Bessel's equation on positive x-axis. [4]

c) Determine the nature of the point  $x=0$  for the equation  $xy'' + (\sin x)y = 0$  [2]

**Q4)** a) Let  $y(x)$  be a non trivial solution of the equation  $y'' + q(x)y = 0$  on the interval  $[a,b]$ . Then show that  $y(x)$  has atmost a finite number of zeros in this interval. [4]

b) Replace the following differential equation by an equivalent system of differential equation  $y''' = y'' - x^2(y')^2$ . [4]

c) Write Volterra's prey predator equations. [2]

**Q5)** a) Verify the series expansion on the left hand sides.

$e^x = \lim_{b \rightarrow \infty} F\left(a, b, a, \frac{x}{b}\right)$ . Where  $F(a, b, c, x)$  denotes the Gauss Hypergoemetric expansion. [4]

b) Find the general solution to the system of differential equation. [4]

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

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

c) Show that the function  $f(x, y) = 3y^{2/3}$  does not satisfy the Lipschitz condition on the rectangle  $|x| \leq 1, |y| \leq 1$ . [2]

**Q6) a)** Write a short note on obtaining a Forbenius series solution to the differential equation  $y'' + P(x)y' + Q(x)y = 0$ . [4]

b) Find the indicial equation and the roots for the differential equation.

$$2x^2 y'' + x(2x + 1)y' - y = 0 \quad [4]$$

c) Determine whether the function  $f(x, y) = x^2 - xy - y^2$  is positive definite, negative definite or neither. [2]

**Q7) a)** Show that (0,0) is the critical point of the system of equations given by

$$\frac{dx}{dt} = -x - 2y.$$
$$\frac{dy}{dt} = 4x - 5y.$$

Also determine its nature and stability. [5]

b) Consider the system of differential equations given by [5]

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

i) Show that (0,0) is an isolated critical point.

ii) Discuss the stability of the critical point using Liapunov function.

**Q8) a)** Find the general solution to the differential equation  $y'' - y' - 2y = 4x^2$  using method of undetermined co-effecients. [5]

b) Use the method of variation of parameters to find a particular solution to the differential equation  $y'' + y = \operatorname{cosec} x$  . [5]



Total No. of Questions : 8]

SEAT No. :

**P2943**

**[4839]-402**

[Total No. of Pages :2

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

**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) Write a note on communication channels. [5]  
b) Discuss decoding of BCH codes. [5]
- Q2)** a) Explain Binary Hamming codes. [5]  
b) construct incomplete maximum likelihood decoding table for the following binary code.  $C = \{101, 111, 011\}$ . [5]
- Q3)** a) Write a note on burst error correcting codes. [5]  
b) Let  $C = \{0000, 0111, 1111\}$  be a binary code. What is distance of a code? [3]  
c) Define Reed solomon code. [2]
- Q4)** a) Explain quadratic residue codes. [5]  
b) Define dual code  $C^\perp$  of  $C$  prove that  $(C^\perp)^\perp = C$ . [3]  
c) Define Hamming weight. [2]

**P.T.O.**



**Q5) a)** Define coset of a linear code C. If  $C=\{000, 101, 010, 111\}$  Find all cosets. [5]

b) Define cyclic code. Give one example. [3]

c) What is length of BCH code. [2]

**Q6) a)** Write a note on syndrome decoding. [5]

b) Consider the binary (7, 4, 3) Hamming code with generator Poly nomial

$$g(x) = 1 + x^2 + x^3. \quad [3]$$

Find parity check matrix H Decode the word

$$W=0110110$$

c) Define Gilbert-Varshamov bound. [2]

**Q7) a)** Discuss equivalence of linear codes. [5]

b) Write a note on generator matrix of cyclic codes. [3]

c) Define q-ary Hamming code. [2]

**Q8) a)** Write a note on quadratic residue code. [5]

b) What is nearest neighbour decoding. [3]

c) Let C be a binary(5, 3) linear code with generator [2]

$$\text{Matrix } G = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 \end{bmatrix}$$

Encode the message  $u=101$ .



Total No. of Questions : 8]

SEAT No. :

**P2944**

**[4839]-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.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non-programmable scientific calculator is allowed.*

**Q1)** Attempt all of the following:

- a) Differentiate between OSI model and TCP/IP reference model. [4]
- b) Write a short note on tasks performed by physical layer in OSI model. [4]
- c) Is the frequency domain plot of an alarm system discrete or continuous? [2]

**Q2)** Attempt the following:

- a) Compare and contrast a circuit-switched Network and a packet-switched Network. [4]
- b) Compare the TCP header and the UDP header. List the fields in the TCP header that are missing from UDP header. Give the reason for their absence. [4]
- c) What is the relationship between period & Frequency. [2]

**Q3)** Attempt the following:

- a) Define “Shannon capacity theorem”. Solve the following using shannon’s capacity formula. Calculate the theoretical highest bit rate of a regular telephone line which has a bandwidth of 3000 Hz assigned for data communications. The signal-to-noise ratio is 3162. Calculate the capacity for this channel. [4]
- b) Explain in brief Bluetooth architecture along with its types. Draw a suitable diagram for each type. [4]
- c) What is the purpose of cladding in an optical fiber? [2]

**P.T.O.**

**Q4)** Attempt the following:

- a) What is transmission impairment? What are its different types? Explain any one in brief with neat diagram. [4]
- b) What are the differences between parallel and serial transmission? [4]
- c) How DM (Delta Modulation) differs from Pcm (pulse code Modulation)? [2]

**Q5)** Attempt the following:

- a) Define Line coding. What are different characteristics of line coding? Explain in brief any two characteristics. [4]
- b) What is polling? Explain different functions in polling access method with a neat diagram. [4]
- c) Distinguish between a signal element and a data element. [2]

**Q6)** Attempt the following:

- a) What are the three types of guided media? Explain any one in brief with a suitable diagram. [4]
- b) Compare and contrast the Go-Back-N ARQ protocol with Selective-Repeat ARQ. [4]
- c) How does a single-bit error differ from a burst error? [2]

**Q7)** Attempt the following:

- a) What is congestion control? Explain in brief following two open-loop congestion control policies. [5]
  - i) Retransmission policy.
  - ii) Acknowledgment policy.
- b) Write a short note on VPN. Draw a suitable diagram. [5]

**Q8)** Attempt the following:

- a) Define the term: [5]
  - i) Unicasting
  - ii) Multicasting
  - iii) Broadcasting
  - iv) Multiplexing
  - v) Periodic signal
- b) Differentiate between classfull addressing and classless addressing. [5]



Total No. of Questions : 8]

SEAT No. :

**P2945**

**[4839]-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) “The PHP script is case sensitive” Justify true or false. [4]  
b) What is regular expression. Explain with suitable example. [4]  
c) What is the difference between strcmp ( ) and strcmpi ( )? [2]
- Q2)** a) Write a note on any five sorting functions in array with example. [5]  
b) What is an introspection? Explain any four introspective functions. [5]
- Q3)** a) Write a PHP script to accept the directory name and print the files with extension “txt”. [5]  
b) Write a PHP script to read the contents of table student (Roll, Name, class) from the database. Show all the records in tabular form. [5]
- Q4)** a) Write a note on associative array. [4]  
b) What is a constructor? Explain how to use it in PHP script. [4]  
c) Compare between include ( ) and require ( ). [2]

**P.T.O.**

- Q5)** a) Write a PHP program to create class employee (No, Name, Salary, designation) with member functions accept ( ) and display ( ). Accept the details of 5 employees. Display the details of employee earning maximum salary. [5]
- b) Write a PHP script to accept two strings from the user. Check whether occurrence of 2<sup>nd</sup> string appears at the start and end of first string [5]
- Q6)** a) Write a note on XML parser. [4]
- b) Explain various techniques used to maintain state in PHP. [4]
- c) What is the use of here document? [2]
- Q7)** a) Explain the following functions with their syntax. [5]
- strpos ( )
  - strstr ( )
  - array-pad ( )
  - array-reduce ( )
  - sizeof ( )
- b) How to find the number of parameters passed to function? [3]
- c) Find output: [2]
- ```
<? php
    for ($i=1; $i<=3 ; $i ++ )
        echo "I have counted : $i";
?)
```
- Q8)** a) Write a note on response headers [4]
- b) Explain the use of interfaces with example. [4]
- c) Find output: [2]
- ```
< ? php
    $ val 1=10;
    $ val 2 = "10";
    if ($val 1== $val 2)
        echo ("equal");
    else
        echo (" Not equal");
? >
```



Total No. of Questions : 8]

SEAT No. :

**P2946**

**[4839]-405**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-405 : Java Programming**

**(2013 Pattern) (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 indicates full marks.*

- Q1)** a) Explain packages with examples. [4]  
b) What is an exception? How is a user defined exception created? [4]  
c) What is the purpose of super keyword? [2]
- Q2)** a) Write a note on event handling in java. [4]  
b) Explain how interfaces can be used for multiple inheritance. [4]  
c) Define polymorphism. [2]
- Q3)** a) Explain the types of jdbc drivers. [4]  
b) Explain character and byte streams. [4]  
c) State the difference between final and finally. [2]
- Q4)** a) Write a program to accept details of n students ( roll no, name, percentage) and sort them on the basic of percentage. [4]  
b) Write a note on inheritance in java. [4]  
c) What is java virtual machine? [2]
- Q5)** a) Create a GUI screen in java to accept two numbers and display all prime numbers between them in a text area. [4]  
b) Explain the features of java. [4]  
c) What is the difference between linked list and ArrayList class? [2]
- Q6)** a) Write a note on collection framework in java. [4]

**P.T.O.**

- b) Define an interface 'shape' with methods area ( ) and volume ( ). Implement this interface in classes circle and Rectangle to perform operations . [4]
- c) What is an abstract class? [2]
- Q7)** a) Write a program using j dbc to read employee data ?( id, name, salary) and perform the following operations: [5]
- i) Search by name.
  - ii) Find employee having highest salary.
- b) Explain the use of protected keyword with suitable example. [5]
- Q8)** a) Accept a string from the uses and write a program to perform the following: [5]
- i) Check if the string ends with "ing".
  - ii) Display alter nate characters.
- b) Write short notes on: [5]
- i) This keyword.
  - ii) Wrapper classes.



Total No. of Questions : 5]

SEAT No. :

**P2919**

**[4839]-41**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-401 : Topology**

**(2008 Pattern) (Semester-IV)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) If  $\{\tau_\alpha\}$  is a family of topologies on  $X$  then is  $\cup \tau_\alpha$  a topology on  $X$ .
- b) State pasting lemma.
- c) Let  $Y$  be a subspace of  $X$ . If  $U$  is open in  $Y$  and  $Y$  is open in  $X$  then show that  $U$  is open in  $X$ .
- d) Define a locally path connected space  $X$ .
- e) State tube lemma.
- f) Show that every metric space is Hausdroff.
- g) Let  $Y=[0,1] \cup [2,3]$  considered as a subset of  $\mathbb{R}$ . Then is  $[0,1]$  open in  $Y$ ?
- h) State Tychonoff theorem.
- i) Let  $X$  and  $Y$  be topological spaces. If  $f: x \rightarrow y$  maps all of  $X$  into the single point  $y_0$  of  $Y$  then show that  $f$  is continuous.
- j) If  $A \subset B$  where  $A, B$  are subsets of a space  $X$  then show that  $\bar{A} \subset \bar{B}$ .

**Q2)** a) Attempt any one of the following.

**[6]**

- i) Show that image of a compact set under a continuous map is compact.
- ii) Show that a finite cartesian product of connected spaces is connected.

**P.T.O.**



- b) Attempt any two of the following. [10]
- i) Let  $f: X \rightarrow X$  be continuous. Show that if  $X=[0,1]$  then there is a point  $x$  such that  $f(x)=x$ .
  - ii) Show that a space  $X$  is locally connected if and only if for each open set  $U$  of  $X$  each component of  $U$  is open in  $X$ .
  - iii) Show that every closed subspace of a compact space is compact.

- Q3) a)** Attempt any one of the following: [6]
- i) State and prove extreme value theorem.
  - ii) Let  $X$  be a nonempty compact Hausdroff space. Show that if  $X$  has no isolated points then  $X$  is uncountable.

- b) Attempt any two of the following: [10]
- i) Show that a finite union of compact subspaces of  $X$  is compact.
  - ii) Show by an example that a subspace of a Lindelof space need not be Lindelof.
  - iii) Show that the product of two Hausdroff spaces is Hausdroff.

- Q4) a)** Attempt any one of the following: [6]
- i) Show that  $\mathbb{R}^{\omega}$  in box topology is not a metrizable space.
  - ii) Show that every metrizable space is normal.

- b) Attempt any two of the following. [10]
- i) Show that every path connected space is connected.
  - ii) Give an example of a bijective function  $f: X \rightarrow Y$  which is continuous but not a homeomorphism.
  - iii) Show that a product of regular spaces is regular.

- Q5) a)** Attempt any two of the following. [16]
- i) Show that every regular space with countable basis is normal.
  - ii) If  $f_n: X \rightarrow Y$  is a sequence of continuous functions from a topological space  $X$  into a metric space  $Y$  and suppose  $f_n$  converges uniformly to  $f$  then show that  $f$  is continuous.
  - iii) Show that the product of finitely many compact spaces is compact.



Total No. of Questions : 5]

SEAT No. :

**P2920**

**[4839]-42**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH  
COMPUTER APPLICATIONS  
MIM-402 :Computer Networks  
(2008 Pattern) (Semester-IV)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non- programmable scientific calculator is allowed.*

**Q1)** Attempt Any Eight of the following:

**[8×2=16]**

- a) For n devices in a network, what is the number of cable links required for a mesh and ring topology?
- b) What is the DC component?
- c) Define Redundancy.
- d) What is the purpose of hamming code?
- e) What is flow control?
- f) What is the function of Go-Back-N ARQ?
- g) What is piggybacking?
- h) In OSI model, which layers are network support layers?
- i) Define Routers.
- j) What is the difference between physical address and logical address?

**Q2)** Attempt Any Four of the following:

**[4×4=16]**

- a) What are responsibilities of a transport layer? State any four in brief.
- b) Differentiate between TCP and UDP.

***P.T.O.***

- c) Write a short note on LRC.
- d) Explain following connecting devices in brief.
  - i) Repeater
  - ii) Hub
- e) Find the class of each address:
  - i) 227.12.14.87
  - ii) 252.5.15.111
  - iii) 134.11.78.56
  - iv) 75.45.34.78

**Q3) Attempt Any Four of the following: [4×4=16]**

- a) Compare and contrast virtual circuit and Datagram Subnets.
- b) Write a short note on Next-hop routing. Draw a suitable diagram.
- c) Define channelization. What are different channelization protocol? Explain any one in brief.
- d) What are different types of errors? Explain each in brief with an example.
- e) State any four advantages of optical fiber over twisted pair and coaxial cable.

**Q4) Attempt Any Four of the following: [4×4=16]**

- a) Differentiate between parallel transmission and serial transmission.
- b) Consider a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with two signal levels. Calculate the maximum bit rate with appropriate formula?
- c) What is transmission impairment? What are its different types? Explain any one in brief with a suitable diagram.
- d) Define Multiplexing. State its different categories. Write a short note on any one in brief.
- e) Define following terms.
  - i) Period
  - ii) Frequency
  - iii) Wavelength
  - iv) Bit rate

**Q5) Attempt Any four of the following:**

**[4×4=16]**

- a) Define Analog signal. What are its different types? Explain each.
- b) Write a short note on flooding.
- c) What is congestion control? Explain following two congestion control policies in brief.
  - i) Retransmission policy
  - ii) Acknowledgment policy
- d) Explain IEEE 802.11 architecture in brief. Draw a suitable diagram.
- e) Write a short note on unipolar line coding scheme. Draw a suitable diagram.



Total No. of Questions : 5]

SEAT No. :

**P2921**

**[4839]-43**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-403: Web Technologies**

**(2008 Pattern) (Semester-IV)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Four of the following:

**[4 × 4 = 16]**

- a) What is internet? Explain concept of IP addresses.
- b) Explain concept of constructor in java script.
- c) Explain the concept of MIME.
- d) Explain Request phase of HTTP protocol.
- e) What is DOM? Explain.

**Q2)** Attempt any four of the following.

**[4 × 4 = 16]**

- a) PHP is loosely typed. Justify.
- b) Differentiate between java and javascript.
- c) Explain concept of array and its types in PHP with example.
- d) What are two approaches to pattern matching in Java script.
- e) Write a short note on web servers.

**Q3)** Attempt any four of the following:

**[4 × 4 = 16]**

- a)
  - i) Explain use of shift and unshift operators with examples.
  - ii) What is IPv4 and IPv6?
- b)
  - i) What is the use of anchor (`<a>`) tag? Explain with example.
  - ii) How input is accepted from user in perl?

**P.T.O.**

- c) Explain various tags used in HTML for table creation.
- d) What is reference in perl? Explain with an example.
- e) Write a perl program for accepting set numbers as command line argument and find largest and smallest numbers from them.

**Q4)** Attempt any four of the following: **[4 × 4 = 16]**

- a) Explain XML document structure in detail.
- b) What are cookies? How CGI.pm module supports cookies in perl?
- c) Explain different types of lists supported in HTML.
- d) “XML is Replacement of HTML”. State true or false. Justify.
- e) Explain different control statements with syntax and example in PHP.

**Q5)** Attempt any four of the following. **[4 × 4 = 16]**

- a) State difference between GET and POST methods in PHP.
- b) Write an HTML code for following output using frames.

|           |  |
|-----------|--|
| • APPLES  |  |
| • BANANAS |  |
| • ORANGES |  |

When user clicks on a specific hyperlink, corresponding details about the fruit should be displayed in the second frame.

- c) How to define variable in PHP? Explain in detail different types of scope of variables.
- d) Explain concept of URL.
- e) “HTTP is a stateful protocol”. State true or false. Justify.



Total No. of Questions : 5]

SEAT No. :

**P2922**

**[4839]-44**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-404 : Design and Analysis of Algorithms**

**(Old) (2008 Pattern) (Semester-IV)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[16]**

- a) Show that  $6n^2 + 2n$  is  $O(n^2)$ .
- b) What is divide and conquer strategy?
- c) What is greedy strategy?
- d) Define  $\theta$  &  $\Omega$  notations.
- e) Write best and worst case time complexity of merge sort.
- f) Give recurrence relation for merge sort.
- g) Comment “count sort is a linear sorting algorithm”.
- h) Describe longest common subsequence problem.
- i) Define NP-Hard problem.

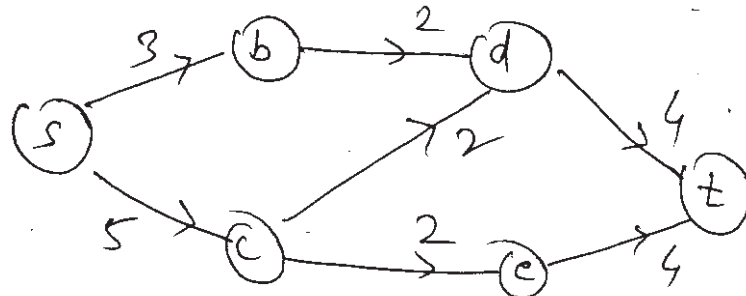
**Q2)** Attempt any two of the following.

**[16]**

- a) Explain Heap sort. Explain the algorithm to construct heap from elements of given array. Write Heapify algorithm. What is its time complexity?

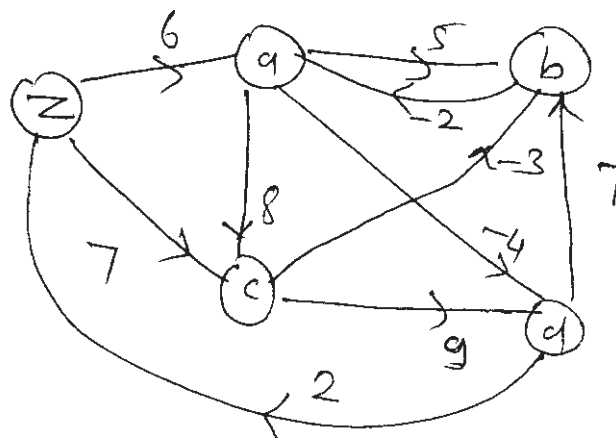
**P.T.O.**

- b) What is matrix chain multiplication problem? What is the best way to multiply following chain of matrices  $A_1 A_2 A_3 A_4 A_5$  having dimensions  $(10 \times 5, 5 \times 2, 2 \times 20, 20 \times 12, 12 \times 4)$  respectively.
- c) Explain Ford-Fulkerson method to find maximum flow in the network. Illustrate it on following graph.



**Q3) Attempt any two of the following: [16]**

- a) What is negative weight cycle? Explain Bellman Ford algorithm for calculating shortest path. Illustrate it on following graph to compute shortest path from Z to all vertices.



- b) What is vertex cover problem? prove that vertex cover problem is NP-complete.
- c) Explain quick sort algorithm. Apply it on  $(1, 2, 4, 1, 6, 8, 9, 18)$ . Give its best case and worst case complexity.

**Q4) Attempt any four of the following: [16]**

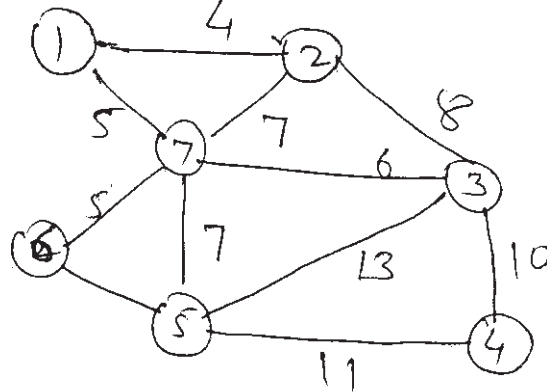
- a) Apply Huffman's algorithm for the frequencies

| a  | b  | c  | d  | e | f |
|----|----|----|----|---|---|
| 45 | 13 | 12 | 16 | 9 | 5 |

- b) Illustrate radix sort algorithm on  $(233, 255, 312, 311, 385, 495, 997, 125)$



- c) How dynamic programming is different from greedy strategy and divide and conquer? Explain.
- d) What is spanning tree? Use Kruskal's algorithm to find minimum spanning tree for following graph.

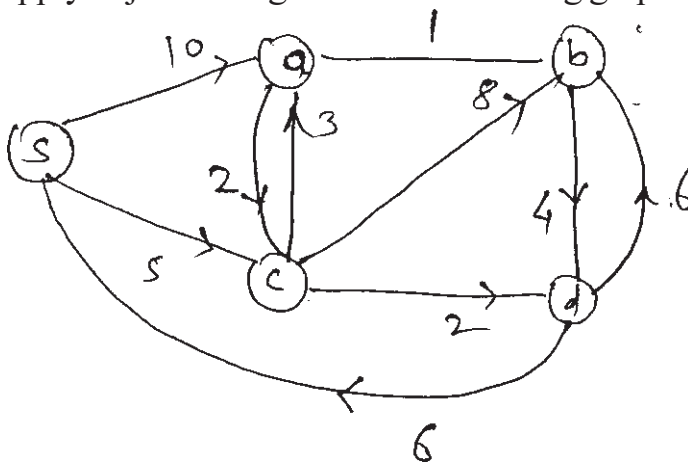


- e) Explain count sort algorithm. Give its time complexity.

**Q5) Attempt any Four of the following.**

**[16]**

- a) Explain topological sort algorithm.
- b) Write note on NP-completeness.
- c) Rank following functions in their increasing order of growth rates.  
 $n^2$ ,  $n \log n$ ,  $30 n \log n$ ,  $n!$ ,  $n^n$ ,  $\log n$
- d) Apply Dijkstra's algorithm on following graph.



- e) State Master's theorem. Solve following recurrence relation using Master's theorem.

$$T(n) = 7T(n/2) + n^2$$



Total No. of Questions : 8]

SEAT No. :

P2947

[4839]-501

[Total No. of Pages :3

M.Sc. (Tech.)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-501:Digital Image Processing

(2013 Pattern) (Semester-V)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

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

Q1) Attempt the following.

- a) Define: Digital image. [2]
- b) Write a note on image acquisition using a single sensor. [4]
- c) For a 3-bit image(L=8) of size 64×64 pixels has the intensity distribution given in the following table; where intensity levels are integers in the range  $[0, L-1]=[0, 7]$ ; Draw the equalized histogram of the image. [4]

| $r_k$<br>(Intensity levels) | $n_k$<br>(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                       |

Q2) Attempt the following.

- a) Define the following terms: [2]
  - i) Saturation
  - ii) Noise.
- b) Write a note on components of an image processing system. [4]
- c) Explain the use of digital image processing in fingerprint identification.[4]

P.T.O.

**Q3)** Attempt the following:

- a) Explain in short: 'Gamma Correction'. [2]
- b) Write a note on RGB colour model. [4]
- c) Explain the terms 'correlation' and 'convolution' with suitable example. [4]

**Q4)** Attempt the following:

- a) Define the term : 'pepper and salt' Noise. [2]
- b) Explain sampling and quantization of digital image. [4]
- c) Write a note on Digital image watermarking. [4]

**Q5)** Attempt the following:

- a) Define the terms: [2]
  - i) Luminance.
  - ii) Radiance.
- b) Write a note on boundary extraction with an example. [4]
- c) With the help of suitable mask, explain the line detection in image processing. [4]

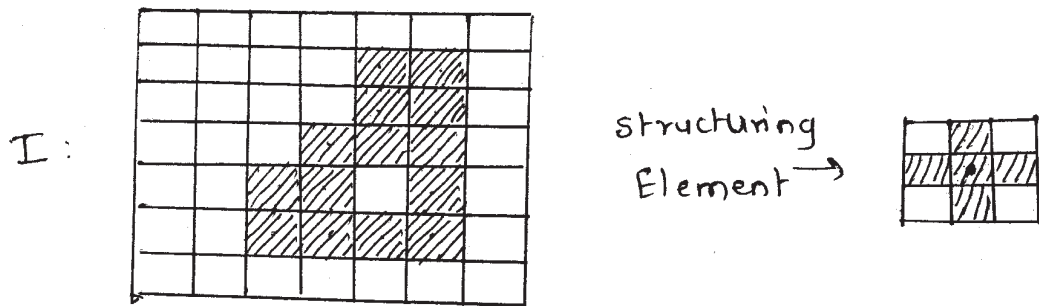
**Q6)** Attempt the following:

- a) Explain in short 'contrast stretching'. [2]
- b) Using 'Mean filter' smooth the following image. (Use  $3 \times 3$  mean filter). [4]

I: 
$$\begin{matrix} 0 & 0 & 1 & 1 & 2 \\ 1 & 2 & 3 & 0 & 1 \\ 1 & 1 & 1 & 2 & 1 \\ 0 & 7 & 6 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 \end{matrix}$$

where I is 3-bit image and  $V = \{0, 1, \dots, 7\}$ .

- c) Use dilation a morphological operation on following image to obtain a new image. [4]

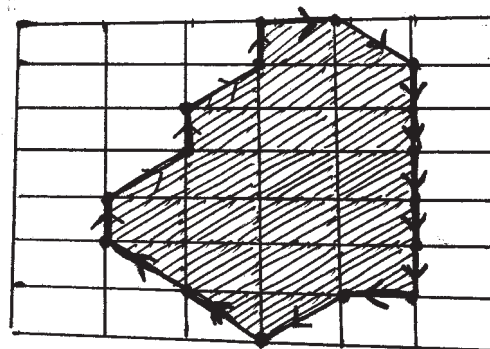


**Q7)** Attempt the following:

- a) Write a note on sharpening of an image with suitable example. [5]
- b) Explain the following image enhancement techniques in spatial domain. [5]
  - i) Image negative.
  - ii) Brightness.

**Q8)** Attempt the following:

- a) Why do we process images? Explain with suitable examples. [5]
- b) Define chain code; and obtain chain code for the following image: [5]



Total No. of Questions : 8]

SEAT No. :

**P2948**

**[4839]-502**

[Total No. of Pages :2

**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 ASP.NET page life cycle with the help of diagram. **[4]**
- b) Write note on interfaces. Compare it with abstract classes. **[4]**
- c) What is boxing and unboxing in C#. **[2]**

**Q2)** Attempt the following.

- a) What is CLR? Explain the working of CLR? **[4]**
- b) Write short on garbage collection in C#. **[4]**
- c) What is a sealed class? **[2]**

**Q3)** Attempt the following:

- a) List and explain types of dialog boxes. Also explain openfile dialog box. **[4]**
- b) Write a note on: DotNet assemblies. **[4]**
- c) What are the two distinct collection types in C#? **[2]**

**Q4)** Attempt the following:

- a) Write a program in C# to sort and reverse an array of five elements. **[4]**
- b) Write a short note on SOAP. **[4]**
- c) What is a Web Form? **[2]**

**P.T.O.**

**Q5)** Attempt the following:

- a) Explain the concept of delegates with suitable examples. [4]
- b) Explain FileInfo and DirectoryInfo class. [4]
- c) What is a TCPListener? [2]

**Q6)** Attempt the following:

- a) List and explain access specifiers in C#. [4]
- b) Briefly explain the ASP.NET MVC architecture. [4]
- c) Write a static method to accept param array of integers. The method should find the sum of all integers passed and display the result. [2]

**Q7)** Attempt the following:

- a) Explain the XML validating techniques [5]
  - i) DTD'S.
  - ii) Schemas.
- b) Design a windows form which will have a Label and a Button. On the click of the button, a colordialog should open and on selection of the color from the dialog box, the color of the text in the label should change. [5]

**Q8)** Attempt the following:

- a) Write a note an exception handling in C#. [5]
- b) Explain the objects from Dot Net framework that provides the functionality of data providers in ADO.NET. [5]



Total No. of Questions : 8]

SEAT No. :

**P2949**

**[4839]-503**

[Total No. of Pages : 2

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-503 : UNIX**

**(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*

**Q1)** Attempt the following

- a) "Write a source code that will describe the use of "exec" system call. [2]
- b) Explain three types of commands on the shell. [3]
- c) Write note on process states and transitions. [5]

**Q2)** Attempt the following

- a) Write a note on file table and user file descriptor table. [2]
- b) What is u area? [3]
- c) Write a note on getblk (.). [5]

**Q3)** Attempt the following

- a) Describe the steps for a context switch. [2]
- b) Explain the different parts of file system structure. [3]
- c) Explain the structure of Disk i node. [5]

**P.T.O.**

**Q4)** Attempt the following

- a) Explain brelse algorithm. [2]
- b) What is interrupt? [3]
- c) Write a note on bmap( ). [5]

**Q5)** Attempt the following

- a) Define -buffer cache. [2]
- b) What is use of fork ( )? How it work? [3]
- c) Explain race conditions for unlink ( ) system call. [5]

**Q6)** Attempt the following

- a) Define init process [2]
- b) Explain logical layout of the executable file. [3]
- c) Explain different types of processes in UNIX system [5]

**Q7)** Attempt the following

- a) Explain the characteristics of UNIX file system. [5]
- b) What is concept of pipe? Explain different types of pipe. [5]

**Q8)** Attempt the following

- a) Draw and explain UNIX system architecture [6]
- b) How process handles a signal? [4]





Total No. of Questions : 8]

SEAT No. :

**P2950**

**[4839]-504**

[Total No. of Pages :4

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM:504-Numerical and Statistical Methods**

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

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Figures to the right side 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)** Five hundred people are attending a party are each given a number, 1 to 500. One number is declared as a lucky number. Find the probability that the lucky number is, **[4]**

- i) 123
- ii) has the same three digits
- iii) ends with 8.

**b)** Explain the following terms: **[4]**

- i) An event
- ii) Impossible event
- iii) Sure event
- iv) Complement of event.

**c)** If A and B are two events with  $P(B')=0.7$ ,  $P(A \cap B) = 0.1$ , find  $P(A/B)$ . **[2]**

**Q2) a)** Define each of the following for a discrete random variable X: **[4]**

- i) Probability mass function
- ii) Cumulative distribution function
- iii) Expectation
- iv) Variance.

**b)** Let  $X \rightarrow B(n,p)$ . If  $p/q=2/3$  and  $P(X=1)=2p(X=0)$ , find the values of n and p. Hence find  $E(X)$ . **[4]**

**c)** State the pmf of poisson distribution with parameter  $\lambda$ . State its mean. **[2]**

**P.T.O.**

**Q3) a)** The distribution function of a continuous random variable X is given by,

$$\begin{aligned} F(x) &= 0, & x < 0 \\ &= \frac{1}{4} X^2, & 0 \leq x \leq 2 \\ &= 1, & x > 2 \end{aligned}$$

Find probability density function of X. Also find  $P(1/2 < X < 3/2)$ . [4]

b) Define a uniform random variable over an interval [a,b]. Find its distribution function. Hence find its median. [4]

c) Let  $X \rightarrow N(\mu, \sigma^2)$ . State the distribution of [2]

i)  $(X - \mu) / \sigma$

ii)  $2X+5$ .

**Q4) a)** The lifetime of a microprocessor is exponentially distributed with mean 3000 hours. Find the probability that, [4]

i) The microprocessor will fail within 600 hours.

ii) The microprocessor will function for more than 4500 hours.

b) 5% of the articles manufactured by a company are defective. Using normal approximation find probability that in a sample of 500 articles, 50 or more will be defective. Also find the probability that the number of defectives will lie between 20 and 40. [4]

c) State the additive property of normal distribution. [2]

**Q5) a)** The equations of the two lines of regression are given by, [4]

$$X-4Y-5=0 \text{ and } X-16Y+64=0.$$

Find,

i) Means of X and Y.

ii) correlation coefficient between X and Y.

b) Define positive and negative correlation with one illustration each. [4]

c) State any two properties of regression coefficients. [2]

- Q6) a)** Obtain the equation of plane of regression of  $X_1$  on  $X_2$  and  $X_3$  from the following data. Assume that the variable  $X_1$ ,  $X_2$  and  $X_3$  are measured from their respective means: **[4]**

$$\sigma_1 = 3, \sigma_2 = 4, \sigma_3 = 5$$

$$r_{12} = 0.7, r_{23} = 0.4, r_{13} = 0.6$$

- b) Explain in brief the method of least squares to obtain the line of regression of Y on X. **[4]**
- c) State whether the following statement is true or false: **[2]**

For a trivariate data if  $R_{1.23} = 1$  then  $R_{2.13} = 1$  justify your answer.

- Q7) a)** Define the following terms: **[5]**

- i) Null Hypothesis.
- ii) Alternative Hypothesis.
- iii) Critical region.
- iv) Type I error.
- v) One sided test.

- b) To determine the association between gender and preference for ice cream flavor, a survey was conducted and data collected is summarized in a table given below: **[5]**

|        |       | Flavour   |         |            |       |
|--------|-------|-----------|---------|------------|-------|
|        |       | Chocolate | Vanilla | Strawberry | Total |
| Gender | Men   | 100       | 120     | 60         | 280   |
|        | Women | 350       | 200     | 90         | 640   |
|        | Total | 450       | 320     | 150        | 920   |

At 5% level, check whether preference for ice cream flavors depends upon gender.

- Q8) a)** Two hundred students in a class are divided into two groups of 100 each. One of the groups was given a vaccine against common cold. The other group was not given any vaccine. It was found that in the group that was given the vaccine, forty five got colds. In the other group, fifty four got cold. At 2% level of significance, is the vaccine effective against the common cold? **[5]**
- b) Explain in brief paired t test. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P2951**

**[4839]-505**

[Total No. of Pages :2

**M.Sc. (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 questions.*
- 2) *Figures to the right indicate full marks.*

**Q1) a)** Write a note on history of cryptography. **[5]**

b) Discuss monoalphabetic cipher. Give an example. **[5]**

**Q2) a)** Write a note on electronic code book. **[5]**

b) Give an algorithm for DES (data encryption standard). **[5]**

**Q3) a)** Discuss Diffie Hellman key exchange. **[5]**

b) Write a note on attacks on RSA cryptosystem. **[3]**

c) What is stream cipher? **[2]**

**Q4) a)** What is pretty good privacy? Explain . **[5]**

b) What is digital signature? **[3]**

c) What is rail fence technique? **[2]**

**Q5) a)** Explain ellipticwaue cryptography. **[5]**

b) Write a flow chart for output feedback mode. **[3]**

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

**P.T.O.**

OR

- Q6)** a) Discuss attacks on MD5. [5]  
b) What is menezes vanstone encryption? [3]  
c) Explain: block cipher. [2]
- Q7)** a) How cryptography has changed in modern world? [5]  
b) What is internet protocol security? [3]  
c) What is one time pad? [2]
- Q8)** a) Explain : Kerberos [5]  
b) Explain : Discrete logarithm. [3]  
c) What is ceaser cipher? [2]



Total No. of Questions : 8]

SEAT No. :

**P2952**

**[4839]-506**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-506: Distributed Database System**

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

*Time : 3 Hours]*

*[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) State any four problem areas in implementing distributed database. [4]
- b) Write a note on “ Layers of Query Processing” [4]
- c) State true or False’
  - i) INGRESS uses a dynamic optimization algorithm
  - ii) System R performs dynamic optimization. [2]

**Q2)** Attempt the following

- a) Explain Horizontal Fragmentation [4]
- b) Explain following types of failures in distributed database [4]
  - i) Transaction failures
  - ii) Communication failures
- c) Define Dead lock [2]

**P.T.O.**

**Q3)** Attempt the following

a) Explain the meaning of following architectural alternatives [4]

i) (A0,D0, H1)

ii) (A1,D0, H0 )

b) Give the query graph and join graph of the following. [4]

Assume the, database is

Emp (eno, ename , title)

Asg (eno, pno, resp, dur)

Proj [pno,pname]

SELECT ename, pname

From Emp, Asg, Proj

WHERE dur>12

AND Emp eno Asg eno

c) Define: DDBMS [2]

**Q4)** Attempt the following:

a) Write a note on 2- phase- locking as a distributed concurrency control.[4]

b) Write a note on Peer-to - Peer- distributed system. [4]

c) State any two orthogonal dimensions on which organization of a distributed database system can be investigated. [2]

**Q5)** Attempt the following:

a) Write note on distributed databases Vs centralized databases. [4]

b) Discuss Allocation problem. [4]

c) What do you mean by Hybrid Fragmentation? [2]

**Q6)** Attempt the following:

a) What are the properties of a Transactions. [4]

b) Explain “Normalization” and “ Analysis “ in query decomposition. [4]

c) What is the meaning of read -set and write- set. [2]



**Q7)** Attempt the following:

- a) Explain the working of a INGRESS algorithm on (Assume data base from Q3b) [5]

```
SELECT Emp. ename
FROM Emp, Asg, Proj
WHERE Emp.eno = Asg. eno
AND Asg. pno = Proj. pno
AND Pname =? CAD/CAM'
```

- b) Consider the following queries in SQL on “Proj” relation as proj(pno, pname, budget, Loc). [5]

q<sub>1</sub>: Select budget  
from proj  
Where pno=5

q<sub>2</sub>: Select pname, budget  
from proj

q<sub>3</sub>: Select pname  
from proj  
where Loc =6

q<sub>4</sub>: Select sum (budget)  
from proj  
where Loc =6.

Assume A<sub>1</sub>: pno , A<sub>2</sub>: pname, A<sub>3</sub>: budget A<sub>4</sub>: Loc

Calculate attribute usage matrix.

Assume that  $ref_1(9_k) = 1 \forall 9_k$  and  $S_1$ . If the application accession frequencies are

|   |   |   |
|---|---|---|
| acc <sub>1</sub> (q <sub>1</sub> ) = 15 | acc <sub>2</sub> (q <sub>1</sub> ) = 20 | acc <sub>3</sub> (q <sub>1</sub> ) = 10 |
| acc <sub>1</sub> (q <sub>2</sub> ) = 5  | acc <sub>2</sub> (q <sub>2</sub> ) = 0  | acc <sub>3</sub> (q <sub>2</sub> ) = 0  |
| acc <sub>1</sub> (q <sub>3</sub> ) = 25 | acc <sub>2</sub> (q <sub>3</sub> ) = 25 | acc <sub>3</sub> (q <sub>3</sub> ) = 25 |
| acc <sub>1</sub> (q <sub>4</sub> ) = 4  | acc <sub>2</sub> (q <sub>4</sub> ) = 0  | acc <sub>3</sub> (q <sub>4</sub> ) = 0  |

Calculate Attribute Affinity Matrix

**Q8)** Attempt the following:

- a) i) Define serial schedule with example [3]

ii) Check whether [2]

S: R<sub>i</sub>(x). W<sub>i</sub>(x). R<sub>i</sub>(y). R<sub>j</sub>(y). W<sub>j</sub>(y) R<sub>k</sub>(y). W<sub>k</sub>(y) is serial schedule

- b) Write a note on distributed deadlock [5]



Total No. of Questions : 8]

SEAT No. :

P2953

[4839]-507

[Total No. of Pages : 3

M.Sc. (Tech.)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-507 : Artificial Intelligence

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

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

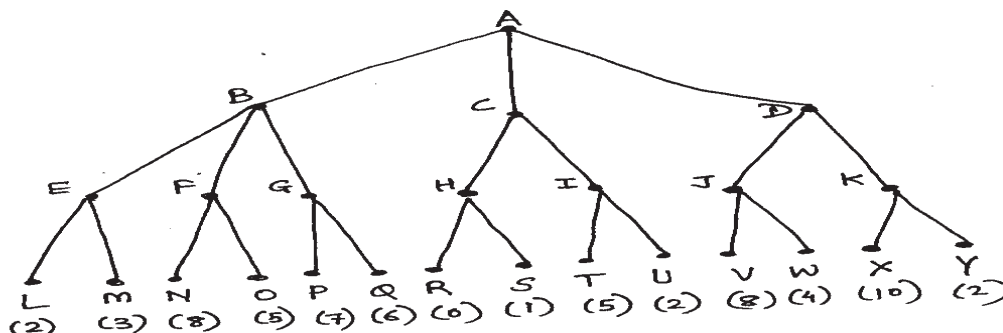
- 1) .Answer any five questions out of eight questions
- 2) Figures to the right indicate full marks
- 3) Assume suitable data if necessary.

Q1) Attempt the following

- a) State where in the CYC ontology, following concepts should fall? [4]
  - i) Cat
  - ii) Court case
  - iii) New York Times
  - iv) Glass of water
- b) Write PEAS description for any two agent types. [4]
- c) Define term "Frame". [2]

Q2) Attempt the following

- a) Consider the following game tree in which static scores are all from the first player's point of view. [4]



P.T.O.

- i) Assume that the first player is maximizing player. What move should be chosen?
- ii) What nodes would not need to be examined using the alpha-beta pruning procedure?
- b) Analyze any one of the following problem with respect to the seven problem characteristics. [4]
  - i) Chess
  - ii) Missionaries & cannibals
- c) Would conceptual dependency be a good way to represent the contents of a typical issue of National Geography? [2]

**Q3)** Attempt the following

- a) Write a short note on Rote Learning. [4]
- b) Give the problem space for the Monkey - Banana problem. [4]
- c) What is intelligence? What is artificial intelligence? [2]

**Q4)** Attempt the following

- a) Trace the constraint satisfaction procedure solving the following cryptarithmic problem: [4]
 
$$\begin{array}{r}
 \text{C R O S S} \\
 + \text{R O A D S} \\
 \hline
 \text{D A N G E R}
 \end{array}$$
- b) Describe various properties of the task environment. [4]
- c) Construct semantic net representation for the following. "Mary gave the green flowered vase to her favourite cousin". [2]

**Q5)** Attempt the following

- a) Explain in detail simple Reflex agent with neat diagram. [4]
- b) Write and explain Generate - and - Test algorithm. [4]
- c) i) Give an example of a problem for which Breadth - first search would work better than depth- first search. [1]
- ii) Give an example of a problem for which depth - first search would work better than breadth- first search. [1]

**Q6)** Attempt the following sentences:

a) Consider the following:

- i) John likes all kinds of food.
- ii) Apples are food.
- iii) Chicken is food.
- iv) Anything anyone eats and is not killed by is food.
- v) Bill eats Peanuts and is still alive
- vi) Sue eats everything bill eats.

Translate above sentences into formulas in predicatelogic [4]

b) Differentiate between informed search and uninformed search. [4]

c) What are different layers in neural network? [2]

**Q7)** Attempt the following:

a) Write a short note on Artificial Neural Network. [5]

b) Differentiate between Greedy search & A\* search [5]

**Q8)** Attempt the following:

a) Consider the following sentences. [5]

- i) John likes all kinds of food.
- ii) Apples are food.
- iii) Chicken is food
- iv) Anything anyone eats and isn't killed by is food.
- v) Bill eats peanuts and is still alive.
- vi) Sue eats everything bill eats.

Prove that John likes peanuts using backward chaining

b) What are different approaches of AI? Explain in brief. [5]

Total No. of Questions : 5]

SEAT No. :

**P2923**

**[4839]-51**

[Total No. of Pages : 5

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-501 : Operations Research and Optimization Techniques**

**(2008 Pattern) (Semester-V)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *All questions are compulsory.*
- 3) *Use of non-programmable scientific calculator is allowed.*
- 4) *Graph papers will be supplied on demand.*

**Q1)** Attempt Any Eight of the following:

**[8 × 2 = 16]**

- a) Define a linear programming problem.
- b) Using graphical method, obtain feasible region for a L.P.P. whose constraints are given by,

$$X_1 + X_2 \leq 2$$

$$2X_1 + X_2 \geq 3$$

$$X_1, X_2 \geq 0.$$

- c) Write the dual of the following LPP:

$$\text{Max } Z = 3X_1 + 2X_2$$

$$\text{Subject to } X_1 + X_2 \leq 4$$

$$X_1 - X_2 \leq 2$$

$$X_1, X_2 \leq 0$$

- d) Explain degeneracy in a transportation problem. How is it resolved?
- e) What is an unbalanced assignment problem? How to balance it?
- f) Solve the following game:

|                | Player B       |                |                |
|----------------|----------------|----------------|----------------|
| Player A       | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> |
| A <sub>1</sub> | 1              | 3              | 0              |
| A <sub>2</sub> | 0              | -4             | -3             |
| A <sub>3</sub> | 1              | 5              | -1             |

**P.T.O.**

- g) Explain the terms 'Pure Strategy' and 'Mixed strategy'.
- h) State any two advantages of duality.
- i) State whether the following statement is true or false:

An LPP can have exactly 2 optimum solutions.

Justify your answer.

- j) Convert the following LPP into standard form:

$$\text{Max } Z = 5X_1 + 8X_2$$

$$\text{Subject to, } X_1 + 3X_2 \leq 5$$

$$2X_1 + 5X_2 \leq 10$$

$$X_1, X_2 \geq 0.$$

**Q2)** Attempt any FOUR of the following.

**[4 × 4 = 16]**

- a) Define the following:
  - i) Slack variable
  - ii) Surplus variable
  - iii) Artificial variable
  - iv) Objective function
- b) A furniture maker has 6 units of wood and 28 hours of free time in which he will make decorative screens. Two models have sold well in the past, so he will restrict himself to those two. He estimates that model A requires 2 units of wood and 7 hours of time, while model B requires 1 unit of wood and 8 hours of time.  
  
The prices of the models are Rs. 12,000 and Rs. 8000 respectively. How many screens of each model should he assemble to maximize his sale? Formulate as a LPP.
- c) Explain the steps involved in obtaining the optimum solution from initial basic feasible solution of a transportation problem by MODI method.
- d) Find an initial basic feasible solution by VAM for the following transportation problem.

| Origin | Destination |    |    |    | Supply |
|--------|-------------|----|----|----|--------|
|        | D1          | D2 | D3 | D4 |        |
| O1     | 23          | 27 | 16 | 18 | 30     |
| O2     | 12          | 17 | 20 | 51 | 40     |
| O3     | 22          | 28 | 12 | 32 | 53     |
| Demand | 22          | 35 | 25 | 41 | 123    |

- e) The table below gives the cost of assigning four operators to four machines.

| Machines | Operators |    |     |    |
|----------|-----------|----|-----|----|
|          | I         | II | III | IV |
| A        | 5         | 7  | 11  | 6  |
| B        | 8         | 5  | 9   | 6  |
| C        | 4         | 7  | 10  | 7  |
| D        | 10        | 4  | 8   | 3  |

Assign the operators to different machines so as to minimize the total cost.

**Q3)** Attempt any four of the following:

**[4 × 4 = 16]**

- a) Solve the following LPP using graphical method.

$$\text{Min } Z = 5X_1 + 8X_2$$

$$\text{Subject to } X_1 \leq 4$$

$$X_2 \geq 2$$

$$X_1 + X_2 \geq 5$$

$$X_1, X_2 \geq 0.$$

- b) Explain the least cost method for obtaining an initial basic feasible solution of a transportation problem.
- c) Explain Hungarian Method of an assignment problem.
- d) Reduce the following game by rule of dominance and solve it.

|          |    | Player B |    |    |   |
|----------|----|----------|----|----|---|
|          |    | 2        | -2 | 4  | 1 |
| Player A | 6  | 6        | 1  | 12 | 3 |
|          | -3 | -3       | 2  | 0  | 6 |
|          | 2  | 2        | -3 | 7  | 7 |
|          | 7  | 7        | 7  | 7  | 7 |

- e) Explain the following terms for activities in a network:
- Earliest start time.
  - Earliest finish time.
  - Latest start time.
  - Latest finish time.

**Q4)** Attempt any two of the following:

**[2 × 8 = 16]**

- a) Solve the following LPP using simplex method.

$$\text{Max } Z = 5X_1 + 3X_2$$

$$\text{Subject to } X_1 + X_2 \leq 2$$

$$5X_1 + 2X_2 \leq 10$$

$$3X_1 + 8X_2 \leq 12$$

$$X_1, X_2 \geq 0.$$

- b) Find the initial basic feasible solution of the following transportation problem by North west corner method. Is this solution optimal? If not, find optimum solution.

| Origin | Destination |    |    |    | Supply |
|--------|-------------|----|----|----|--------|
|        | D1          | D2 | D3 | D4 |        |
| O1     | 7           | 3  | 8  | 6  | 60     |
| O2     | 4           | 2  | 5  | 10 | 100    |
| O3     | 2           | 6  | 5  | 1  | 40     |
| Demand | 20          | 50 | 50 | 80 |        |

- c) i) Explain in brief 'dual simplex method'.  
 ii) Explain the algebraic method for solving a 2X2 game. Illustrate with an example.

**Q5)** Attempt any two of the following.

**[2 × 8 = 16]**

- a) Explain the method of solving an assignment problem for maximization. Illustrate the same by solving the following assignment problem for maximization:

|                | M <sub>1</sub> | M <sub>2</sub> | M <sub>3</sub> | M <sub>4</sub> |
|----------------|----------------|----------------|----------------|----------------|
| J <sub>1</sub> | 100            | 140            | 280            | 70             |
| J <sub>2</sub> | 130            | 160            | 200            | 60             |
| J <sub>3</sub> | 80             | 130            | 300            | 90             |
| J <sub>4</sub> | 150            | 110            | 250            | 50             |



b) Solve the following game graphically:

|          | Player B |    |     |
|----------|----------|----|-----|
| Player A | I        | II | III |
| I        | 6        | 7  | 15  |
| II       | 20       | 12 | 10  |

c) A project consists of a series of activities labelled A,B,---,H,I. The relationship between the activities and the duration of each is given in a table below:

| Activity    | A | B | C | D | E  | F   | G | H | I     |
|-------------|---|---|---|---|----|-----|---|---|-------|
| Preceded by | - | A | A | - | C  | B,E | C | D | F,G,H |
| Duration    | 2 | 5 | 4 | 8 | 10 | 6   | 5 | 4 | 4     |

- i) Draw the project network.
- ii) Determine the critical path.



Total No. of Questions : 5]

SEAT No. :

**P2924**

**[4839]-52**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-502 : Numerical and Statistical Methods**

**(2008 Pattern) (Semester-V)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *All questions are compulsory.*
- 3) *Use of non-programmable scientific calculator is allowed.*

**Q1) Attempt Any Eight of the following:**

**[8×2 =16]**

- a) Determine the probability of getting at least one head when a fair coin is tossed 2 times.
- b) Verify whether the following defines a probability model on the sample space  $S = \{a_1, a_2, a_3\}$   
 $P(a_1) = 0.7, P(a_2) = 0.2, P(a_3) = 0.5.$
- c) Define independence of two events A and B on  $\Omega$ .
- d) Define probability distribution of a discrete random variable.
- e) State mean and variance of Binomial distribution with  $n=10$  and  $p=0.4$ .
- f) State the p.m.f. of Poisson distribution with parameter  $\lambda$ .
- g) Find k if the following function represents pdf of a continuous random variable X:  $f(x) = \frac{k}{\sqrt{x}}, 0 < x < 4$   
 $= 0,$  otherwise
- h) State the additive property of Normal distribution.
- i) Define Karl Pearson's Coefficient of correlation 'r'. State the limits of 'r'.
- j) For a trivariate data, define multiple correlation coefficient.  $R_{1.23}$ .

**P.T.O.**

**Q2)** Attempt Any Four of the following:

**[4×4=16]**

- a) Explain the following with suitable examples.
  - i) Sample Space
  - ii) Event
  - iii) Complement of an event
  - iv) Impossible event
- b) A fair coin is tossed 3 times. Consider the events  $A = \{ \text{first toss is head} \}$ ,  $B = \{ \text{second toss is head} \}$ , Verify whether A and B are independent events.
- c) Suppose a discrete random variable X takes values -3, -1, 2 and 5 with probabilities  $(2k-3)/10$ ,  $(k-2)/10$ ,  $(k-1)/10$ ,  $(k+1)/10$ .
  - i) Determine the value of k.
  - ii) Find  $E(X)$ .
- d) Define cumulative probability distribution of a continuous random variable X and state its important properties.
- e) Let  $X \rightarrow P (\lambda = 1.5)$ . Find  $P(X=2)$  and  $P(X<3)$ .

**Q3)** Attempt Any Four of the following:

**[4×4=16]**

- a) A discrete random variable has Binomial distribution with parameters n and p. if  $n = 9$  and  $P(X=0) = p(X=1)$ , find p and  $P(X=1)$ .
- b) Find the following probabilities if  $Z \rightarrow N(0,1)$ .
  - i)  $P(-0.5 < Z < 1.1)$
  - ii)  $P(0.2 < Z < 1.4)$
- c) State the pdf of exponential distribution with mean  $\theta$ . State its mean and variance. Also state the forgetfulness property of exponential distribution.
- d) Suppose  $X \rightarrow U(0,10)$ . Find mean and variance of X.
- e) Describe a scatter diagram. Explain its utility in measuring the correlation between two variables.

**Q4) Attempt Any Four of the following: [4×4=16]**

- a) Given the following information for a bivariate data (X,Y), find the line of regression of Y on X:  
 $n=20, \Sigma X = 80, \Sigma Y = 40, \Sigma X^2 = 1680, \Sigma Y^2 = 320, \Sigma XY = 480.$
- b) Explain the procedure of fitting a line of regression of Y on X for a bivariate data  $\{(x_i, y_i), i = 1, 2, \dots, n\}$
- c) The two lines of regression are given by,  
 $X + 2Y - 5 = 0$   
 $2X + 3Y - 8 = 0.$   
If variance of X = 12, find mean values of X and Y. Also find variance of Y.
- d) For a trivariate data if,  $r_{12} = 0.8, r_{23} = -.6, r_{13} = -0.4$ , find  $r_{12.3}$  and  $r_{23.1}$ .
- e) Explain the test procedure for testing  $H_0: P = P_0$  against  $H_1: P \neq P_0$  for a large sample at  $\alpha\%$  level of significance.

**Q5) Attempt Any four of the following: [4×4=16]**

- a) Define positive and negative correlation with one illustration each.
- b) In a sample of 8 observations the sum of squares of deviations of the sample values from the mean was 84. In another sample of 10 observations it was 99. If the means of the two samples are 55 and 60 respectively, test whether the difference between population means is significant 5% level of significance.
- c) A nationalized bank utilizes four teller windows to render fast services to the customers. On a particular day 800 customers were observed. They were given services at the different windows as given below:

|                     |     |     |     |     |
|---------------------|-----|-----|-----|-----|
| Window number       | 1   | 2   | 3   | 4   |
| Number of Customers | 150 | 250 | 170 | 230 |

Test whether the customers are uniformly distributed over the windows. ( use  $\alpha = 0.05$ ).

- d) Define the following terms:
- Alternative hypothesis
  - Null Hypothesis
  - Standard Error
  - Test Statistic
- e) Write a note on Analysis of Variance.

Total No. of Questions : 5]

SEAT No. :

**P2925**

**[4839]-53**

[Total No. of Pages : 3

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

**INDUSTRIAL MATHEMATICS WITH  
COMPUTER APPLICATIONS**

**MIM-503(C) : Digital Image Processing  
(Semester-V) (2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of non-programmable scientific calculator is allowed. .*

**Q1)** Attempt Any Eight of the following:

**[8 × 2 = 16]**

- a) Define the following terms:
  - i) Luminance
  - ii) Radiance
- b) Explain in short image restoration.
- c) What is image histogram?
- d) Define the term 'pepper and salt' Noise.
- e) What is JPEG and TIFF?
- f) Justify the statement:  
'Quality of picture depends on the number of pixels and number of gray levels that represents the picture'.
- g) Define: 4-adjacency and 8-adjacency.
- h) If all the pixels in the image are shuffled, will there be any change in the histogram?
- i) Define: Saturation in digital image.
- j) Consider the image segment shown below. Let  $V = \{0, 1, 2\}$  and compute the length of shortest 4 -path between the pixels 'p' and 'q', if such path exists.

|      |   |   |   |   |     |
|------|---|---|---|---|-----|
|      | 3 | 4 | 1 | 2 | 0   |
| I =  | 0 | 1 | 0 | 4 | 2=q |
|      | 2 | 2 | 3 | 1 | 4   |
| p =3 | 0 | 4 | 2 | 1 |     |
|      | 1 | 2 | 0 | 3 | 4   |

**P.T.O.**

**Q2)** Attempt any FOUR of the following. **[4 × 4 = 16]**

- a) Explain with suitable diagram any one type of image acquisition device.
- b) Discuss the CMY model for colour images.
- c) Explain the terms:
  - i) Coding Redundancy
  - ii) Spatial Redundancy
- d) Explain smoothing of image using spatial filters in detail.
- e) Obtain the result of convolution of image 'f' with the mask 'w', where 'f' is one dimensional image.

f: 0 0 0 1 0 0 0 0      w : 5 3 2 1 2

**Q3)** Attempt any four of the following: **[4 × 4 = 16]**

- a) Explain the use of image processing in fingerprint identification.
- b) Write a note on gamma correction.
- c) Discuss any two methods of noise removal from the image data.
- d) Draw the histogram for the following  $5 \times 5$  image; where  $V=\{0, 1, 2, 3\}$ .

I=

|   |   |   |   |   |
|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 2 |
| 1 | 2 | 3 | 0 | 1 |
| 3 | 3 | 2 | 2 | 0 |
| 2 | 3 | 1 | 0 | 0 |
| 1 | 1 | 3 | 2 | 2 |

- e) Define the following terms:
  - i) City - block distance.
  - ii) Chess board distance.

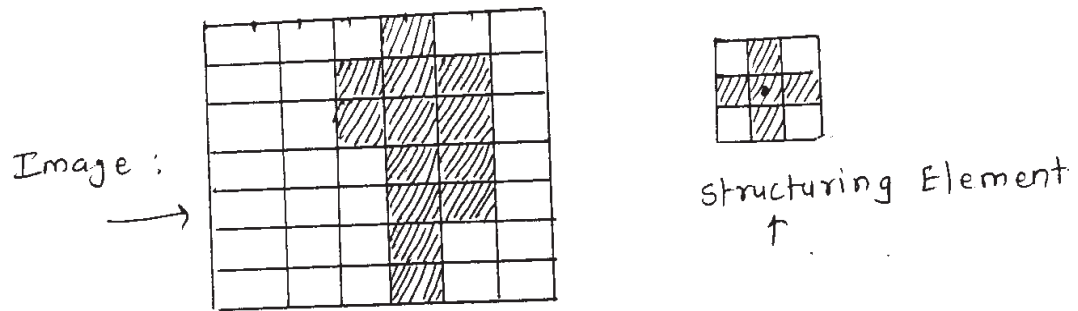
**Q4)** Attempt any four of the following: **[4 × 4 = 16]**

- a) Discuss the role of image processing in medical applications.
- b) With the help of suitable masks, explain line detection.
- c) What is threshold? Explain how to obtain the threshold for image segmentation.
- d) Write a note on boundary extraction.
- e) Why do we process images? Explain with suitable examples.

Q5) Attempt any two of the following.

[2 × 8 = 16]

- a) With the help of neat diagram, illustrate and explain various steps in image processing.
- b) Explain the following image enhancement techniques in spatial domain.
  - i) Image Negative
  - ii) Brightness.
- c) Use Erosion on the following image to obtain thin image, using the given structuring element.



Total No. of Questions : 5]

SEAT No. :

**P2926**

**[4839]-54**

[Total No. of Pages : 3

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

**COMPUTER SCIENCE**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM-504 : Advanced Operating Systems**

**(2008 Pattern) (Semester-V)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Attempt Any Eight of the following:

**[8 × 2 = 16]**

- a) Explain the role of process control subsystem.
- b) What is the role of free list and hash queue of buffers?
- c) How kernel handles the signal?
- d) State and explain the fork ( ) system call.
- e) Explain program counter and stack pointer components of register context.
- f) State formula to calculate process priority. Also mention which system call is used to control the priority of process?
- g) In which situations the kernel swaps a process out if it needs a space in memory?
- h) Which system call is used for polling? State and explain its syntax.
- i) Draw state diagram for page aging.
- j) Explain accept ( ) system call with syntax.

***P.T.O.***



**Q2) a)** Attempt any one of the following. **[1 × 6 = 6]**

- i) Explain the various fields of region table entry.
- ii) Write a note on init process.

**b)** Attempt any two of the following. **[2 × 5 = 10]**

- i) Write a note on shell.
- ii) State the several drawbacks during the use of ptrace for process tracing.
- iii) Explain the behavior of following program:

```
main ()
{
    int status;
    if (fork ( ) == 0 )
        execl (“/bin / ls”, ls, NULL);
    wait ( & status);
}
```

**Q3) a)** Attempt any one of the following: **[1 × 6 = 6]**

- i) Explain socket layer, protocol layer and device layer. Draw diagram.
- ii) Write a note on RPM. Also explain the various options of rpm command.

**b)** Attempt any two of the following: **[2 × 5 = 10]**

- i) State sequence of operations performed by kernel for fork ( ).
- ii) Write a note on system boot.
- iii) State the role of
  - A) Valid
  - B) Reference
  - C) Modify
  - D) Copy on write
  - E) Agebit fields to support demand paging.

- Q4) a)** Attempt any one of the following: **[1 × 6 = 6]**
- i) Write a note on functions of a line discipline.
  - ii) State several parts of an executable file. Also draw diagram.
- b)** Attempt any two of the following. **[2 × 5 = 10]**
- i) Write a note on attaching a region.
  - ii) What is service in Linux? Explain different service manipulation commands.
  - iii) Write a note on expansion swap.

- Q5) a)** Attempt any one of the following. **[1 × 6 = 6]**
- i) Explain with suitable diagram any two scenarios of buffer retrieval.
  - ii) What is the relationship between inode table and region table for shared text? Explain with suitable diagram.
- b)** Attempt any two of the following: **[2 × 5 = 10]**
- i) How process responds if it receives a signal “death of child”?
  - ii) What is chkconfig? Explain various options of chkconfig.
  - iii) Explain various conditions used to identify status of buffer.

