Total No. of Questions : 5] **[Total No. of Pages : 3**

P893 **[3835] - 304**

M.Sc. Tech.

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 304: Operating Systems

(Sem. - III) (New Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Q1) Attempt any Eight of the following: **[8 × 2 = 16]**

a) Define the terms: Hard real time system and soft real time system.

b) List out any four file attributes. Also give one line explaination of each.

c) Explain any two components of Process Control Block (PCB).

d) Define the terms: Overlays and page faults.

e) Explain the following terms:

i) Status register. ii) Control register.

iii) data -in register. iv) data - out register.

f) Explain race condition. Also suggest the solution to avoid race condition.

g) Write a short note on P Thread.

h) Explain any two options used to break deadlock.

i) Give any four device management system calls.

j) Write a short note on DMA.

P.T.O.

Q2) Attempt.

a) Attempt any <u>one</u> of the following: **[1 × 6 = 6]**

i) Write a note on Banker's algorithm. Also explain the various data structures used in Banker's algorithm.

ii) What is process? Explain the various states of process. Also draw the neat diagram for process state.

b) Attempt any <u>two</u> of the following: **[2 × 5 = 10]**

i) Define:

A) Dispatcher.

B) Through put.

C) Turnaround time.

D) Waiting time.

E) Response time.

ii) Write a note on overlapped swapping.

iii) What is deadlock? Explain the necessary conditions for deadlock.

Q3) Attempt any <u>four</u> of the following: **[4 × 4 = 16]**

a) Write a note on user and system view of the operating system.

b) Explain how protection can be provided to the file system?

c) What is critical section problem? Give the solution to critical section problem.

d) Explain any four benefits of multithreading model.

e) Consider five processes with their arrival time and burst - time as shown below:

<u>Process ID</u>	<u>Arrival Time</u>	<u>Burst time</u>
P_1	0	1
P_2	1.5	5
P_3	4	6
P_4	2	3
P_5	3	9

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.

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

a) Explain in detail any four file operations.

b) Write a note on system call implementation.

c) 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.

d) What do you mean by binary semaphore? Write a note on implementation of binary semaphore.

e) Write a note on buffering and caching.

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

a) Consider the following snapshot of the system:

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

i) Give the contents of matrix Need.

ii) Check whether system is in safe state? If yes give the safe sequence.

iii) Calculate the initial instances per resource type A,B and C.

b) Explain any two access methods to access the information of file.

c) What is system program? Explain shell as a system program.

d) Write a note on inverted page table.

e) Write a note on dinning - philosopher problem.

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P896

[3835] - 402
M.Sc. Tech
COMPUTER SCIENCE
Industrial Mathematics with Computer Applications
MIM - 402: Computer Networks
(Sem. - IV) (New Course)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates:

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

Q1) Attempt any eight of the following. **[8 × 2 = 16]**

a) Explain the functions of data link layer.

b) Encode the following bit pattern using Manchester and differential Manchester encoding scheme. Bit pattern: 10110110111.

c) Explain any two methods of framing.

d) "Computer networks can be circuit switched or packet switched but never message switched". Justify your answer.

e) Write a note on repeaters.

f) Identify netid and hostid fields of the following IP address: 192 - 168 - 16 - 5.

g) Give the frame format of UDP packet. Also give one line explaination of each Field.

h) " HTTP is a stateless protocol". Justify your answer.

i) What is network? Define LAN, WAN and MAN.

j) Define: mail agent and user agent.

P.T.O.

Q2) a) Attempt <u>any one</u> of the following. **[1 × 6 = 6]**

i) Give the Comparison of the OSI and TCP /IP reference models.

ii) Differentiate between Analog and digital signals.

b) Attempt <u>any two</u> of the following. **[2 × 5 = 10]**

i) Explain with suitable diagram structure of the telephone network.

ii) Write a short note on PAR. Also explain sender and receiver side of protocol.

iii) Explain any five characteristics of routing algorithm.

Q3) a) Attempt <u>any one</u> of the following. **[1 × 6 = 6]**

i) Write a note on NRZ - I and NRZ - L Line encoding scheme.

ii) What is stop and wait protocol? Explain sender and receiver's role in stop and wait protocol.

b) Attempt <u>any two</u> of the following. **[2 × 5 = 10]**

i) Write a note on organization of OSI Layers.

ii) Write a note on Spanning tree bridges.

iii) Explain the different types of services provided to network layer by data link layer.

Q4) a) Attempt <u>any one</u> of the following. **[1 × 6 = 6]**

i) Explain BSS and ESS architecture of IEEE 802-11 protocol

ii) Write a note on ICMP query messages.

b) Attempt <u>any two</u> of the following. **[2 × 5 = 10]**

i) Write a note on one-bit sliding window protocol.

ii) Explain the characteristics of line coding.

iii) Write a note on remote procedure call.

Q5) a) Attempt <u>any one</u> of the following. **[1 × 6 = 6]**

i) Explain the static versus dynamic routing table.

ii) Explain the six different control flags used in the TCP segment header.

b) Attempt <u>any two</u> of the following. **[2 × 5 = 10]**

i) Write a note on poll and select method.

ii) Write a difference between virtual circuit and datagram subnets.

iii) Explain the transport service Primitives.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P897

[3835] - 403
M.Sc. Tech. - II
COMPUTER SCIENCE
Industrial Mathematics with Computer Applications
MIM - 403: Web Technology
(New 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) What is the task of a DNS name server?

b) What is the purpose of 'colspan' attribute of the <th> tag?

c) What are the three categories of Perl variables?

d) What is LAMP?

e) What is hypertext?

f) Give usage of the 'alt' attribute of <img> tag with suitable example.

g) What is internet and web?

h) What is URL? Give general format of URL.

i) What is Servlet?

j) List the popup boxes supported by Javascript.

P.T.O.

Q2) Solve any four of the following. **[16]**

a) Explain various predefined character classes in Javascript.

b) Write short note on MIME.

c) Explain different types of lists supported in HTML.

d) What is file handle in Perl? Write a Perl program to copy contents of one file to another.

e) Explain Servlet lifecycle methods.

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

a) Give difference between Java and Javascript.

b) Explain HTTP request phase.

c) What is "shebang"?

d) Create an XML document for catalog of CDs, where each CD has child elements as, Title, Company, Price, Year.

e) Write short note on DTD (Document Type Definition)

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

a) Differentiate between XML and HTML.

b) Explain concept of constructor in Javascript with suitable example.

c) Explain asort and ksort functions of PHP with suitable example.

d) Give purpose of:

i) Telnet.

ii) FTP

e) Find output of the following PHP Program.

```
Function incr_one ( $ first, $ second, & $ third)
{
        $ first ++;
        $ second ++;
        $ third ++;
}
        $ x = 5;
        $ y = 10;
        $z = 15;
        incr_one ($x, & $y, $z);
        print (" \ $x, \$y, \$z are now : $x, $y, $z <br>");
```

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

a) Create a form in HTML to collect information as, name of student, marks1, marks2, marks3.

Write PHP script that checks the submitted marks are in range 0 - 100 and prints total and percentage of the student.

b) Write a perl program for accepting set of numbers as command line argument and find sum of these numbers.

c) Create HTML form to accept user name. As and when user name is submitted the servlet should greet the user as.

" Hello", name - "welcome to Servlet programming".

d) Explain various HTML tags used in table creation Give suitable example for the same.

e) What is CGI. pm module?

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P1252

[3835] - 503

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 503 : Functional Analysis

(New Course) (Sem. - V)

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 X is a non-zero Banach space then prove that

$$\{x \in X \mid \| x \| = 1\}$$

is complete.

b) Let X be a normed linear space. If E_1 and E_2 are subsets of X and $\in_1$ is open in X then show that $E_1 + E_2$ is open.

c) Let X be a normed linear space over K and F : X $\rightarrow$ K

be a linear map. Show that if

$$\{ x \in X \mid F(x) = 0\}$$

is a closed set in X then F is continuous at 0.

d) State the Hahn-Banach Extension theorem.

e) If x and y are vectors in a Hilbert space X, then show that

$$\| x + y \|^2 + \| x - y \|^2 = 2 \| x \|^2 + 2\| y \|^2.$$

f) Let $\{x_1,.....,x_n\}$ be an orthogonal set in a Hilbert space X. Then show that

$$\| x_1 + ...+x_n \|^2 = \| x_1 \|^2 + ...+ \| x_n \|^2.$$

g) State the closed graph theorem.

h) State Riesz Representation theorem.

i) Show that every finite dimensional subspace of the Hilbert space H is closed in H.

j) Show that every Hilbert space is a Banach space.

P.T.O.

Q2) a) Attempt <u>any one</u> of the following : **[6]**

i) Let X be a normed linear space. Show that the closed unit ball in X is compact if and only if X is finite dimensional.

ii) Let X be a normed linear space and Y a closed subspace of X. Prove that Y with the induced norm and X/Y with the quotient norm are Banach spaces if and only if X is a Banach space.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let X be a normed linear space over K and $0 \neq a \in X$.

Then prove that there exists $f \in X'$ with $f(a) = \| a \|$ and $\| f \| = 1$.

ii) Let X and Y be normed linear spaces over K.

If X is finite dimensional then show that every linear map from X to Y is continuous.

iii) Prove that a finite dimensional normed linear space is a Banach space.

Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) Let $X \neq \{0\}$ and Y be normed linear spaces. Prove that BL(X, Y) is a Banach space if Y is a Banach space.

ii) State and prove the closed graph theorem.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let X be a Banach space, and Y and Z be closed subspaces of X such that $X = Y + Z$ and $Y \cap Z = \{0\}$. For $x \in X$, let $p(x) = y$, where $x = y + 2$, $y \in Y$, $z \in Z$. Show that p is a continuous.

ii) Let X be a Banach space and $F \in BL(X)$. Then show that F^{-1} exists and belongs to BL(X) if and only if F is one-one and onto.

iii) Let X, Y, Z be Banach spaces, $G \in BL(X, Z)$ and $H \in BL(Y, Z)$. Suppose that for every $x \in X$ the equation $G(x) = H(y)$ has a unique solution $y \in Y$. Then the map $F(x) = y$ from X to Y is in BL(X, Y).

Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Let $\{x_n : n = 1, 2, ...\}$ be a linearly independent set in an inner product space X. Define $y_1 = x_1$, $u_1 = \frac{y_1}{\|y_1\|}$.

and for $n = 2, 3.....$,

$$y_n = x_n - \sum_{j=1}^{n-1} < x_n, u_j > u_j, \; u_n = \frac{y_n}{\| y_n \|} .$$

Then show that

$\{u_n : n = 1, 2.....\}$ is an orthonormal

set in X and

span $\{u_1,.....,u_n\}$ = span $\{x_1,.....,x_n\}$ for every $n = 1, 2,.....$

ii) Let f be a continuous linear functional on a Hilbert space H.

Prove that there exists a unique $y \in$ H such that for all

$x \in$ H, $f(x) = < x, y >$.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let H be a Hilbert space and A $\in$ BL(H). Show that A is unitary if and only if $\| A(x) \| = \| x \|$ for all $x \in$ H and A is onto.

ii) Let F be a non-empty closed subspace of a Hilbert space H. If $F^{\perp}$ denotes the set of all elements of H which are orthogonal to F, then show that $H = F + F^{\perp}$ Further, show that $F^{\perp}$ is a closed subspace of H with $F \cap F^{\perp} = \{0\}$.

iii) Let H be a Hilbert space and k $\in$ K. If A, B $\in$ BL (H) then prove that

$(A + B)^* = A^* + B^*$, $(k A)^* = kA^*$

and $(AB)^* = B^*A^*$.

Q5) a) Attempt <u>any one</u> of the following : **[6]**

i) State and prove Bessel's inequality.

ii) Prove that a closed convex subset C of a Hilbert space H contains a unique vector of smallest norm.

b) Attempt <u>any two</u> of the following : **[10]**

i) If N_1 and N_2 are normal operators on H with the property that either commutes with the adjoint of the other then prove that $N_1 + N_2$ and $N_1 N_2$ are normal.

ii) If *p* is a projection on Hilbert space H with range M and null space N then prove that $N \perp M$ if and only if P is self-adjoint.

iii) Show that every Hilbert space is separable if and only if every orthonormal set in H is countable.

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P1252

[3835] - 503
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 503 : Modelling and Simulation
(Old Course) (Sem. - V)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Assume suitable data, if necessary.***
3) ***Figures to the right indicate full marks.***

Q1) Attempt any four of the following : **[4 × 5 = 20]**

a) Explain the two approaches to carry out model verification.

b) Which are the characteristics of a good random number generator.

c) How is simulation used as a decision making tool. Explain with a brief example.

d) What are the advantages and dis - advantages of simulation.

e) Define the following terms :

i) Source system.

ii) Continuous system.

iii) Simulator.

iv) Logical time.

v) Simulation clock.

Q2) Attempt any four of the following : **[4 × 5 = 20]**

a) Give the application areas of simulation.

b) Explain the types of simulation with examples of each.

c) Compare the consequences obtained from experimenting with actual system and a model of the system.

d) What are Pseudo random numbers?

e) Explain the methods used for testing of random number generators.

P.T.O.

Q3) Attempt the following : **[4 × 5 = 20]**

a) Which are the phases in the development of simulation models?

b) What is the difference between discrete and continuous distributions.

c) Write a note on comparison and selection of simulation languages.

d) Explain stochastic simulation model with an example.

Q4) Attempt any <u>one</u> of the following : **[1 × 20 = 20]**

a) In a Local Area Network there are ten client machines and one server. Each client sends request to print, save, load documents on server machine. Design a simulation model for this single server queuing system and answer the following questions.

   i) Identify whether the system is Discrete or Continuous. Justify your answer.

   ii) Draw the logic flow chart for the system.

   iii) Identify and specify the states of the system, contents in the Event list, Timing routine and Report Generation.

   iv) Write the initialize ( ) method in any simulation language.

b) A Drug store Inventory maintains details of stock like items, on-hand, re-order level, moving or most demanded items and generation of purchase order. Design a simulation model for this inventory system and answer the following questions.

   i) Identify the type of the system.

   ii) Draw the logic flow chart for the system.

   iii) Identify and specify the states of the system, the types of events and report generation.

   iv) Write the initialize ( ) method in any simulation language.

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P1252

[3835] - 503
M.Sc. Tech.
FUNCTION ANALYSIS
(New Course) (Sem. - 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) If X is a non-zero Banach space the prove that

$\{x \in X \mid \| x \| = 1\}$

is complete

b) Let X be a normed linear space. If E_1 and E_2 are subsets of X and E_1 is open in X then show that $E_1 + E_2$ is open.

c) Let X be a normed linear space over K and $F : x \to k$

be a linear map show that if

$\{ x \in X \mid F(x) = 0\}$

is a closed set in X then F is continuous at 0.

d) State the Hahn-Banach Extension theorem.

e) If x and y are vectors in a Hilbert space X then show that

$\| x + y \|^2 + \| x - y \|^2 = 2 \| x \|^2 + 2\| y \|^2$.

f) Let $\{x_1,.....x_n\}$ be an orthogonal set in a Hilbert space X then show that

$\| x_1 + ...x_n \|^2 = \| x_1 \|^2 + ...+ \| x_n \|^2$.

g) State the closed graph theorem.

h) State Riesz representation theorem.

i) Show that every finite dimensional subspace of a the Hilbert space H is closed in 4.

j) Show that every Hilbert space is Banach space.

P.T.O.

Q2) a) Attempt <u>any one</u> of the following : **[6]**

i) Let X be a normed linear space. Show that the closed unit ball in X is compact if and only if X is finite dimensional.

ii) Let X be a normed linear space and y a closed subspaced X. Prove that Y with the induced norm and X/Y with the quotient norm are Banach spaceds if and only if X is a Banach space.

b) Attemp any two of the following : **[10]**

i) Let X be a normed linear space over K and $0 \neq a \in X$.

Then prove that there exists $F \in X^1$ with $f(a) = \| a \|$ and $\| f \| = 1$.

ii) Let X and Y be normed linear spaces over k.

If X is finite dimensional then show that every linear map from X to Y is continuous.

iii) Prove that a finite dimensional normed linear space is a Banach space.

Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) Let X {0} and Y be normed linear spaces. Prove that BL(X, Y) is a Banach space if Y is a Banach space.

ii) State and prove the closed graph theorem.

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

i) Let X be a Banach space, and Y and Z be closed subspaces of X such that $X = Y + Z$ and $Y \cap Z = \{0\}$. For $x \in X$, let $p(x) = y$, where $x = y + 2$, $y \in Y$, $x \in Z$. Show that p is a continuous.

ii) Let X be a Banach space and $F \in BL(X)$. Then show that F^{-1} exists and belongs to BL(X) if and only if F is one-one and onto.

iii) Let X, Y, Z be Banach spaces, $G \in BL(X, Z)$ and H BL(Y, Z) suppose that for every $x \in X$ the equation $G(x) = H(y)$ has a unique solution $y \in Y$. Then the map $F(x) = y$ from X to Y is in BL(X, Y).

Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Let $\{x_n : n = 1, 2, ...\}$ be a linearly independent set in an inner product space X. Define $y_1 = x_1$, $u_1 = \frac{y_1}{\|y_1\|}$.

and for n = 2, 3.....,

$$y_n = x_n - \sum_{j=1}^{n-1} < x_n, u_y > uj, \; u_n = \frac{y_n}{\| y_n \|}$$

then show that

$\{u_n, n = 1, 2.....\}$ is an orthonormal

set in X and

span $\{u_1,.....,u_n\}$ = span $\{x_1,.....x_n\}$ for every $n = 1, 2,$

ii) Let f be a continuous linear functional on a Hilbert space H. Prove that there exists a unique y H such that for all $x \in$ H, $f(x) = < x, y >$.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let H be a Hilbert space and A BL(H). Show that A is unitary if and only if $\| A(x) \| = \| x \|$ for all $x \in$ H and A is onto.

ii) Let f be a non-empty closed subspace of a Hilbert space H. If $F^{\perp}$ denotes the set of all elements of H which are orthogonal to f, then show that $H = F + F^{\perp}$ Further, show that $F^{\perp}$ is a closed subspace of H with $F \cap F^{\perp} = \{0\}$.

iii) Let H be a Hilbert space and k K. If A, B BL (H) then prove that

$(A + B)^* = A^* + B^*$, $(k A)^* = kA^*$

and $(AB)^* = B^*A^*$.

Q5) a) Attempt <u>any one</u> of the following : **[6]**

i) State and prove Bessel's inequality.

ii) Prove that a closed convex subset C of a Hilbert space H contains a unique vector of smallest norm.

b) Attempt <u>any two</u> of the following : **[10]**

i) If N_1 and N_2 are normal operators on H with the property that either commutes with the adjoint of the other then prove that $N_1 + N_2$ and $N_1 N_2$ are normal.

ii) If p is a projection on Hilbert space H with range M and null space N then prove that $N \perp M$ if and only if p is self-adjoint.

iii) Show that every Hilbert space is separable if and only if every orthonormal set in H is countable.

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P883

[3835] - 104
M.Sc. Tech.
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 104 : Programming in 'C' with ANSI Features - I
(Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***

Q1) Attempt any eight of the following : **[16]**

a) Write the prototype of

f flush( ), *f* seek( )

b) Explain the unary operator & in C.

c) What is the difference between get c( ) & get ch( ).

d) State the use of typedef.

e) What is the output of following code

```
# include < stdio.h >
int main ( )
{
    printf ("5t" Good Morning \ n");
    return 0;
}
```

f) What is recursion?

g) What is the output of the following code

```
char 5[ ] = "Hello India";
    printf("%5", 5+4);
```

h) Compare the member selection operators '.' & '→'.

i) Explain various file opening modes.

j) What is type casting in 'C'?

P.T.O.

Q2) Attempt any two of the following : **[16]**

a) Write a program that reads to strings using pointer, sort them in ascending order and display the longest and shortest strings.

b) Write function subprograms :

i) To find the inverse of the matrix.

ii) To find the column sum & row sum of the matrix.

c) Write a recursive function to find the gcd of two numbers.

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

a) Write a note on pointer arithmetic in C.

b) Explain the difference between structure and union with the help of the example.

c) What is the difference between call by value & call by reference. Explain with the help of example.

d) Explain different storage class specifiers.

e) Write a note on while loop.

f) Explain break and continue statements.

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

a) What will be the output of following program?

```
# include < stdio. h >
int main( )
{
    Union var
    {
        int a, b ;
    }
    Union var v ;
    v.a = 10 ; v.b = 20
    printf("%d \ n", v.a); return 0;
}
```

b) Trace the output it the program is correct

```
# include < stdio.h >
void main( )
{
    char a[ ] = “Visual C ++” ;
    char *b = “Visual C ++” ;
    printf(“%d%d\n”, sizeof (a),
                    sizeof (b)) ;
    printf(“%d %d\n”, sizeof (*a),
                        sizeof (*b));
}
```

c) Trace the output it the program is correct.

```
# include < stdio.h >
int reverse (int);
int main( )
{
    int no = 5 ;
    reverse (no);
    return 0;
}
int reverse (int no)
{
    if (no = = 0) return 0 ;
    else printf(“%d”, no); reverse (no --);
}
```

d) Justify the following

“main( ) function doesn’t have any arguments”.

e) What is the use of the preprocessor directives.

f) If a = 3, b = 10, c = 5, d = 1 find the value of following expression

a / = b * = c + d.

g) Trace the output it the program is correct

```
# include < stdio.h >
void main( )
{
    int n = 100 ;
    while (n)
    printf("%d", n >> = 2);
}
```

h) State the use of static variables.

i) Declare P as array of 100 pointers to int.

j) Explain the use of file pointer.

Q5) a) Attempt any two of the following : **[8]**

i) Explain functions malloc and realloc.

ii) Write a note on two dimensional array in C.

iii) Explain the concept of enum with suitable example.

b) Attempt any two of the following : **[8]**

i) Write a 'C' program to check whether.

ii) Write a program to find sin h, using sin e series correct to 5 decimal places.

iii) Explain the use of any four string handling functions.

❖ ❖ ❖ ❖

Total No. of Questions : 5] **[Total No. of Pages : 2**

P870

[3835] - 31
M.Sc. Tech. - II
TOPOLOGY
MIM - 301 : Industrial Mathematics with Computer Applications
(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.***
3) ***X,Y denote the topological spaces.***

Q1) Attempt any eight of the following: **[16]**

a) Give an example of a topological space in which discrete topology and indiscrete topology are same.

b) State

i) Schroeder Berstein theorem.

ii) Well-ordering theorem.

c) State the Tychonoff theorem.

d) Give an example of a sub basis which is not a basis for a topological space.

e) Give a bijective function from [0, 1] to (0, 1).

f) Define locally compact space with example.

g) Let {A} be a family of sets in X. Then, give an example such that $\bigcup \overline{A}_\alpha \neq \overline{\bigcup A_\alpha}$.

h) Let $A \subset X$, $B \subset Y$. show that in the space $X \times Y$ $\overline{A \times B} = \overline{A} \times \overline{B}$.

i) Give an example of a non Hausdorff space with justification.

j) Find the closures of the following sets in R

i) A = Z

ii) A = Q

($\mathbb{R}$ has usual metric topology)

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

i) In the finite complement topology on R, to what point or points does the sequence $x_n = \frac{1}{n}$ converge?

ii) State and prove the Urysohn lemma for metric spaces.

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

i) State and prove the tubelemma.

ii) Show that X is Hausdorff if and only if the diagonal $\Delta = \{x \times x \mid x \in X\}$ is closed in $X \times X$.

iii) Prove that every metrizable space is normal.

P.T.O

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

i) Every well-ordered set X is normal in the order topology.

ii) Suppose that f: $X \to Y$ is continuous. Then show that for every subset A of X, one has $f(\overline{A}) \subseteq \overline{f(A)}$. If x is a limit point of the subset A of X is it necessarily true that $f(x)$ is a limit point of f(A)? Justify.

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

i) Show that the one point compactification of R is nomeomorphic with the circle S^1.

ii) Prove that the image of a connected space under a continuous map is connected.

iii) Let $Y \subset X$; Let X and Y be connected. Show that if A and B form a separation of X-Y, then $Y \cup A$ and $Y \cup B$ are connected.

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

i) State and prove the Intermediate value theorem.

ii) Show that a space X is locally connected if and only if for every open set U of X, each component of U is open in X.

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

i) Define connected space, locally compact space. Give an example of a space which is connected but not path connected with justification.

ii) Is product of two Lindelöf spaces Lindelöf? Justify.

iii) Show that space R_l is normal.

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

i) Let f,g: $X \to Y$ be continuous functions. Assume that Y is Hausdorff. Show that $\{x \in X | f(x) = g(x)\}$ is closed in X.

ii) Is the set of rationals Q is locally compact? Justify.

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

i) Prove that set of open intervals
$\{(a, b) \mid a, b \in Q\}$ forms a basis for usual topology on R.

ii) Let Y be a subspace of X. Then show that a set A is closed in Y if and only if it equals the intersection of a closed set of X with Y.

iii) Let A,B denote subsets of a space X. Then prove the following:

A) If $A \subset B$ then $\overline{A} \subset \overline{B}$

B) $\overline{A \cup B} = \overline{A} \cup \overline{B}$

Total No. of Questions : 5] **[Total No. of Pages : 2**

P871

[3835] - 32
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 302 : Databases
(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) Define : relation in RDBMS.
b) State the purpose of 'σ' operators.
c) What are multivalued attributes?
d) How 'foreign key' establish referential Integrity?
e) Define : Hashing.
f) What are functional dependencies?
g) Define : Schema.
h) Give the differences between an attribute and a value set.
i) What is the difference between where and having clause?
j) Define : Normal form in Relational Databases.

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

i) A small scale electronic unit is manufacturing various electronic equipments as per customer requirement. Each equipment is composed of many different parts. Each order is assigned to one particular project but a project can make many orders.
Draw 1) E-R model 2) Entity Model.
ii) Explain database system architecture.

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

i) Why is a B^+ tree usually preferred as an access structure to a data file?
ii) State possible levels for the 'RAISE' statement.
iii) Write a note on cursors.

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

i) Describe the concept of transitive dependency and explain how this concept is used to define 3NF.
ii) Explain with a suitable example "Mandatory access method".

P.T.O

b) Attempt <u>any two</u> of the following: **[10]**

i) Consider the following entities and relationship.

Works (Pname, Cname, Salary)
Lives (Pname, street, city)
Located-in (Cname, city)
Manager (Pname, Mgrname)

Where Pname = person name, Cname = company name and Mgrname = Manager name.

Write the SQL for the following:

1) List the names of the people who work for the company wipro along with the cities they live in.
2) Find the names of the persons who do not work for 'Infosys'.

ii) Explain Aggregate functions with an example.

iii) Explain the limitations in file systems over Databases.

Q4) a) Attempt <u>any one</u> of the following: **[6]**

i) Explain DBMS Languages.

ii) Explain 'Natural Join' and 'Cartesian Product' operator in Relational Algebra with an example.

b) Attempt <u>any two</u> of the following: **[10]**

i) What are the different techniques used for database security?

ii) Using relations, create following queries in relational Algebra:

Members (Member-id, Name, Designation, Age)
Books (Bookid, Booktitle, Author, Publisher, Price)
Reserves (Member-id, Bookid, Date)

1) Find the names of members who are professors older than 45 years.
2) List the titles of books reserved by Professors.

iii) Explain specialization and Generalization.

Q5) Attempt <u>any four</u> of the following: **[16]**

a) Explain non-trivial dependency with an example.

b) Explain hashing technique that are partitioned.

c) Write a note on : End Users in DBMS.

d) What are weak Entity Types? Explain with an example.

e) "Triggers are implicitly called for execution" comment on this statement and give a suitable example.

Total No. of Questions : 5] **[Total No. of Pages : 3**

P872

[3835] - 33

M.Sc. Tech. (Sem. - III)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 303 : Object Oriented Programming with C++ - I

(Old)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***Figures to the right indicate full marks.***
2) ***Use of logarithmic tables calculator is allowed.***
3) ***All questions are compulsory.***

Q1) Attempt any eight of the following: **[16]**

a) Define Encapsulation.
b) What are the two different ways of opening a file?
c) What is a copy constructor?
d) Illustrate with an example how setw manipulator works.
e) Give two benefits of Object Oriented programming.
f) Is the following code correct?

```
int charvar = 22;
int *ptr;
cont <<*ptr;
```

g) Give two advantages of function prototyping.
h) Which operator can not be overloaded using friend function?
i) Define static & extern variables.
j) Name access specifiers in C++.

Q2) Attempt any four of the following. **[16]**

a) Explain Exception Handling in C++.
b) Write C++ program to accept a string & print it in reverse order.
c) Explain multiple inheritance with example.
d) What is a file mode? Describe various file opening modes available.
e) Explain three models of modeling system.

P.T.O

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

a) Find output of following. Consider that all necessary header files are included class T

```
{     public :
            Virtual void f1 ( )
                  {     cont << end1 << " in function f1 of T".;}
            Void f2 ( )
                  {     cont << endl  << " in function f2 of T";}
}
class T1 : public T
{     public :
       void f1 ( )
       { cont << endl<< "in function f1 of T1";}
       void f2 ( )
       { cont << endl << "in function f2 of T1";}
}
       void main ( )
       {     T *ptr, *ptr1;
             T t; T1 t1;
             ptr = & t; ptr1 = &t1;
             ptr → f1 ( );
             ptr1 → f1 ( );
             ptr1 → f2 ( );
}
```

b) Explain function template in C++.

c) Explain seek ( ) & tell ( ) functions associated with file pointors.

d) Write program in C++ to read a file containing list of names (containing one word) & telephone numbers separated by space. Print the contents of the file in two columns.

e) Explain different types of constructors.

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

a) Explain main features of object based programming language.

b) Explain public & private inheritance in C++.

c) Distinguish between class template & template class.

d) What is a friend function? When they are used in a program.

e) Write a C++ program to read two fractions & find sum & difference of two fractions.

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

a) Explain memory management operator in C++ with example.

b) Write a program which defines class to represent bank account. The class contains name of depositor, acc-no, type of account, Balance amount. & function to assign initial values, deposit an amount, withdraw & display.

c) Write a program for addition of two complex numbers, include two member functions get ( ) , put ( )

Total No. of Questions : 5] **[Total No. of Pages : 3**

P873

[3835] - 34
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 304 : Operating Systems - I
(Old Course) (Sem. - 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 is victim page? How victim page is selected?

b) What is co-operating process?

c) Define :
   i) CPU bound Job.
   ii) I/O bound Job.

d) What is Belady's anomaly? Which page replacement algorithm suffers from Belady's anomaly?

e) Define:
   i) Absolute Path.
   ii) Relative Path.

f) List any two disadvantages of linked allocation.

g) What is local page replacement & global page replacement.

h) What is reentrant code?

i) List any two operations which can be performed on a directory.

j) What is external fragmentation? How compaction solves the problem of external fragmentation.

Q2) Attempt any four of the following. **[16]**

a) Explain MFT with unitied queue and separate queues.

b) Differentiate between long term scheduler and short term scheduler.

c) What is critical section problem? State the requirements which should be satisfied by a solution to the critical section problem.

d) A disk has 200 cylinders numbered 0 to 199. Consider a disk queue with requests
   98, 180, 30, 120, 16, 185, 65, 124, 69.
   The disk head is presently at cylinder 58. Find total head movement using SSTF and FCFS.

e) Explain deadlock recovery scheme.

P.T.O

Q3) Attempt any four of the following; **[16]**

a) Consider the following reference string

7, 0, 1, 2,, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. How many page faults will occur for the following page replacement algorithms assuming 3 frames.

i) Optimal.

ii) LRU.

b) Explain in brief:

i) Acyclic graph directories.

ii) General graph directories.

c) Write short note on semaphores.

d) Define:

i) Rotational Latency.

ii) System call.

iii) Context switch.

iv) Starvation.

e) Consider the following snapshot of a system.

	Allocation				Max			
	A	B	C	D	A	B	C	D
P_0	0	0	1	2	1	0	1	2
P_1	1	0	0	0	1	7	5	0
P_2	1	3	5	1	2	3	5	5
P_3	0	3	2	2	0	6	5	2
P_4	0	0	1	4	0	6	4	6

Available			
A	B	C	D
1	5	2	0

Answer the following questions using Banker's algorithm.

i) Find Need.

ii) Is the system in a safe state.

iii) If a request from Process P_1 arrives for (0, 4, 2, 0) can it be immediately granted?

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

a) What is dynamic storage allocation problem? How it can be solved?

b) What is deadlock? Explain the conditions necessary for the deadlock occurrence.

c) Consider the following set of processes.

Process	Arrival Time	CPU Burst Time
P_1	1	10
P_2	0	1
P_3	2	2
P_4	3	1
P_5	4	5

Calculate average Turn Around Time and average Waiting Time by applying preemptive SJF.

d) State the types of 'threads'. Describe benefits of multithreaded programming.

e) What is "virtual memory"? Explain the terms 'locality of reference' and 'dirty bit'.

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

a) What is page fault? Explain how page fault is handled by the operating system.

b) Write short note on:

i) Buffering.

ii) Polling.

c) Explain second chance page replacement algorithm with example.

d) Consider following segment table.

Segment Number	Base	Limit/length
0	4000	1000
1	6000	500
2	6500	500
3	5000	500

Find the physical address for following logical addresses in segmentation.

i) Logical address (0, 450)

ii) Logical address (2, 300)

e) What is Resource allocation Graph? Explain how it can be used in deadlock avoidance.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P874

[3835] - 35

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 305 : Design and Analysis of Algorithms - I

(Old) (Sem. - 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: **[8 × 2 = 16]**

a) Define Ω notation. Is matrix multiplication algorithm Ω (n^2). Justify.

b) Order the following functions in ascending order of their growth rates.
5!, 5^n, n^5, 5^n, $\log n^5$

c) Explain the two components of space complexity.

d) Find the value of $\sum_{k=2}^{n} \frac{1}{(k-1)k}$ using telescoping series.

e) What is amortized analysis? How amortized cost is defined in potential method of amortized analysis?

f) What is a heap? Is (42, 5, 17, 15, 2, 10) a heap?

g) Explain fractional knapsack problem.

h) What is a flow network?

i) Explain the process of relaxing an edge with an example.

j) Explain longest common subsequence problem.

Q2) Attempt any TWO of the following. **[2 × 8 = 16]**

a) Discuss the aggregation and accounting method of amortized analysis on a stack data structure with push, pop and multipop operation.

b) State Master's theorem, Solve the following recurrence relations using Master's theorem.
i) $T(n) = 9\ T(n/3) + n^2$
ii) $T(n) = 6\ T(n/2) + n^2$

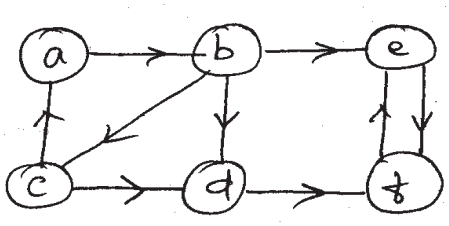
c) Show that a straightforward algorithm for evaluating a polynomial of order n is of $O(n^2)$. Write an algorithm using divide and conquer strategy for the same problem and derive its time complexity. Show that there exists an O(n) algorithm using Horner's rule.

P.T.O

Q3) Attempt any two of the following; **[2 × 8 = 16]**

a) Explain matrix chain multiplication problem. Show that it satisfies optimal substructure property. Obtain the recurrence relation for the value of optimal solution. Give the algorithm to compute values of optimal solution in bottom up manner.

b) What are strongly connected components? Give the algorithm to compute strongly connected components of a diagraph based on DFT. Illustrate it on the following problem instance.



c) What are prefix codes? Explain Huffman coding algorithm. Obtain optimal Huffman coding for the following set of frequencies.

M_1	M_2	M_3	M_4	M_5	M_6	M_7
100	20	70	10	200	150	50

Q4) Attempt any FOUR of the following. **[4 × 4 = 16]**

a) Write insertion sort algorithm. Derive Best case time.

b) Let f(n) and g(n) be positive functions. Prove or disprove each of the following.

i) $f(n) = O(g(n))$ or $f(n) = \Omega(g(n))$

ii) If $f(n) = O(g(n))$ then $2^{f(n)} = O(2^{(g(n))})$

c) Discuss linear order sorting algorithms.

d) Explain activity selection problem and show how it can be solved using greedy strategy.

e) Compare and contrast Prim's and Kruskal's algorithm

f) Explain divide and conquer strategy. Show how it is applied in Quicksort algorithm.

Q5) Attempt any FOUR of the following: **[4 × 4 = 16]**

a) Explain Bellnam Ford algorithm. Derive its time complexity.

b) Discuss classification of edges based on Depth first traversal.

c) Explain Breadth first search algorithm and Breadth first Traversal algorithm.

d) Explain Ford Fulkerson algorithm for finding maximum flow in a network.

e) Explain the algorithm to compute all pairs shortest path using dynamic programing.

f) Explain how heapily algorithm is used to construct heap and to maintain heap property.

Total No. of Questions : 5] **[Total No. of Pages : 3**

P875

[3835] - 41
M.Sc. Tech.
MATHEMATICS
Industrial Mathematics with Computer Applications
MIM - 401 : Functional Analysis
(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) Give an example of a continuous functional on X which is not Linear, where X is normed Linear space.

b) Let $\{x_n\}$ be a sequence in an inner product space X. If $\langle xn, x\rangle \to \langle x, x\rangle$ and $||x_n|| \to ||x||$ then prove that $xn \to x$ in X.

c) Is Y $=\{t(1, 2, 3) / t \in R\} \subseteq R^3$ a hyperspace?

d) If in an inner product space X, for $x, y \in X$, $x \perp y$ then show that $||x+y|| = ||x-y||$

e) Is it true that an infinite dimensional subspace of normed space closed? Justify.

f) Give an example of an inner product space which is not a Hilbert space.

g) If X is a normed space and if for $x \in X$. $f(x) = 0$ for every $f \in X^{/}$ then prove that $x = 0$.

h) Prove that an orthonormal set in a Hilbert space is Linearly independent.

i) Is $L^{\infty}(R) \subseteq L^{P}(R)$? Justify.

j) State the Riesz representation theorem.

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

i) State and prove Riesz Lemma.

ii) Let H be a Hilbert space and A$\in$ BL(H). Prove that there is a unique B$\in$ BL(H) such that for all $x, y \in$ H,
$\langle A(x), y\rangle = \langle x, B(y)\rangle$.

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

i) Prove that a Linear map F From a normed space X to a normed space Y is a homeomorphism if and only if there are α, β, γ o such that $\beta\ ||x|| \le ||F(x)|| \le \alpha\ ||x||$ for all $x \in X$.

ii) If M and N are closed linear subspaces of a Hilbert space H such that M$\perp$N then prove that the subspace M + N is closed.

P.T.O

iii) Let X be a normed space over K (Ror $\in$), $f \in X^{|}$ and $f \neq 0$. Let $a \in X$ with $f(a) = 1$ and $\epsilon > 0$. Prove that $U(a,\in)\, nz(f) = \phi$ if and only if $\|f\| \leq \frac{1}{\in}$.

Q3) a) Attempt <u>any one</u> of the following; **[6]**

i) Let H be a Hilbert space and F be a nonempty closed subspace of H. Prove that $H = F + F^{\perp}$.

ii) Let X and Y be normed spaces and $X \neq \{0\}$. Prove that BL(X,Y) is a Banach space in the operator norm if and only if Y is a Banach space.

b) Attempt <u>any two</u> of the following. **[10]**

i) Let X be an inner product space. Prove that for all x, $y \in X$, $|\langle x,y\rangle|^2 \leq \|n\|^2\|y\|^2$, where equality holds if and only if the set $\{x,y\}$ is Linearly dependent.

ii) Show that a Banach space cannot have a denumerable basis.

iii) Let X be an inner product space. Let E be an orthonormal subset of X with $o \notin E$ then prove that E is Linearly independent and $\|x-y\| = \sqrt{2}$ for all $x \neq y$ in E.

Q4) a) Attempt <u>any one</u> of the following. **[6]**

i) Let X be a normed space. Prove that projection map P on X is a closed map if and only if the subspaces R(P) and Z(P) are closed in X.

ii) Let H be a Hilbert space. If A is a self adjoint operator on H then prove that $\|A\| = \sup\{|1\langle A(x), x\rangle| \; x \in H, \|x\| \leq |\}$

b) Attempt <u>any two</u> of the following. **[10]**

i) Let X=Coo with sup norm and

$$E=\{x \in X \mid |x(\overset{o}{J})| \leq \frac{1}{\overset{o}{J}}, \; \overset{o}{J} = 1, 2, --\}.$$

Show that E is convex subset of X, E spans X & $E^{o} = \phi$, where Coo = {x all but finitely many x(j)'s are equal to zero}

ii) If X is a Hilbert space and $\sum_n |Kn|^2 < \infty$ then prove that $\sum_n k_n u_n$ converges in X.

iii) Justify with an example that the open mapping theorem fails if X and Y are not Banach spaces.

Q5) a) Attempt <u>any one</u> of the following: **[6]**

i) Let H be a Hilbert space and Let {An} be a sequence in BL(H) and $A \in BL(H)$ such that $\|An-A\| \to 0$ as $n \to co$. If each An is self adjoint, unitary prove that A is self adjoint and unitary.

ii) State and prove Bounded inverse theorem.

b) Attempt <u>any two</u> of the following: **[10]**

i) Let H be a Hilbert space and $A,B \in BL(H)$, $k \in K$. Prove that.

a) $(A+B)^* = A^*+B^*$

b) $(KA)^* = \overline{K} A^*$

c) $(AB)^* = B^*A^*$

ii) Let X be a normed space and $A \in BL(X)$. Prove that the following are closed subspaces of BL(X).

a) $\{B \in BL(X) / AB = 0\}$

b) $\{B \in BL(X) / AB = BA\}$

iii) Let H be a Hilbert space and $A \in BL(H)$. Prove that

a) The closure of R(A) equals $Z(A^*)^{\perp}$ and

b) The closure of R(A*) equals $Z(A)^{\perp}$.

Total No. of Questions : 5] **[Total No. of Pages : 5**

P876

[3835] - 42

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 402 : Operations Research

(Old Course) (Sem. - 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) Define the following for a Linear Programming Problem:
   i) Feasible Solution.
   ii) Basic solution.

b) Draw a graph and highlight the feasible region for the following constraint:
   $-2x_1+x_2 \geq 5$.

c) Find one basic solution for the following system of equations:
   $x_1+2x_2+x_3 = 4$
   $2x_1+x_2+5x_3 = 5$.

d) Convert the following Transportation Problem into LPP:

	D_1	D_2	Availability
O_1	10	15	20
O_2	2	13	25
Requirement	15	30	

e) Define the following for a Transportation Problem:
   i) Degenerate solution.
   ii) Optimum solution.

f) Define an assignment problem.

g) What is an unbalanced Assignment Problem? How do we balance it?

h) Solve the following game:

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	3	-5	0	6
	A_2	-4	-2	1	2
	A_3	5	4	2	3

P.T.O

i) Define the following terms:
   i) Pure strategy.
   ii) Mixed strategy.

j) For a network, explain the following terms for an event:
   i) Earliest start time.
   ii) Latest start time.

Q2) a) Attempt <u>any two</u> of the following. **[16]**

i) Solve the following LPP graphically:

Min $Z = 2x_1+3x_2$

Subject to

$$x_1+x_2 \geq 6$$
$$7x_1+x_2 \geq 14$$
$$x_1\ x_2 \geq 0.$$

ii) Write the dual of the following LPP and hence find its optimal value:

Min $Z = 10x_1 + 3x_2 - 5x_3$

Subject to,

$$2x_1 - 5x_2 + 7x_3 \geq 50.$$
$$x_1, x_2, x_3 \geq 0.$$

b) Solve the following LPP using Simplex method:

Max $Z = 3x_1+5x_2-2x_3$

Subject to,

$$x_1+2x_2+2x_3 \leq 10$$
$$2x_1+4x_2+3x_3 \leq 15$$
$$x_1, x_2, x_3 \geq 0$$

c) Solve the following LPP using BigM method:

Max $Z = 3x_1-x_2$

Subject to,

$$2x_1+x_2 \geq 2$$
$$x_1+3x_2 \leq 3$$
$$x_2 \leq 4$$
$$x_1, x_2 \geq 0.$$

Q3) Attempt <u>any two</u> of the following; **[16]**

a) Using dual show that the following LPP has no solution.

Max $Z = x_1+5x_2$

Subject to,

$$3x_1+4x_2 \leq 6$$
$$x_1+3x_2 \leq 2$$
$$x_1, x_2 \geq 0.$$

b) Solve the following Transportation Problem.

From \ To	W_1	W_2	W_3	W_4	Availability
F_1	30	25	40	20	100
F_2	29	26	35	40	250
F_3	31	33	37	30	150
Requirement	90	160	200	50	

Find initial solution using Least cost method and optimum solution using MODI method.

c) i) Explain north west corner rule for finding an initial solution for a transportation problem with an example.

ii) How do we solve an assignment problem for maximization?

Q4) Attempt <u>any two</u> of the following. **[16]**

a) Following is the IBFS of a certain Transportation problem:

	I	II	III	IV	Supply
A	5	10	4 (10)	5	10
B	6 (20)	8	7	2 (5)	25
C	4 (5)	2 (10)	5 (5)	7	20
Demand	25	10	15	5	

i) Is the solution feasible?

ii) Is it optimum?

iii) Is it degenerate?

iv) Does it have one more optimum solution? If so, find one more optimum solution.

b) i) Solve the following assignment problem:

Jobs \ Machines	1	2	3	4
A	1	3	5	2
B	8	6	9	8
C	3	4	10	6
D	7	6	7	4

ii) Solve the following game using rule of dominance:

$$\begin{array}{c} \\ B_1 \\ B_2 \\ B_3 \\ B_4 \end{array} \begin{array}{c} \begin{array}{ccccc} A_1 & A_2 & A_3 & A_4 & A_5 \end{array} \\ \begin{bmatrix} 2 & 4 & 3 & 8 & 4 \\ 5 & 6 & 3 & 7 & 8 \\ 6 & 7 & 9 & 8 & 7 \\ 4 & 2 & 8 & 4 & 3 \end{bmatrix} \end{array}$$

c) Solve the following game using graphical method:

		Player A	
		A_1	A_2
Player B	B_1	20	-6
	B_2	-8	2
	B_3	-4	3

Q5) Attempt <u>any two</u> of the following: **[16]**

a) Consider the following LPP:

Max $Z = 20x+30y$

Subject to,

$3x+3y \leq 36$

$5x+2y \leq 50$

$2x+6y \leq 60$

$x, y \geq 0.$

The optimal solution is $(x_1, x_2, s_2)^T$ and the optimal inverse is

$$\begin{bmatrix} 1/2 & 0 & -1/4 \\ -1/6 & 0 & 1/4 \\ -13/6 & 1 & 3/4 \end{bmatrix}$$

Find the optimal solution if a third variable Z is added to the system whose cost co-efficient is 10 and the co-efficients in the constraints are 2,3 and 5 respectively.

b) A project consists of 8 activities with the following information:

Activity	Predecessor	Duration (days)
A	-	5
B	-	7
C	A	3
D	B	6
E	C	4
F	A,D	7
G	E,F	8
H	G	5

i) Draw the network for the project.

ii) Prepare the activity table consisting of earliest-start and finish, latest start and finish and total float.

c) Given the following information for a project,

Activity	Duration in weeks		
	Optimistic	Pessimistic	Most likely
1-2	1	7	1
1-3	1	7	4
1-4	2	8	2
2-5	1	1	1
3-5	2	14	5
4-6	2	8	5
5-6	3	15	6

i) Find the expected time and variance for each activity.

ii) Draw the project network and find the critical path.

Total No. of Questions : 5] **[Total No. of Pages : 2**

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[3835] - 43

M.Sc. Tech. (Sem. - IV)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 403 : Object Oriented Programming with Java

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

Q1) Attempt any eight of the following: **[16]**

a) State the difference between a scrollbar and a scrollpane.
b) Is it possible to implement the interface partially? If yes, how?
c) What is an abstract class? Give an example.
d) How are 'this' and 'super' keywords used with a constructor.
e) What is the difference between error and an exception.
f) If system.exit (O) is written at the end of the try block, will the finally block still execute? Give reason.
g) What is serialization? How do we serialize an object to a file.
h) What is the difference between static and non-static variables.
i) Explain with example, concept of pass-by-value and pass-by-reference.
j) What is the difference between a constructor and a method.

Q2) Attempt any four of the following. **[16]**

a) Explain the steps to be performed in java database connectivity using JDBC-ODBC bridge and explain why is a bridge needed to use the database.
b) What are inner classes and explain the different types of inner classes.
c) Explain synchronization with an example.
d) Explain exception handling in java.
e) Explain Flow Layout & BorderLayout with suitable examples.

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

a) Define a class Actor having abstract method act ( ). from Actor class derive two classes Comedy Actor and Tragedy Actor ( ). Method act ( ) of these classes print 'Comedy Actor' and 'Tragedy Actor' respectively. Write one more class stage having a member Actor and two methods; perform Play ( ) that calls method act ( ), and change ( ) that changes actor performing on stage.

P.T.O

b) Write a class Cricket and three member functions; enterdetails ( ), average single ( ) and average all ( ).
The program should accept details from user (max : 10) player code, name, runs, innings played, number of times not out,
The program should provide the facility of:
i) Entering details of maximum 10 players.
ii) Display average runs of a single player.
iii) Display average runs of all players.

c) Write a program to create an Applet with a choicebox having five names of fonts. There must be another choice box with items 10, 15, 20, 25, 30, 35, 40 to represent the size of the font. Then the text 'welcome to java world' should appear in the selected font and size.

Q4) Attempt <u>any two</u> of the following. **[16]**

a) Explain the complete Thread Model in java with suitable example.

b) Write a class student with attributes; name, age, contact number. Initialize values through parameterized constructor. Throw user-defined execeptions for:
i) If name contain special characters or number.
ii) If age is not between 15 to 21 throw 'Age not within range'.
iii) If contact does not follow the rules of mobile number i.e. no characters only digits and only 10 digits.

c) Write a java program to accept 'n' numbers through the command line and store all the prime numbers and perfect numbers into different arrays and display both the arrays.

Q5) Attempt <u>any four</u> of the following: **[16]**

a) Differentiate and explain with suitable examples:
i) Compile-time errors and
ii) Run-time errors.

b) Explain the various access specifiers in java with respect to packages.

c) Explain in brief any four features of Java programming language.

d) What is the use of iteration statements in a program? State the various types of iteration statements available in java.

e) State whether each of the following is true or false. If false explain why?
i) When string objects are compared with = = , the result is true if the strings contain the same value.
ii) A string can be modified after it is created.

Total No. of Questions : 5] **[Total No. of Pages : 2**

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[3835] - 44

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 404 : Operating Systems - II

(Old Course) (Sem. - 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) What is process? Which process is parent of all the processes?

b) What is FAT in DOS? How many copies of FAT are maintained in DOS?

c) Give syntax of following system calls:

i) Chmod.

ii) Chown.

d) What is use of 'WC' command? List any 2 options used with WC.

e) State the 2 types of page faults that the system can incur.

f) State the types of user ids associated with a process.

g) State any 2 characteristics of UNIX file system.

h) What is buffer cache?

i) What is shell? What are different shells available in Unix?

j) What is use of dup ( ) system call?

Q2) Attempt any four of the following: **[16]**

a) Write shell script for accepting the name from user and print message "Welcome name, to shell programming".

b) Describe the "getblk" algorithm.

c) Explain how protection fault is handled in demand paging.

d) What is super block? What are the contents of super block?

e) Explain Open ( ) system call with suitable example.

P.T.O

Q3) Attempt <u>any four</u> of the following: **[16]**

a) Explain the concept of distributed system. Give advantages of distributed system.

b) Give usage of following commands:

i) ls.
ii) cat
iii) head
iv) tail

c) Differentiate between named and unnamed pipes.

d) Write a shell script to accept a number and check whether it is even or odd.

e) "Abuffer can be on hash queue and on free list simultaneously", Justify whether True or False.

Q4) Attempt <u>any four</u> of the following: **[16]**

a) What is a C-list? Describe operations performed on C-list.

b) Explain architecture of UNIX system with suitable diagram.

c) Write a shell program to find factorial of a number.

d) Explain following UNIX commands.

i) pwd
ii) who

e) Write short note on disk inode.

Q5) Attempt <u>any four</u> of the following: **[16]**

a) How does Kernel maintains free space for the swap device?

b) Explain the link system call.

c) Explain following UNIX commands.

i) grep
ii) diff

d) Write short note on generic inode.

e) Describe the algorithm to convert the pathname to an inode number.

Total No. of Questions : 5] **[Total No. of Pages : 3**

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[3835] - 45

M.Sc. Tech. - II

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 405 : Design and Analysis of Algorithms - II

(Old) (Sem. - 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: **[8 × 2 = 16]**

a) Define the terms Depth of a wire and Depth of a comparator.

b) When a PRAM algorithm is said to be work efficient?

c) Show how to multiply complex numbers $a+bi$ and $c+di$ using only three real multiplications.

d) What is principal n^{th} root of unity and how is it related to other complex n^{th} roots of unity?

e) Explain Digital Signature.

f) State Chinese remainder theorem.

g) Explain good suffix heuristic.

h) Explain the term convex hull and Bounding Box.

i) Explain P and NP class.

j) Define the term Approximation ratio and Approximation scheme.

Q2) a) Attempt any ONE of the following: **[1 × 6 = 6]**

i) State and prove zero-one principle.

ii) Explain Merging Networks. Show that the depth of a Merger [n] is of O(log n).

b) Attempt any TWO of the following: **[2 × 5 = 10]**

i) How are the three processors in a Euler-Tour formation in a EREW PRAM? What are their initial values?

ii) Explain CRCW algorithm for finding maximum in an array.

iii) What is a bitonic sequence? Explain the use of half cleaner in bitonic sorting.

P.T.O

Q3) a) Attempt any ONE of the following: **[1 × 6 = 6]**

i) Use strassen's algorithm to compute the matrix product of following matrices giving each computation step

$$A = \begin{bmatrix} 2 & 5 \\ -7 & 3 \end{bmatrix} \qquad B = \begin{bmatrix} 4 & 3 \\ 2 & -1 \end{bmatrix}$$

ii) What is LV decomposition? Give LV decomposition for the matrix.

$$\begin{bmatrix} 4 & 2 & 3 & 1 \\ 8 & 4 & 2 & -4 \\ 12 & -2 & 22 & 4 \\ 4 & -2 & 17 & 2 \end{bmatrix}$$

b) Attempt any TWO of the following: **[2 × 5 = 10]**

i) Explain the steps of computing matrix inverse of A using LVP decomposition.

ii) Explain Bit reverse copy with an example and its significance in iterative FFT.

iii) Give two ways of representing polynomials and discuss complexities of addition and multiplication operation.

Q4) a) Attempt any ONE of the following: **[1 × 6 = 6]**

i) Give extended Euclid algorithm that returns a triplet for arbitrary integer. Compute the values (d, x, y) that are output by the invocation to extended Euclid (495, 372).

ii) Explain the RSA cryptosystem and prove its correctness.

b) Attempt any TWO of the following: **[2 × 5 = 10]**

i) Explain the modular exponentiation algorithm.

ii) Explain Naive string matching algorithm. Show the comparisons made for the pattern 0101 for the text T= 0100100101001010.

iii) Define prefix function Π and give the algorithm to compute prefix function.

Q5) a) Attempt any ONE of the following: **[1 × 6 = 6]**

i) Discuss the Rabin Karp String matching algorithm. How many spurious hits does the Rabin Karp encounter in the text T = 55431242312368 when looking for pattern 42 working modulo 13.

ii) Give the algorithm to find whether the given pair of line segments intersect or not.

b) Attempt any TWO of the following: **[2 × 5 = 10]**

i) Prove that circuit satisfiability problem belongs to NP class.

ii) What is vertex cover problem? Explain the approximation algorithm for vertex cover problem.

iii) Define NP complete class. Show that NP complete problem is polynomial time solvable iff P = NP.

Total No. of Questions : 5] **[Total No. of Pages : 3**

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[3835]-101

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 101 : Real Analysis

(New) (Sem. - I)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Q1) Answer in short any eight of the following : **[16]**

a) Prove that the interior of a set is an open set in a metric space.

b) If X = R and d : X_X X $\rightarrow$ R defined by $d(x, y) = 0$ if $x = y$
$= 2$ if $x \neq y$

Is <X, d> a metric space?

c) Give an example to show that an arbitrary union of closed sets in a metric space need not be closed.

d) Prove that $\lim_{n\to\infty} \frac{a^n}{n!} = 0$, $\forall\, a$.

e) Explain what you mean by discontinuity of second kind of a function by giving suitable example.

f) Let f be a continuous function on [a, b]. If $\int_a^b f(x)\,dx = 0$.

Prove that $f(c) = 0$ for atleast one c in [a, b].

g) Show that the sequence $\{f_n\}$ defined by $f_n(x) = \frac{x}{1+nx^2}, \forall\, x \in \mathrm{R}$,

n = 1, 2, 3, ... converges uniformly.

h) Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{x^n}{n}$, $x \in \mathrm{R}$, $x > 0$

i) Prove that convergence of a sequence $\{s_n\}$ implies convergence of the sequence $\{|s_n|\}$ of real numbers.

P.T.O.

j) Give an example of a function which is differentiable but whose first derivative is not continuous.

Q2) a) Attempt <u>any one</u> of the following : **[6]**

i) Prove that in a metric space a set is open iff it's complement is closed.

ii) Define a compact subset of a metric space. Prove that compact subsets of a metric space are closed.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let $S_1 = 1$ and $S_{n+1} = \sqrt{2S_n}$ $(n = 1, 2, 3, ...)$ show that the sequence $\{S_n\}$ is monotonic increasing and bounded in R.

ii) Suppose $a_1 \geq a_2 \geq a_3 \geq ..... \geq 0$. Show that the series $\sum_{n=1}^{\infty} a_n$ converges iff the series $\sum 2^K a_{2^k}$ is convergent.

iii) Give an example of an open cover of (0, 1) which has no finite subcover.

Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) Prove that every bounded sequence in R has a convergent subsequence.

ii) Show that a mapping f of a metric space X into a metric space Y is continuous on X iff f^{-1} (C) is closed in X for every closed set C in Y.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let E be a connected subset of a metric space X and $F \subset X$ such that $E \subset F \subset \overline{E}$, then prove that F is connected.

ii) Verify the Mean Value Theorem for $f(x) = \log x$ on [l, e].

iii) Show that if f is a continuous real valued function on $[a, b]$ then $f \in R(\alpha)$ on $[a, b]$.

Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Suppose f is continuous mapping of a compact metric space X into a metric space Y. Prove that $f(x)$ is compact.

ii) If $f \in R$ on $[a, b]$ and F is differentiable function on $[a, b]$ such that $F^1 = f$ then prove that, $\int_a^b f(x)\,dx = F(b) - F(a)$

b) Attempt <u>any two</u> of the following : **[10]**

i) With usual notations, prove that if p* is a refinement of p then $L(p, f, \alpha) \leq L(p^*, f, \alpha)$.

ii) State and prove Taylor's Theorem for a function of real variables.

iii) Let $f(x) = x$ and $\alpha(x) = x^2$. Does $\int_0^1 f \, d\alpha$ exists? If it exists find its value.

Q5) Attempt <u>any four</u> of the following : **[16]**

a) If $\{f_n\}$ is a sequence of continuous functions on E and if $f_n \to f$ uniformly on E then prove that f is continuous on E.

b) Let f be monotonic on (a, b). Prove that the set of points of (a, b) at which f is discontinuous is almost countable.

c) If $f \in R(\alpha)$ and c is a constant then show that $cf \in R(\alpha)$.

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

e) Let E = [0, 1]. For each $n \in N$, define :

$$f_n(x) = \frac{n^2 x}{1 + n^4 x^2}, \quad \forall x \in E$$

Define $f(x) = 0 \quad , \forall x \in E$. Show that $\{f_n\}$ does not converge to $f(x)$ uniformly on E.

Total No. of Questions : 5] **[Total No. of Pages : 3**

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[3835]-102
M.Sc. Tech.
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 102 : Algebra - I
(Old & New Course) (Sem. - 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) In S_3 find all elements which satisfy the equation $x^2 = e$, where e denotes the identity element of S_3.

b) Prove that if every element of a group G is its own inverse, then G is abelian.

c) Prove that every proper subgroup of a group of order 15 is cyclic.

d) Let $\phi : G \to G$ be a homomorphism of the group G defined by $\phi(a) = a^{-1}, \forall\ a \in G$. Prove that G is abelian.

e) State Sylow's theorems.

f) Give an example of a ring with unity 1 that has a subring with unity $1' \neq 1$.

g) Does there exist an integral domain of characteristic 143? Justify your answer.

h) Determine whether $x^2 + x + 1$ is irreducible over Z_7.

i) Find all associates of $2-5i$ in the ring $Z[i]$ of Gaussian integers.

j) True or false? 'R is the field of quotients of the ring Q'. Justify your answer.

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

i) Prove that every subgroup of a cyclic group is cyclic.

ii) If N and M are normal subgroups of a group G, prove that NM is also a normal subgroup of G.

P.T.O.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let $\sigma = (1\ 4\ 5)\ (2\ 3)\ (1\ 5\ 6\ 7\ 9)\ (1\ 8)$ in S_9. Express σ as a product of disjoint cycles. Determine whether σ is even/odd.

ii) Find all subgroups of S_3.

iii) Let $G = \left\{ \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix} / \alpha \in R \right\}$.

show that G is a group w.r.t. multiplication of matrices. Is it an abelian group?

Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) State and prove the fundamental theorem of group Homomorphisms.

ii) Let p be a prime. Prove that a p-group must have a non-trivial centre.

b) Attempt <u>any two</u> of the following : **[10]**

i) Show that a group of order 30 is not simple.

ii) Let G be a group and $a, b \in G$ such that $aba^{-1} = b^2$, $a^5 = e$, $b \neq e$. Find O (b).

iii) With proper justification determine whether the Klein 4-group is isomorphic to $(Z_4, +_4)$?

Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Let R be a commutative ring with unity. If M is a maximal ideal of R, prove that R/M is a field.

ii) Let $\phi : R \rightarrow R'$ be a homomorphism of a ring R into a ring R'. Prove that ker ϕ is an ideal of R and ϕ (R) is a subring of R'.

b) Attempt <u>any two</u> of the following : **[10]**

i) A ring R is called Boolean if $a^2 = a$, $\forall\ a \in R$. Prove that every Boolean ring is commutative.

ii) Find all prime ideals of Z_{10}.

iii) Show that $A = \left\{ \begin{bmatrix} a & 0 \\ b & 0 \end{bmatrix} / a, b, \in R \right\}$ is a left ideal but not a right ideal of M_2 (R).

Q5) a) Attempt <u>any one</u> of the following : **[6]**

i) State and prove division algorithm for polynomials over a field.

ii) Let R be a Euclidean ring. Prove that any two elements a and b in R, have a greatest common divisor d. Also prove that d can be expressed in the form $\lambda a + \mu b$. for some $\lambda, \mu \in R$.

b) Attempt <u>any two</u> of the following : **[10]**

i) Use Euclidean algorithm to find a *gcd* of $8 + 6i$ and $5 - 15i$ in $Z[i]$.

ii) If R is an Integral Domain, prove that $R[x]$ is also an Integral Domain.

iii) If P_2 is a prime, prove that $1 + x + x^2 + ... + x^{p-1}$ is irreducible over Q.

Total No. of Questions : 5] **[Total No. of Pages : 4**

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[3835]-103
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 103 : Discrete Mathematical Structures - I
(New 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) Draw the Hasse diagram for the following partially ordered set, A = {2, 3, 5, 17} with operation $a \leq b$ if and only if $a|b$.

b) Transcribe the following into logical notation. Let the universe of discourse be the real numbers. "There is a value of X such that, if Y is positive then $x + y$ is negative.

c) Prove following logical equivalence $p \rightarrow q \equiv \sim p \vee q$.

d) Fill in the following table so that the binary operation $*$ is commutative.

*	a	b	c
a	b	-	-
b	c	b	a
c	a	-	c

e) State principle of inclusion and exclusion for two finite sets A and B.

f) Show that if any five numbers from 1 to 8 are chosen, then two of them will add to 9.

g) Show that every chain is modular lattice.

h) Define monoid. Give one example of monoid.

i) Let $(L, \leq)$ be a lattice. Prove that for every a and b in L, $a \vee b = b$ iff $a \leq b$.

j) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.

P.T.O.

Q2) a) Attempt <u>any one</u> of the following : **[6]**

i) Let (S, $*$) be a semigroup. Let R be an equivalence relation on S.

Let $\frac{S}{R} = \{\bar{a} \mid a \in S\}$ where $\bar{a}$ is the equivalence class of $a \in S$ under R.

Define $\circledast$ on S/R by $\bar{a} \circledast \bar{b} = \overline{a * b}$ $\forall$ $\bar{a}, \bar{b} \in$ S/R. Show that S/R is a semigroup with respect to $\circledast$.

ii) Prove that product of two lattices is a lattice.

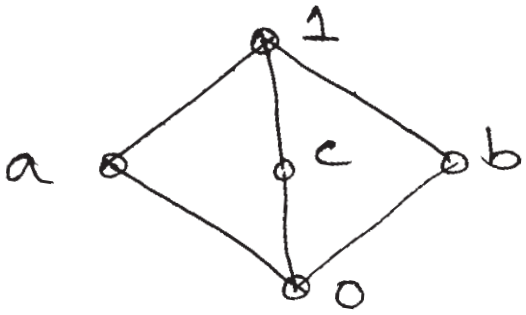
b) Attempt <u>any two</u> of the following : **[10]**

i) Give direct proof for $p \rightarrow r, \sim q \rightarrow p, \sim r \vdash q$.

ii) Test validity of following argument.

"Team a will win the cricket match if and only if they are playing against B. If team A does not win, then team C will take away the trophy. Team C does not get the trophy. Hence team A does not play against team B".

iii) Show that the following lattice is complemented but not distributive.



Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) Prove that a lattice L is distributive if and only if $(a \vee b) \wedge (b \vee c) \wedge (c \vee a) = (a \wedge b) \vee (b \wedge c) \vee (c \wedge a)$ $\forall$ $a, b, c \in$ L.

ii) Prove that homomorphic image of a distributive lattice is distributive.

b) Attempt <u>any two</u> of the following : **[10]**

i) In a department of mathematics and computer science, out of 350 students, it is known that 92 can program in C, 120 can program in JAVA and 51 can program in C ++, 12 in C and JAVA, 18 in C and C ++, 24 in JAVA and C ++ and 6 in all three languages.

A) Determine the number of students who can program in either of three languages.

B) Determine the number of students who can program in none of the languages mentioned.

ii) Let A = {0, 1}. Consider semigroup (A*, .) where A* is set of all strings from A. Define relation R on A* α R β if and only if α and β have the same number of 1's, $\alpha, \beta \in$ A*. Show that R is a congruence relation on (A*, .).

iii) Define an atom in a Boolean algebra [B, –, $\vee$, $\wedge$]. Show that 2, 3 and 5 are atoms of Boolean algebra D_{30} where $a \leq b$ is $a|b$.

Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Explain "Karnaugh map". Use K-map to minimize sum of products expansion $xy\bar{z} + x\bar{y}\bar{z} + \bar{x}yz + \bar{x}\bar{y}\bar{z}$.

ii) Let f be a homomorphism from a semigroup (S, $*$) to a semigroup (T, $*'$). If S' is a subsemigroup of (S, $*$) then prove that $f(S')$ = $\{t \in T / t = f(S)$ for some $S \in S'\}$ is a subsemigroup of (T, $*'$).

b) Attempt <u>any two</u> of the following : **[10]**

i) Construct a circuit that produces the output $(x + y)\ (\overline{x\ y})$.

ii) Negate each of the following in such a way that the symbol ~ does not appear outside the bracket :

A) $\exists x \ \forall y\ [p(x, y) = 7]$

B) $\forall x \ \exists y\ [p(x) \vee q(y)]$

C) $\exists x \ \exists y\ [p(x) \vee \sim q(y)]$

iii) Find disjunctive normal form for the Boolean function $f(x, y, z) = xy + \bar{x}z$.

Q5) a) Attempt <u>any one</u> of the following : **[6]**

i) State and prove DeMorgan's law for Boolean algebra [B, –, $\vee$, $\wedge$].

ii) Give indirect proof for $\sim p \vee q$, s $\vee$ p, ~ q $\vdash$ s.

b) Attempt <u>any two</u> of the following : **[10]**

i) Use Quine-McCluskey method to simplify the expression.
$xyz + x\bar{y}z + \bar{x}yz + \bar{x}\bar{y}z + \bar{x}\bar{y}\bar{z}$.

ii) Consider the monoid. S = $\{e, a, b, c\}$ with the following multiplication table

*	e	a	b	c
e	e	a	b	c
a	a	e	b	c
b	b	e	b	c
c	c	b	b	c

consider congruence relation R = {(e, e), (e, a), (a, e), (a, a), (b, b), (b, c), (c, b), (c, c) on S.

A) Determine the multiplication table of the quotient monoid S/R.

B) Determine the natural homomorphism $f_R : S \rightarrow S/R$.

iii) Find all subsemigroups of the semigroup (Z_6, X_6).

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P883

[3835] - 104

M.Sc. Tech.

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 104 : Programming in C

(New Course) (Sem. - 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) Find the errors it present, in the following declaration

```
Struct test
    {
        int a;
        void print-x (int y);
    };
```

b) Determine the action of the following function

```
test (char *5, char *6)
{
    while (*t ++ = *5++);
}
```

c) State whether the following are valid definitions

int $x = 5$, $y = x$, $z = x + y + p$, $p = 10$;

d) Describe the use of comma (,) operator.

e) Explain in short conditional operator.

f) Give the prototype of

*f*scantc], *f*writer].

g) Can we add integer to the pointer? If yes give example.

h) Explain the concept of macro with the help of example.

i) Distinguish between keywords and identifiers.

j) Differentiate with ++a and a++.

P.T.O.

Q2) Attempt any two of the following : **[16]**

a) Write a program to print out all armstrong numbers between 1 to 500. If the sum of cubes of each digit of the number is equal to the number itself then the number is armstrong numbers.
[eg. 153 = (1 ∗ 1 ∗ 1) + (5 ∗ 5 ∗ 5) + (3 ∗ 3 ∗ 3)]

b) Write a 'C' program for the following.
Accept a file name as a command line argument. The file contains integers. Read this file and copy all even numbers into a file name even and all odd numbers in the file named odd.

c) Write a program which reads *n* strings using pointers, sort them in ascending order & display the longest string.

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

a) What is recursion? What are the advantages and disadvantages of recursion?

b) Differentiate between macro & a function.

c) Explain the goto & break statements.

d) Compare and contrast between while and do-while.

e) What are the different ways of passing arguments to a function.

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

a) Find the difference between foll. declarations

i) int (*P) [30];

ii) int *P [30];

b) Determine the output of following code

```
Union test
    {
        int a, b;
    }
void main ( )
    {
        test t ;
        t.a = 10; t.b = 20;
        printf ("%d", t.a);
    }
```

c) Determine the output of following code

```
main( )
{
    int i = 2, j, k;
    j = add (++ i);
    k = add (i++);
    printf("j = %d, k = %d", j, k);
}
    int add (int a)
    {
        a ++ ;
        return a ;
    }
```

d) What is pre-processor?

e) Determine the output of the following code

```
    void main( )
    {
        int P[5] = {1, 2, 3, 4, 5}, i
        for (i = 0; i < 4; i ++)
        {
            if (i < 4)
            {
            P[i] = i * i ;
            printf("%d", P[i]);
            }
        }
    }
```

f) What is the use of # include preprocessor directive.

g) What is function prototype?

h) Find the output of following program

```
void main( )
    {
        int a = 10, b = 20, c = 30;
        a = a & & b :: c ;
        b = a :: b & & c ;
        printf (" %d %d %d", a, b, c);
    }
```

i) Explain in short the concept of pointer to pointer.

j) Define Compiler, Interpreter.

Q5) a) Attempt any two of the following : **[8]**

i) Explain the functions calloc and realloc.

ii) Explain different storage classes of c.

iii) Explain the concept of nestal structures with the help of the example.

b) Attempt any two of the following : **[8]**

i) Write a recursive function to calculate the gcd of two numbers.

ii) Write a program to check it a given string is palindrome.

iii) Write a function to interchange i^{th} row with j^{th} row of a matrix of order m × n.

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P883

[3835] - 104
M.Sc. Tech.
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 104 : Programming in 'C' with ANSI Features - I
(Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***

Q1) Attempt any eight of the following : **[16]**

a) Write the prototype of

f flush( ), *f* seek( )

b) Explain the unary operator & in C.

c) What is the difference between get c( ) & get ch( ).

d) State the use of typedef.

e) What is the output of following code

```
# include < stdio.h >
int main ( )
{
    printf ("5t" Good Morning \ n");
    return 0;
}
```

f) What is recursion?

g) What is the output of the following code

```
char 5[ ] = "Hello India";
    printf("%5", 5+4);
```

h) Compare the member selection operators '.' & '→'.

i) Explain various file opening modes.

j) What is type casting in 'C'?

P.T.O.

Q2) Attempt any two of the following : **[16]**

a) Write a program that reads to strings using pointer, sort them in ascending order and display the longest and shortest strings.

b) Write function subprograms :

i) To find the inverse of the matrix.

ii) To find the column sum & row sum of the matrix.

c) Write a recursive function to find the gcd of two numbers.

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

a) Write a note on pointer arithmetic in C.

b) Explain the difference between structure and union with the help of the example.

c) What is the difference between call by value & call by reference. Explain with the help of example.

d) Explain different storage class specifiers.

e) Write a note on while loop.

f) Explain break and continue statements.

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

a) What will be the output of following program?

```
# include < stdio. h >
int main( )
{
    Union var
    {
        int a, b ;
    }
    Union var v ;
    v.a = 10 ; v.b = 20
    printf("%d \ n", v.a); return 0;
}
```

b) Trace the output it the program is correct

```
# include < stdio.h >
void main( )
{
    char a[ ] = “Visual C ++” ;
    char *b = “Visual C ++” ;
    printf(“%d%d\n”, sizeof (a),
                    sizeof (b)) ;
    printf(“%d %d\n”, sizeof (*a),
                        sizeof (*b));
}
```

c) Trace the output it the program is correct.

```
# include < stdio.h >
int reverse (int);
int main( )
{
    int no = 5 ;
    reverse (no);
    return 0;
}
int reverse (int no)
{
    if (no = = 0) return 0 ;
    else printf(“%d”, no); reverse (no --);
}
```

d) Justify the following

“main( ) function doesn’t have any arguments”.

e) What is the use of the preprocessor directives.

f) If a = 3, b = 10, c = 5, d = 1 find the value of following expression

a / = b * = c + d.

g) Trace the output it the program is correct

```
# include < stdio.h >
void main( )
{
    int n = 100 ;
    while (n)
    printf("%d", n >> = 2);
}
```

h) State the use of static variables.

i) Declare P as array of 100 pointers to int.

j) Explain the use of file pointer.

Q5) a) Attempt any two of the following : **[8]**

i) Explain functions malloc and realloc.

ii) Write a note on two dimensional array in C.

iii) Explain the concept of enum with suitable example.

b) Attempt any two of the following : **[8]**

i) Write a 'C' program to check whether.

ii) Write a program to find sin h, using sin e series correct to 5 decimal places.

iii) Explain the use of any four string handling functions.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P884

[3835]-105
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 105 : Elements of Information Technology
(New Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***Figures to the right indicate full marks.***
2) ***Use of logarithmic tables calculator allowed.***
3) ***All questions are compulsory.***

Q1) Attempt any eight of the following : **[16]**

a) Distinguish between ASCII and EBCDIC code.

b) State any two differences between RAM and ROM.

c) Define software and hardware.

d) State any two communication medias.

e) State functions of WAM.

f) Define BIT and BYTE.

g) State any two applications of internet.

h) Give any two characteristics of computer.

i) What is logical file? How it is different from physical file.

j) Define terms "seek time" and "latency time" of a hard disk.

Q2) Attempt any four of the following : **[16]**

a) Convert following numbers to binary

i) $(256)_{10}$ ii) $(141.25)_{10}$

b) What is an operating system of a computer? What facilities are provided by an operating system.

c) Distinguish between LAN and MAN.

d) State types of storage devices. Explain any one.

e) Discuss with neat diagram the operation of video display unit.

P.T.O.

Q3) Attempt <u>any four</u> of the following : **[16]**

a) Distinguish between time sharing operating system and multiprogramming operating system.

b) Write note on a file system.

c) Convert following numbers to hexadecimal

i) $(233)_{10}$ ii) $(25)_{8}$

d) What is CD? Compare it with DVD.

e) Give types of computer. State advantages and disadvantages of personal computer.

Q4) Attempt <u>any four</u> of the following : **[16]**

a) Explain fixed and variable length records.

b) Explain with diagram the working of optical mouse.

c) Give applications of information technology.

d) What facilities are provided by batch operating system?

e) Give types of file organisation. Explain any one in detail.

Q5) Attempt <u>any two</u> of the following : **[16]**

a) State types of network topology. Distinguish between bus and ring topology.

b) State different types of printers. Discuss with neat diagram working of DOT matrix printer. What is advantages of an inkjet printer over dot matrix printer?

c) Discuss with neat diagram working of CD-ROM drive.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P884

[3835]-105
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 105 : Computer Architecture
(Old) (Sem. - 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) ***Draw neat diagrams wherever necessary.***

Q1) Attempt any eight of the following : **[8 × 2 = 16]**

a) State De-Morgan's first and second theorem.

b) What is impact printer?

c) What is full form of VGA and LCD in computer monitor?

d) State different types of keyboard based on the number of keys used.

e) What is land and pit in the optical storage device (CD)?

f) Draw the symbol and write the truth table of NAND gate & EX-OR gate.

g) What is the function of program counter (PC) in microprocessor?

h) What is the function of address bus and data bus of microprocessor?

i) State any two shared memory models of parallel computing.

j) What is pipeling in parallel computing?

Q2) Attempt any four of the following : **[4 × 4 = 16]**

a) Explain full adder circuit with neat logic diagram.

b) Draw architectural block diagram of 8086 microprocessor and explain the working of 'Bus Interface Unit'.

c) Explain construction and working of floppy disk.

d) Explain working principle of thermal Ink-Jet Printer.

e) Differentiate between RISC and CISC architecture.

P.T.O.

Q3) Attempt any two of the following : **[2 × 8 = 16]**

a) Explain with neat block diagram Flynn's architectural classification.

b) i) Draw logic diagram of R-S flip-flop. Explain its working with truth-table.

ii) What is register? Explain construction and working of 4-bit register.

c) What is the function of following blocks of the 'Laser Printer'.

i) Drum.
ii) High voltage power supply.
iii) DC power supply.
iv) Paper transport.
v) Primary corona.
vi) Transfer corona.
vii) Fusing rollers.
viii) Controller.

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

a) Explain construction and working of CD-ROM.

b) Perform the following operation using 2's complement method and comment on result.

i) $(1101)_2 - (1001)_2$

ii) $(0111)_2 - (1011)_2$

c) State any four features of 80486 microprocessor.

d) Describe 'Von-Neumann' model of computer architecture.

e) Prove the following boolean identify

$(x + y)\,(\overline{x} + z)\,(y + z) = (x + y)\,(\overline{x} + z)$.

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

a) Differentiate between machine language and assembly language.

b) Explain data dependancies in parallelism.

c) Draw the logic diagram for the boolean expression -

$y = (A.B.C) + (\overline{A} \,.\, B.\, \overline{C}) + (\overline{A} .\, \overline{B} \,.\, C)$

d) Explain the sequence of steps involved during execution of following instructions.

i) PUSH ii) POP

e) Explain J-K flip-flop.

Total No. of Questions : 5] **[Total No. of Pages : 3**

P885

[3835]-201

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 201 : Real and Complex Analysis

(Old & New) (Sem. - II)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Q1) Attempt any eight of the following : **[16]**

a) Let $X \neq \phi$, Let $A \subseteq X$
Let $OC = \{\phi, A, A^C, X\}$
show that OC is an algebra.

b) Define outer measure m* A of a set $A \subseteq R$.

c) Let A be a sigma algebra of subsets of a non-empty set X. Show that A is closed under countable intersection.

d) Let f be a measurable real valued function on the measurable set E of R. Show that $|f|$ is measurable on E.

e) If f and g are integrable over E and if A and B are disjoint measurable sets contained in E, then prove that $\int_{A \cup B} f = \int_A f + \int_B f$.

f) Discuss differentiability of the function $f(z) = \bar{z}$ in C.

g) Find the radius of convergence of the complex series $\sum_{n \geq 0} \frac{z^{2n}}{2^n}$.

h) Determine whether the function $f(z) = xy + iy$ is analytic everywhere?

i) Prove that the real and imaginary parts of an analytic function in a domain D satisfies Laplace's equation on D.

j) Define residue at a pole.

P.T.O.

Q2) Attempt <u>any one</u> of the following : **[6]**

a) i) Let $\{A_n\}$ be a countable collection of sets in R. Prove that

$$m^*\left[\bigcup_{n=1}^{\infty} A_n\right] \leq \sum_{n=1}^{\infty} m^* A_n$$

ii) Let $a \in R$. Prove that $[a, \infty)$ is measurable set.

b) Attempt <u>any two</u> of the following : **[10]**

i) Let $\langle E_n \rangle$ be an infinite decreasing sequence of measurable sets. i.e. $E_{n+1} \subseteq E_n$ for each n. Let mE_1 be finite. Prove that

$$m\left(\bigcap_{i=1}^{\infty} E_i\right) = \lim_{n \to \infty} m\ E_n$$

ii) Let f, g be measurable functions on the measurable set $E \subseteq R$. Show that the set $E(f > g) = \{x \in E / f(x) > g(x)\}$ is measurable set.

iii) Let f be a non-negative function which is integrable over a set $E \subseteq R$. Prove that for every $\in > 0$, there is $\delta > 0$ such that for every set $A \subseteq E$ with $m A < \delta$ we have $\int_A f < \in$.

Q3) Attempt <u>any one</u> of the following : **[6]**

a) i) State and prove Fatou's lemma.

ii) Let ϕ and ψ be simple functions which vanish outside a set of finite measure. Prove that if $a, b \in R$, $\int (a\phi + b\psi) = a\int\phi + b\int\psi$.

b) Attempt <u>any two</u> of the following : **[10]**

i) Show that $u(x, y) = \frac{1}{2}\log(x^2 + y^2)$ is harmonic. Obtain its harmonic conjugate.

ii) Let f be differentiable at $Z_0 \in C$. Show that f is continuous at Z_0. Is the converse true? Justify.

iii) Find $\int_C \frac{z+6}{z^2-4} dz$ where

1) C is the circle $|z| = 1$

2) C is the circle $|z - 2| = 1$

Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Show that a bounded entire function is constant.

ii) State and prove Cauchy's Residue Theorem.

b) Attempt <u>any two</u> of the following : **[10]**

i) Obtain Laurent series for the function $f(z)=\frac{z^2-1}{(z+2)(z+3)}$

valid for $2 < |z| < 3$.

ii) Show that cross ratio is invariant under Möbius transformation.

iii) Using Cauchy's residue theorem to compute $\int_0^{2\pi}\frac{d\theta}{5+3\cos\theta}$.

Q5) a) Attempt <u>any one</u> of the following : **[6]**

i) Show that the composition of two Möbius transformations is also a Möbius transformation.

ii) State and prove Laurent's Theorem.

b) Attempt <u>any two</u> of the following : **[10]**

i) Obtain a Laurent series expansion for

$f(z)=\frac{1}{(z+1)(z+3)}$ in $0 < |z+1| < 2$.

ii) Use Residue Theorem to evaluate, $\int \tan z\, dz$, $C = |z| = 2$.

iii) Obtain $\int_C \frac{e^z}{z}\, dz$, where C is the circle $|z| = 1$ and hence show that

$\int_0^{2\pi} e^{\cos\theta}\cos(\sin\theta)\, d\theta = 2\pi$.

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Total No. of Questions : 5] **[Total No. of Pages :4**

P886

[3835] - 202

M.Sc. Tech. - I

MATHEMATICS

Industrial Mathematics with Computer Applications

MIM - 202: Algebra - II

(Old and New 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) Let $u = (2+d, 1-d)$, $v = (2-d, 1+d)$ be vectors in C^2 where C denotes the field of complex numbers. Find condition on scalar d so that u and v are linearly independent.

b) Let $V = P_n[x]$, the set of all polynomials having real coefficients with degree at most n and zero polynomial.

If $W = \{f \in V / f(1) = 0\}$ then show that W is a subspace of V and find dim (W).

c) Let V be a vector space and V_1, V_2 be subspaces of V such that $V = V_1 \cup V_2$. Prove that either $V = V_1$ or $V = V_2$.

d) Let V be an inner product space over R. Show that

$\|u+v\|^2 + \|u-v\|^2 = 2\|u\|^2 + 2\|v\|^2$ for all $u, v \in V$.

e) Let $V = R^3$ and $W = R^2$. Does there exist a one-one linear transformation from V to W? Justify!

f) Let $E = Q(\alpha)$, where α is a root of the equation $x^3 + x^2 + x + 2 = 0$. Express $(\alpha-1)^{-1}$ in the form $a\alpha^2 + b\alpha + c$, where $a, b, c \in Q$.

g) Let E be a finite extension of field F. If $[E : F] = 7$ and $\alpha \in E, \alpha \notin F$ then show that $E = F(\alpha)$.

h) Show that $Q\left(\sqrt{6}+\sqrt{7}\right) = Q\left(\sqrt{6}, \sqrt{7}\right)$.

i) Let E be an extension of field F such that $[E : F] = 2$. Show that E is a normal extension of F.

P.T.O.

j) Give an example of an irreducible polynomial of degree 3 over Z/3Z. Justify your answer!

Q2) a) Attempt <u>any one</u> of the following: **[6]**

i) Let W_1 and W_2 be finite dimensional subspaces of a vector space V. Show that $W_1 + W_2$ is a finite dimensional vector space. Further, prove that

dim W_1 + dim W_2 = dim $(W_1 + W_2)$ + dim $(W_1 \cap W_2)$.

ii) Let V and W be finite dimensional vector spaces over field F. If dim (V) = *m* and dim (W) = *n* then show that the space of all linear transformations from V to W, Z (V, W), is finite dimensional and has dimension *mn*.

b) Attempt <u>any two</u> of the following: **[10]**

i) Let W be the subspace of R^4 spanned by the vectors

$\alpha_1 = (1, 2, 2, 1)$

$\alpha_2 = (0, 2, 0, 1)$

$\alpha_3 = (-2, 0, -4, 3)$

Prove that $\{\alpha_1, \alpha_2, \alpha_3\}$ form a basis for W. Further,

if $\alpha_1^1 = (1, 0, 2, 0)$

$\alpha_2^1 = (0, 2, 0, 1)$

$\alpha_3^1 = (0, 0, 0, 3)$

then prove that $\{\alpha_1^1, \alpha_2^1, \alpha_3^1\}$ span W.

ii) Let T be the linear operator on R^3 which is represented in the standard ordered basis by the matrix.

$$A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$$

Find the basis and dimension of the eigen space corresponding to the smallest eigenvalue.

iii) Let W_1 and W_2 be subspaces of a finite dimensional vector space V. Prove that

$$(W_1 + W_2)^0 = W_1^0 \cap W_2^0 \text{ and } (W_1 \cap W_2)^0 = W_1^0 + W_2^0.$$

Q3) a) Attempt <u>any one</u> of the following: **[6]**

i) Let W be a subspace of an inner product space V and β be a vector in V. Show that the vector α in W is a best approximation to β by vectors in W if and only if β-α is orthogonal to every vector in W.

ii) Let T be a linear operator on a finite dimensional space V. Let $c_1, c_2, ..., c_k$ be the distinct eigen values of T and let W_i the null space of $(T - c_iI)$. Then prove that

Following are equivalent :

1) T is diagonalizable.

2) The characteristic polynomial for T is

$$f = (x - c_1)^{d_1} ..... (x - c_k)^{d_k}$$

and dim $W_i = d_i$, i = 1,.... k.

3) dim W_1 + dim W_2+ ... + dim W_k = dim V.

b) Attempt <u>any two</u> of the following: **[10]**

i) Apply the Gram – Schmidt process to the vectors $B_1 = (1, 0, 1)$, $B_2 = (1, 0, -1)$ $B_3 = (0, 3, 4)$, to obtain an orthonormal basis for R^3 with the standard inner product.

ii) Let V be a finite-dimensional vector space and let T be a linear operator on V. Suppose that rank (T^2) equals rank (T). Prove that the range and null space of T have only the zero vector in common.

iii) Let A and B be $n \times n$ matrices over the field F. Prove that if (I-AB) is invertible then (I-BA) is invertible.

Q4) a) Attempt <u>any one</u> of the following: **[6]**

i) Let $K = F(\alpha)$ be an extension of field F. Prove that either there does not exist any non-zero polynomial $g(x) \in F[x]$ with $g(\alpha) = 0$ or there exists a unique monic polynomial $f(x)$ of least degree such that $f(\alpha) = 0$. Further, prove that if there exists a non-zero polynomial $f(x) \in F[x]$ such that $f(\alpha) = 0$ then $F(\alpha) = F[\alpha]$.

ii) Let F be a field having infinite number of elements. If K is a finite seperable extension of F then prove that there is $\alpha \in K$ such that $K = F(\alpha)$.

b) Attempt <u>any two</u> of the following: **[10]**

i) Let p be a prime. Show that the splitting field of $x^p - 1 \in Q[x]$ is of degree p–1 over Q.

ii) 'If L/K is a normal extension and K/F is a normal extension then L/F is a normal extension'. Is this statement true or false? Justify your answer!

iii) Let F be finite field and $F^* = F - \{0\}$. Show that F^* is a cyclic group under multiplication.

Q5) a) Attempt <u>any one</u> of the following : **[6]**

i) Let K/F be a Galois extension and $F \subset N \subset K$. Prove that N/F is a Galois extension if and only if Galois group of K/N is a normal subgroup of Galois group of K/F.

ii) Let K/F be a Galois extension of degree *n*. Show that the Galois group of K/F is a group of order *n* and F is the fixed field of the Galois group.

b) Attempt <u>any two</u> of the following : **[10]**

i) Find all the conjugates of $\sqrt{1+\sqrt{2}}$ over Q.

ii) Show that Q $\left(\sqrt{2},\sqrt{3}\right)$ is a Galois extension of Q. Find the Galois group of Q $\left(\sqrt{2},\sqrt{3}\right)$ over Q.

iii) Let F be a finite field having p^n elements, p a prime. Show that $Q : F \to F$ defined by $Q(a) = a^p$ is an automorphism of F. Further, show that order of Q is *n*.

Total No. of Questions : 5] **[Total No. of Pages :6**

P887

[3835] - 203

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 203: Discrete Mathematical Structures - II

(New)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

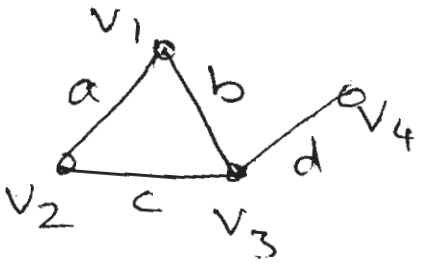
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

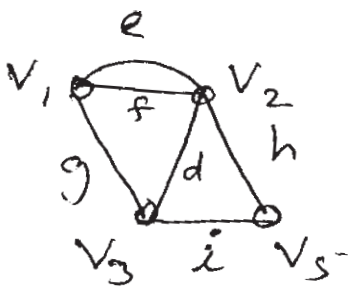
Q1) Attempt any eight of the following : **[16]**

a) Justify following statement "there exists a regular graph of degrees on nine vertices".

b) Prove that number of edges in Kn, complete graph on n vertices is $\frac{n(n-1)}{2}$.

c) Given





Find $G_1 \cup G_2$, $G_1 \cap G_2$.

d) Define (i) Walk (ii) Path in a given graph G.

e) Explain the term cutvertex.

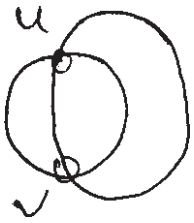
f) Draw the graph represented by the adjacency matrix

$$\begin{bmatrix} 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \end{bmatrix}.$$

P.T.O.

g) Describe chinese postman problem.

h) Is the following graph arbitrarily traceable? Justify?



i) Prove that every tree is a bipartite graph.

j) Find all graphs which are 1 - colourable.

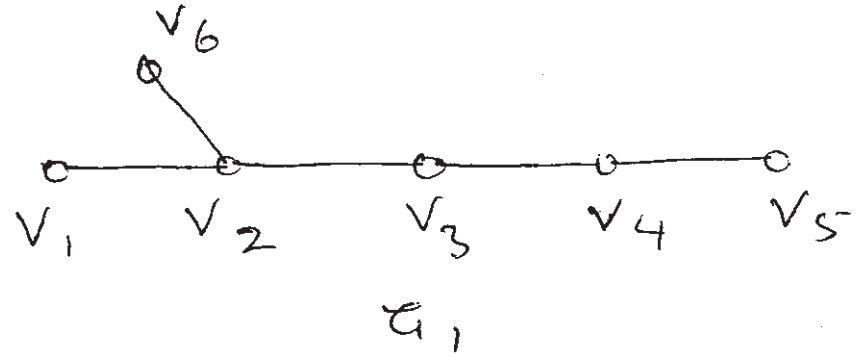
Q2) a) Attempt <u>any one</u> of the following: **[6]**

i) Prove that tree T with n vertices has n–1 edges.

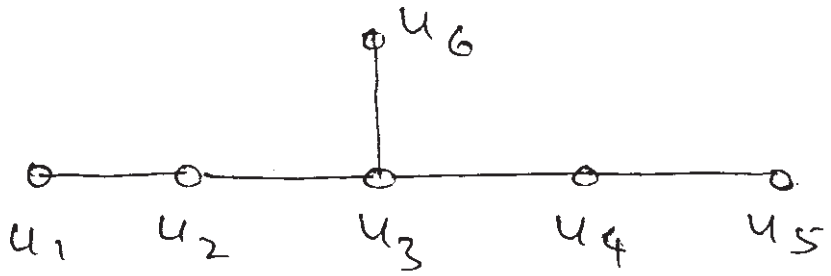
ii) Prove that edge 'e' of a connected graph G is not an isthmus if and only if 'e' is in some circuit of G.

b) Attempt <u>any two</u> of the following: **[10]**

i) Are the following two graphs G_1 and G_2 isomorphic? Justify.

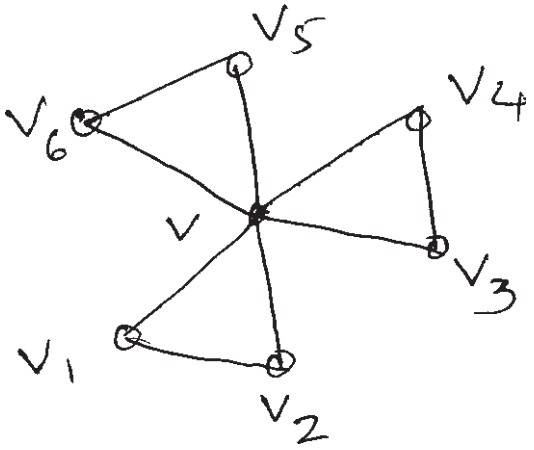


G_1

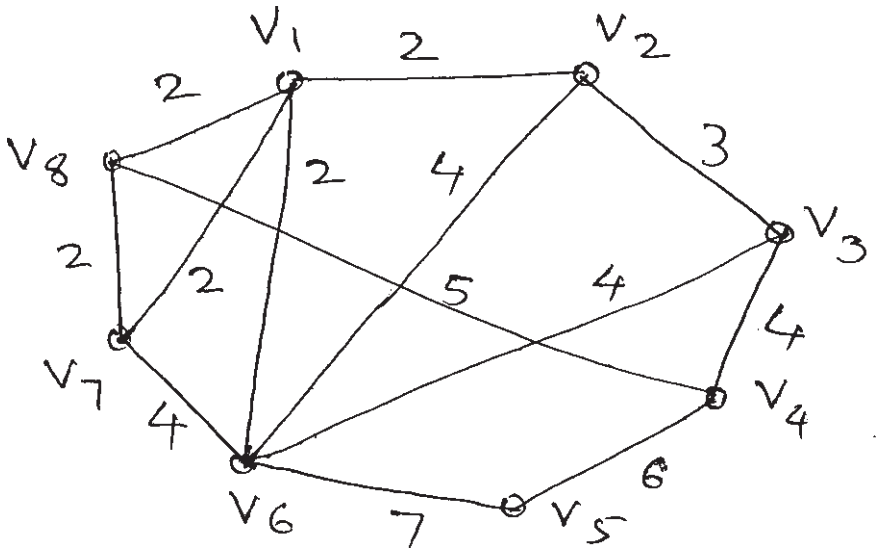


G_2

ii) Using Fleury's algorithm Find Euler's line in the following graph



iii) Consider the following weighted graph G. Find a minimal spanning tree in the following graph using Kruskal's algorithm



Q3) a) Attempt <u>any one</u> of the following: **[6]**

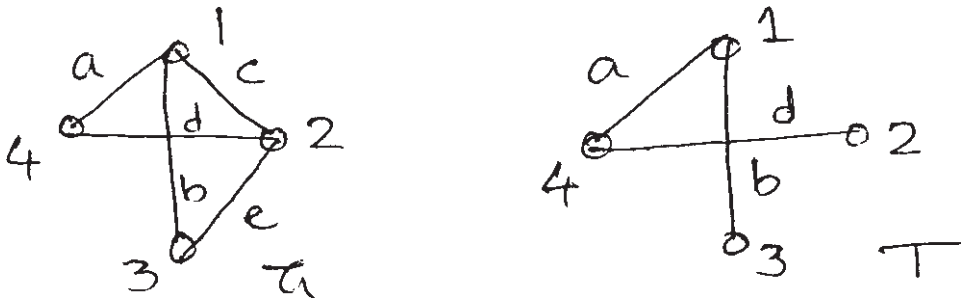
i) Define the following terms.

1) Indegree and outdegree of a vertex in a digraph.
2) Balanced digraph.
3) Simple asymmetric digraph.
4) Complete symmetric digraph.
5) Arborescence.

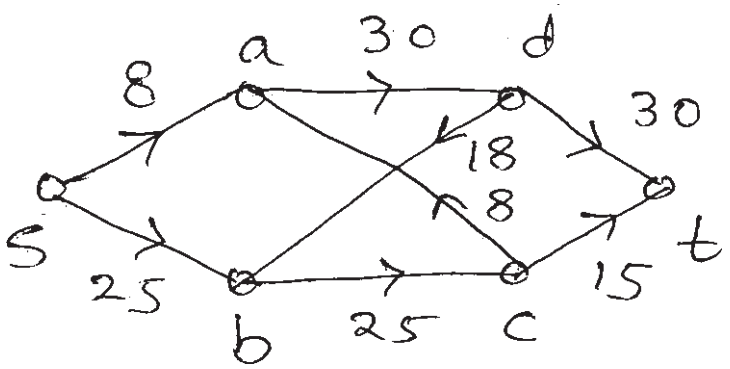
ii) Prove that a connected graph G is an Euler graph if and only if it can be decomposed into circuits.

b) Attempt <u>any two</u> of the following: **[10]**

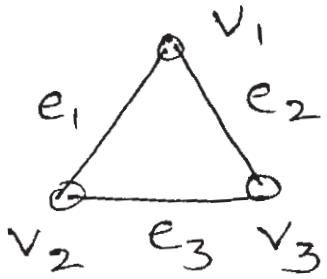
i) Consider the graph G and its spanning tree T as given below. Find all fundamental circuits and cutsets of G with respect to T.



ii) Find the maximum flow using Ford and Fulkerson Algorithm.



iii) Find all subgraphs of the following graph



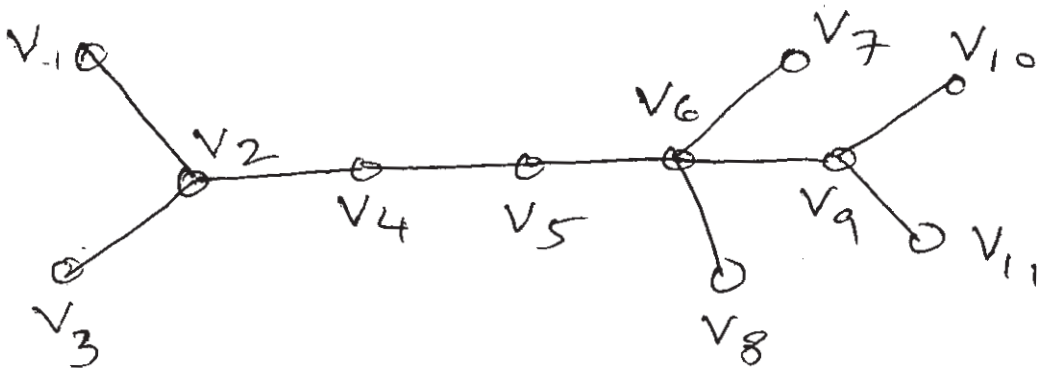
Q4) a) Attempt <u>any one</u> of the following: **[6]**

i) Discuss in detail depth first search (DFS) algorithm. Illustrate with an example.

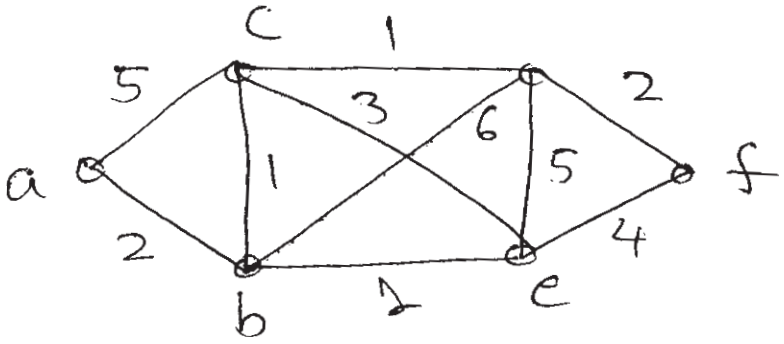
ii) Prove that if G is a connected planar graph with P vertices, q edges and r faces then $p - q + r = 2$.

b) Attempt <u>any two</u> of the following: **[10]**

i) Find the eccentricity of every vertex in the following tree and hence find the centre/s.



ii) Find the shortest path from 'a' to 'f' in the following graph.



iii) Show that the number of vertices of a self complementary graph must be of the form 4K or 4K+1 where K is an integer.

Q5) a) Attempt <u>any one</u> of the following : **[6]**

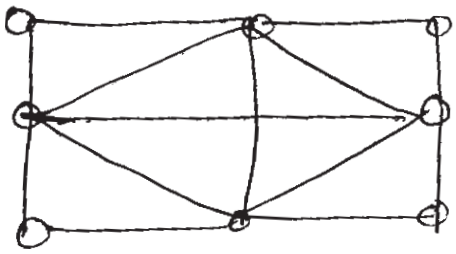
i) Describe simple sequential colouring algorithm for a graph G.

ii) Prove that there is one and only one path between every pair of vertices in a tree T & conversely.

b) Attempt <u>any two</u> of the following : **[10]**

i) Define rooted tree. Show that the number of vertices 'n' of a binary tree is always odd.

ii) Define (1) Vertex connectivity (2) Edge connectivity of a graph G. Find vertex connectivity and edge connectivity for following graph G.



iii) Let G be a regular graph of degree n and H be a graph obtained by removing some vertex of G. Is H regular of degree n–1? Justify.

Total No. of Questions : 5] **[Total No. of Pages :3**

P888

[3835] - 204

M.Sc. Tech.

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204: Database Fundamentals

(New)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

Q1) a) Attempt the following : **[10]**

A student with (st-id, Addr & surname) takes any number subjects. Which have a unique subject-name and a subject-description. The student is enrolled in a major that has a unique major-name and length. The date on which a student started a major is recorded. A subject is taken by one teacher who is identified by a teacher-id and has a teacher-address.

i) Draw an E - R diagram for the above data.

ii) Convert on E - R diagram into relational database by specifying the relational schema.

b) Attempt any one of the following **[6]**

i) What are the main characteristics of the database management system? How it differs from traditional file system.

ii) Explain the difference between physical and logical data independence.

Q2) Attempt any four of the following: **[16]**

a) List the various cases where use of a null value would be appropriate.

b) What is an entity type? What is an entity set? Explain the differences between an entity, an entity type & an entity set.

c) List the operations of the relational algebra and the purpose of each.

P.T.O.

d) Define the following terms

i) primary key ii) super key

iii) foreign key iv) candidate key.

e) Consider the following relational schema.

employee (e-no, name, office, age)

books (isbn, title, authors, publisher)

loan (e-no, isbn, date)

Write the following queries in SQL.

i) Print the names of employees who have borrowed any book published by pearson publication.

ii) Print the names of employees who have borrowed all books published by pearson publication.

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

a) Consider the following relational schema.

employee (P-name, sheet, city)

works (P-name, c-name, salary)

company (C-name, city)

manages (P-name, m-name)

Answer the following queries using relational algebra

i) Find the names of all employees who work for first Bank corporation.

ii) Find the company with the most employees.

iii) Find the names of all employees in this database who live in the same city as the company for which they work.

iv) Find the company with the smallest payroll.

b) Explain generalization and specialization with suitable examples.

c) Define the following terms.

i) database schema ii) internal schema

iii) conceptual schema iv) external schema.

d) Explain the concept of weak entity & strong entity with the help of the example.

e) Explain different types of attributes.

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

a) What is normalization? Explain 1 μf & 2 μf in detail.

b) Consider the following schema.

supplier (<u>sid</u>, sname, address)

parts (<u>pid</u>, pname, color)

catalog (<u>sid</u>, <u>pid</u>, cost)

Answer the following queries.

i) Find the partnames of parts for which there is some supplier.

ii) Find the names of suppliers who supply a red part & a green part.

iii) Find the names of suppliers. Who supply every part.

iv) Find the partnames of parts supplied by ABC corporation & no one else.

c) Explain the loss-less join decomposition with the help of the example.

d) Write a short note on triggers.

e) Explain different aggregate operators of SQL with the help of example.

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

a) Define the following terms.

i) partial key

ii) derived attribute

iii) domain

iv) owner entity type

b) Write a short note on levels of abstraction.

c) Write a note on DCL & TCL.

d) Explain different users of the database.

e) Explain the concept of cursor with the help of the example.

Total No. of Questions : 5] **[Total No. of Pages :3**

P888

[3835] - 204

M.Sc. Tech.

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204: Programming in 'C' with ANSI Features - II

(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) Answer the following (any 8) : **[16]**

a) Find the output and justify.

```
# include < stdio.h >
int main( )
{
    char ch = 'A';
    printf ("%d %d %d", sizeof (ch),
            sizeof (sizeof ('A')), (sizeof (3.14f))
    return 0;
}
```

b) Find the output and justify.

```
# include < stdio.h >
int main ( )
{
    char str 1[ ] = "Hello";
    char str 2 [ ] = "Hello";
    if (str1 = = str 2)
        printf ("Equal \n");
    else
        printf (" Unequal \n");
    return 0;
}
```

P.T.O.

c) What is the difference between putc ( ) & putch ( )?

d) What is the difference between 123, '123' and "123".

e) Define the following :

i) primary key ii) super key.

f) State any two advantages of pointers.

g) Define the following

i) primary index ii) secondary index.

h) Define B^+ tree.

i) State the use of typedef.

j) Give the prototype of fprintf ( ), fscanf ( ).

Q2) Attempt any two : **[16]**

a) Create a structure to specify data of students as R.no, Name, Dept, Course, Year-of-joining.

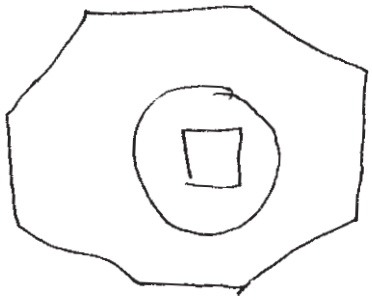
i) Write a function to print names of all students who joined in a particular year.

ii) Write a function to print the data of student whose roll-number is given.

b) Write a 'C' program for the following.

Accept a filename as a command line argument. The file contains text data. Read this file and copy all capital letters into file named capital and all small case letters in the file named small.

c) Write a 'C' program to display the following figure.



Q3) Attempt any four : **[16]**

a) Write a short note on B^+ trees.

b) State any 4 advantages of DBMS.

c) What is data abstraction.

d) Define the following terms.

i) Dense index ii) Sparse index.

e) Explain the role of DBA in database.

Q4) Attempt any eight : **[16]**

a) What is pre-processor?

b) State the use of static variable.

c) Give the prototype of

i) strcmp () ii) strcmpi ( ).

d) Explain any two commands of DML.

e) Write a macro to find the maximum of three numbers.

f) Explain different users of DBMS.

g) Explain clustered and unclustered index.

h) Distinguish between struct and union.

i) Define the term Data Independence.

j) Explain different file opening modes in 'C'.

Q5) a) Attempt any two : **[8]**

i) Define the following terms.

1) Weak entity 2) Strong entity

3) Schema 4) Database

ii) Write a short note an static hashing technique.

iii) Explain in short the structure of DBMS.

b) Attempt any two : **[8]**

i) Write a recursive function to calculate the sum of digits of a numbers.

ii) Explain "dynamic memory allocation" & it's corresponding functions.

iii) Write a program to check whether a given string is palindrom using pointers.

Total No. of Questions : 5] **[Total No. of Pages :3**

P889

[3835] - 205

M.Sc. Tech.

COMPUTER SCIENCE

Industrial Mathematics with Computer Applications

MIM - 205: Data Structures Using 'C'

(New Course) (Sem. - II)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

Q1) Attempt <u>any eight</u> of the following : **[8 × 2 = 16]**

a) Define ADT. Write down the ADT definition of Natural Number. (write any two functions).

b) Write a function to create a two-dimensional array using dynamic memory allocation functions.

c) Define DeQueue-state the two types of DeQueue.

d) What do you mean by stack? Explain the insert and delete operations of the stack. Also draw the suitable diagram for stack operations.

e) Write a function to insert a new element in the singly linked list at first position.

f) Define : Complete binary tree and full binary tree.

g) Write a function to sort 'n' elements of an array using bubble sort method.

h) Describe the steps to convert an adjacency matrix into an adjacency list.

i) Give the array representation of tree with example.

j) What is graph? Give diagramatic form of digraph and undirected graph.

P.T.O.

Q2) Attempt <u>any two</u> of the following: **[2 × 8 = 16]**

a) i) Write an algorithm to convert the infix expression into post fix expression.

ii) Show the contents of recursive stack to compute factorial of a number (n = 4).

b) Write a program to find union and intersection of two linked list.

c) Write a program to implement ascending and descending priority queue.

Q3) Attempt <u>any four</u> of the following: **[4 × 4 = 16]**

a) Explain the efficiency of quick sort algorithm.

b) Write a note on stack, as an abstract data type (ADT).

c) Write a program to implement push and pop operations of queue using singly linked list.

d) Define the following terms :

i) siblings ii) height of tree

iii) forest iv) binary tree.

e) Write a note on adjacency multilist.

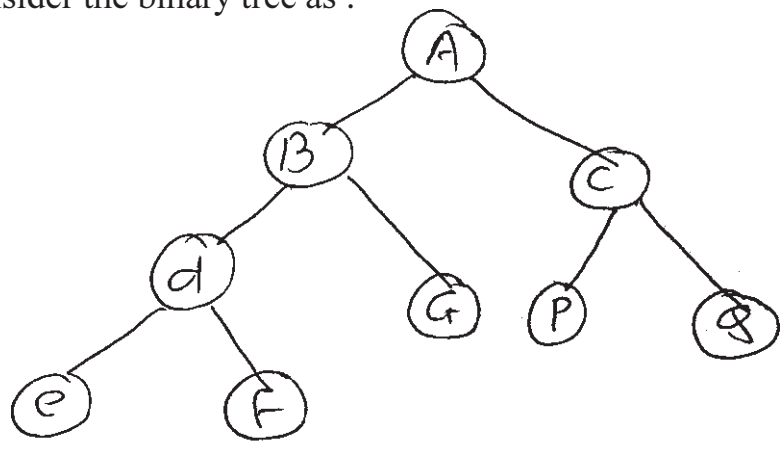
Q4) Attempt <u>any four</u> of the following: **[4 × 4 = 16]**

a) What is array? Explain arrays as ADT.

b) Write a non-recursive function for DFS traversal.

c) Write program to accept the words in dictionary order. Further accept the keyword from the user. Implement the binary search function to check the occurance of keyword in the list of words in dictionary order.

d) Consider the binary tree as :

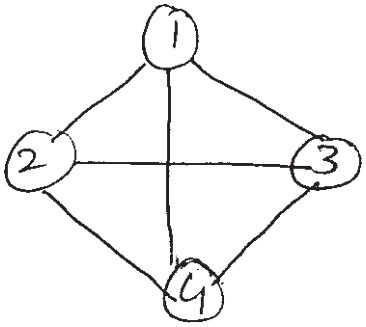


Implement preorder and postorder traversals techniques for the given binary tree.

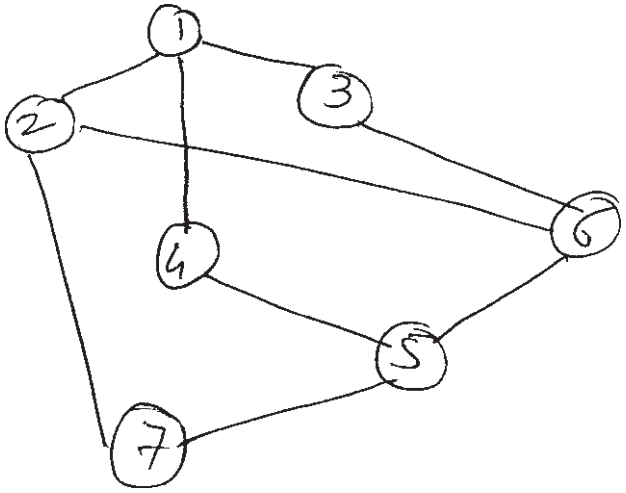
e) What do you mean by linear and non-linear data structure? Give the example of each.

Q5) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

a) Convert the following graph into adjacency list and adjacency multilist.



b) Give the BFS and DFS representation of the following tree.



c) Write a short note on round robin CPU scheduling algorithm. Also give the suitable example.

d) Write a function for insertion sort. Also express the efficiency of insertion sortmethod.

e) Convert the following infix expression to its post fix form. Also draw the contents of post fix stack and operator stack. A + B ∗ C.

Total No. of Questions : 5] **[Total No. of Pages : 4**

P890

[3835]-301
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 301 : Numerical Analysis
(New Course) (Sem. - III)

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 : **[16]**

a) Find the absolute error and relative error in the approximation of $X = 1 \times 10^6$, $\overline{X} = 0.99 \times 10^6$.

b) Find fixed point, if any, of $f(x) = 1 + x - \frac{x^2}{4}$.

c) Does the function $f(x) = x \log_{10}(x) - 1.9$ have a root in the interval [3, 4]? Justify your answer.

d) Find real root of the equation $x^2 - 25 = 0$, by bisection method which lies in [4, 7].

e) Write first two Newton-Cotes quadrature formulas.

f) Define order of convergence.

g) Define Householder matrix.

h) Discuss ill conditioned system.

i) Define orthogonal matrix.

j) Write the formula for Lagrange interpolating polynomial through the points. (x_0, y_0), (x_1, y_1) and (x_2, y_2).

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

i) Let $g(x) = 0.4 + x - 0.1x^2$. Start with $P_0 = 1.9$ and find P_1, P_2, P_3, P_4 and P_5 by using the fixed point iteration $P_{k+1} = g(P_k)$.

ii) Assume that $g \in C[a, b]$, if the range of the mapping $y = g(x)$ satisfies $a \le y \le b$, $\forall\ a \le x \le b$ then g has a fixed point in $[a, b]$.

P.T.O.

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

i) Start with $f(x) = x^2 - A$, A is +ve real number, and derive recursive formula, using Newton's iteration.

$$P_k = \frac{P_{k-1} + A/P_{k-1}}{2}, \; k = 1, 2, \ldots \text{ for finding square root of A.}$$

ii) Let $f(x) = x^3 - 5x - 7 = 0$, start with $[a_0, b_0] = [1, 2]$ and perform four iterations of secant method.

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

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

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

$f_3(x, y, z) = y/xz$.

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

i) Solve the following system of linear equations using triangular factorization.

$2x + 3y + z = 9$

$x + 2y + 3z = 6$

$3x + y + 2z = 8$

ii) Using Gauss-Seidel iterative process to solve the system of linear equations.

$4x - y + z = 7$

$4x - 8y + z = -21$

$-2x + y + 5z = 15$

start with $P_0 = (x_0, y_0, z_0) = (1, 2, 2)$ and perform only three iterations.

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

i) Use the numerical differentiation formula,

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

to approximate $f''(0.8)$ for the function $f(x) = \cos x$ with $h = 0.1$ compare your answer with the true value, $f''(0.8) = -(0)(0.8)$.

ii) Construct a divided difference table for the following data points.

x	2	4	9	10
$f(x)$	4	56	711	980

iii) Assume that $f \in C^3$ $[a, b]$ and that $x - h, x, x + h \in [a, b]$ then prove that the central difference formula,

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

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

i) Derive the composite trapezoidal rule in the form

$$\int_a^b f(x)\,dx = \sum_{k=1}^{m} \int_{x_{k-1}}^{x_k} f(x)\,dx = \sum_{k=1}^{m} \frac{h}{2}\left[f(x_{k-1}) + f(x_k)\right].$$

ii) Compute $\int_0^3 \frac{dx}{1+x}$ by Simpson's $\frac{3^{th}}{8}$ rule dividing interval (0, 3) into 6 equal parts.

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

i) Use composite trapezoidal rule to compute an approximation to the integral of the function $f(x) = \frac{x}{\sqrt{2+x^2}}$ taken over [0, 2].

[Dividing the range into 4 equal parts.]

ii) Suppose that matrix $A = \begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$ show that A is diagonalizable.

iii) Using Euler's method, obtain the solution of $y' = x - y$, (given $x_0 = 0$, $y_0 = 1$), at $x = 0.6$ taking h = 0.2.

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

a) Use power method to find largest eigen value and eigen vectors for the matrix $A = \begin{bmatrix} 0 & 11 & -5 \\ -2 & 17 & -7 \\ -4 & 26 & -10 \end{bmatrix}$ start with $X^{(0)} = (1, 1, 1)^T$ and perform only four iterations.

b) Find all eigen values and eigen vectors by Jacobi's method for

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

c) Use Runge Kutta method of second order to integrate $f(x) = -2x^3 + 12x^2 - 20x + 8.5$ using step size 0.5 and inital conditions $y = 1$, when $x = 0$. Find the value of y at $x = 0.5$ (i.e. only one step).

☒☒☒☒

Total No. of Questions : 5] **[Total No. of Pages : 2**

P891

[3835] - 302

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 302 : Object Oriented Software Engineering

(New 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) What is Software Engineering?

b) Give any 2 key challenges facing Software Engineering.

c) Define : System.

d) List any 2 fundamental activities that are common to all Software Processes.

e) What do you understand by functional requirements?

f) Define : Client - Server architecture.

g) What is an object?

h) List any 2 design issues in user interface design.

i) Define : System testing.

j) Why feasibility study is important in Requirement engineering?

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

i) Draw a context model for a Patient information system in a hospital. The model must include a patient admission system and an image storage system for X-rays, as well as other diagnostic records.

ii) Explain how state machine model describes the internal or external event of a system.

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

i) Explain the characteristics of a Inheritance model.

ii) Draw a data flow diagram for a Bank ATM. The data flow should model the data processing involved when a customer withdraws cash from the machine.

iii) Explain software reliability specification with respective to its dimensions.

P.T.O

Q3) a) Attempt <u>any one</u> of the following: **[6]**

i) What is the fundamental difference between a fat-client and a thin-client approach to client-server systems? Explain in detail.

ii) Explain the layers involved in Architectural design.

b) Attempt <u>any two</u> of the following: **[10]**

i) Using the UML graphical notation for object classes, design the following object classes identifying attributes and operations.

* A telephone * A printer * A bank account assume your own attributes and operations that should be associated with there objects.

ii) Write a note on : user interaction related to Design issues in user interface design.

iii) Explain the 3 basic user analysis techniques.

Q4) a) Attempt <u>any one</u> of the following: **[6]**

i) Explain the principles of Agile methods.

ii) Discuss the difference between verification and validation and explain why validation is a difficult process.

b) Attempt <u>any two</u> of the following: **[10]**

i) Explain : Integration Testing.

ii) Explain the tools that are included in a Rapid Application Development environment.

iii) Draw a sequence diagram showing the actions performed in the ticket - issuing system. The system sells rail tickets. Users select their destination and input a credit card and personal identification number. The rail ticket is issued and their credit card account charged. When the user presses the start button, a menu display of potential destinations is activated, along with a message to the user to select a destination. The credit card validity is checked and once validated, the ticket is issued. Pay particular attention to specify user errors in the diagram.

Q5) Attempt <u>any four</u> of the following: **[16]**

a) Explain spiral Model with an example.

b) Consider an internet Banking system and explain the distribution architecture of the system.

c) Write a short note on: cleanroom software development.

d) Explain partition testing with an example.

e) What are the 4 main phases in requirements engineering process.

Total No. of Questions : 5] **[Total No. of Pages : 3**

P892

[3835] - 303

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 303 : Object Oriented Programming with Java

(Sem. - III) (New Course)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

Q1) Attempt any eight of the following: **[16]**

a) What is the difference between compiled languages and interpreted languages?

b) For each of the following, write a single statement that performs the indicated task.
   i) Compare the string in S1 to the string in S2 for equality of contents.
   ii) Determine the length of the string in S1.

c) What is the major difference between Linkedlist and Arraylist?

d) What are wrapper class and why do we need them?

e) What are runtime exceptions?

f) If a system. exit (0) is written at the end of the try block, will the finally block still execute?

g) What is the difference between declaring a variable and defining a variable?

h) What do you mean by static variables and static methods?

i) What is the difference between JVM (Java Virtual Machine) and JRE (Java Runtime Environment)?

j) State the difference between method overloading and method overriding.

Q2) Attempt any four of the following: **[16]**

a) Explain and compare Abstract classes and Interfaces with example.

b) What do you mean by stream in java? Differentiate between:
   i) Inputstream and Reader.
   ii) Outputstream and Writer.

c) What is the use of control statements? Explain Iteration statements with suitable examples.

d) Explain exception handling mechanism in java.

e) Write a short note on Garbage collection in java.

P.T.O

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

a) Write a class cricket and three member functions: enterdetails ( ), average single ( ), and average-all ( ).

The program should accept details from user (max : 10) : playercode, name, runs, inningsplayed, number of times not out.

The program should provide the facility for :

i) Entering details of maximum 10 players.

ii) Display average runs of a single player.

iii) Display average runs of all players.

b) Write a program to accept '*n*' numbers through the command line and store all the prime numbers and perfect numbers into different arrays and display both the arrays.

c) Create a GUI based program with following specifications: Put two text-areas and one button on a frame. Caption the button as Paste. User will type some text in the first text area, click the button Paste and then text in the first text-area will be copied and pasted in the second text-area programmatically. If first text area has no text and still the 'Paste' button is clicked, an appropriate error message should be displayed.

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

a) What do you mean by an event and the event sources? Explain the Delegation event model in java.

b) Define an exception called 'Nomatch Exception' that is thrown when a string is not equal to 'Mathematics'. Write a program that uses this exception.

c) Write a program using Frame (add, save, modify, delete, exit), for entering the employee information.

'add' button should add the information to the employee.mdb file.

'modify' button should modify the information.

'save' and Delete' button should save and delete the employee information respectively 'exit' button should exit from the application. Following information should be used for the employee.

i)	Emp-ID	Number	//Text Field
ii)	Emp-Name	Text	//Text Field
iii)	Emp-Address	Text	//Text Area
iv)	Emp-Designation	Text	//Text Field
v)	Emp-Gender	('M','F')	//Checkboxgroup

vi) Emp-Type {'Permanent','Temporary', 'Visiting'} //Choice.

Q5) Attempt <u>any four</u> of the following: **[16]**

a) Discuss GridLayout and BorderLayout with suitable example.

b) What is a Package? How are packages in java broadly classified and how to create a package?

c) Discuss various forms of Inheritance in brief.

d) Explain any four features of Java in brief.

e) Write a short note on Inner classes in java.

Total No. of Questions : 5] **[Total No. of Pages : 3**

P894

[3835]-305
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 305 : Theorotical Computer Science
(New Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***Figures to the right indicate full marks.***
2) ***Use of logarithmic tables calculator is allowed.***
3) ***All questions are compulsory.***

Q1) Attempt <u>any EIGHT</u> of the following : **[16]**

a) Define suffix and prefix of a string.

b) What is LBA (Linear Bounded Automata)?

c) Write regular expression for a language cosisting of strings over {0, 1} whose 3rd symbol from rigid end is always 1.

d) Write any four identities of regular expression.

e) Define useless symbol.

f) Define language accepted by PDA.

g) Construct DFA to accept L = {a (a + b)*}.

h) Define alphabet and language.

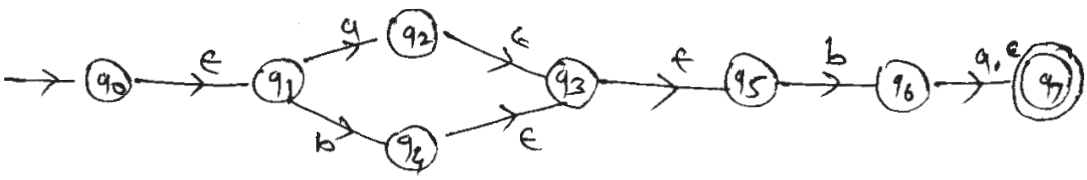
i) Is (a* + b*)* = (a + b)* true? Justify.

j) What is the difference between a recursive language and recursively enumerable language.

Q2) a) Attempt <u>any ONE</u> of the follwing : **[6]**

i) Define moore machine. Design moore machine for 2's complement of a binary number.

ii) Construct DFA for following NFA.



P.T.O.

b) Attempt any TWO of the following : **[10]**

i) Construct DFA to accept binary number whose decimal equivalent is divisible by 3.

ii) Construct NFA for following regular expression
[1 (01)* 1 + 0 (01)* 1].

iii) Show that L = $\{a^p / p$ is prime$\}$ is not regular.

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

i) Construct DFA to accept all strings over $\{a, b\}$ containing substring *abb*. Construct regular grammar for the same.

ii) Show that regular sets are closed under union, intersection & complement.

b) Attempt any TWO of the following : **[10]**

i) Construct minimal DFA for following DFA

M = $(\{9_0, 9_1, 9_2, 9_3, 9_4, 9_5, 9_6, 9_7\}, \{0, 1\}, \delta, 9_0, \{9_1\})$.

δ	0	1
9_0	9_4	9_0
9_1	9_1	9_0
9_2	9_1	9_3
9_3	9_7	9_2
9_4	9_0	9_5
9_5	9_1	9_4
9_6	9_7	9_1
9_7	9_3	9_7

ii) Prove that language L = $\{a^n b^n a^n / n>, 1\}$ is not CFL (context free language).

iii) Explain Chomsky heirarchy of languages.

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

i) Construct an equivalent grammar after removing use less symbols from following grammar.

S $\rightarrow$ AB / CAH, C $\rightarrow$ *a*B / *b*

B $\rightarrow$ BC / ABF, D $\rightarrow$ SS / *d*

A $\rightarrow$ *a*, E $\rightarrow$ *e*

ii) Construct CFG L = $L_1 \cup L_2$

$L_1 = \{a^n b^m / n \geq m, m > 0\}$

L_2 = All strings not having substring 01 over {0, 1}.

b) Attempt <u>any TWO</u> of the following : **[10]**

i) Convert following grammar to CNF.

$S \rightarrow ABC/A$

$A \rightarrow a/b$

$B \rightarrow Bb/bb$

$C \rightarrow aC/CC/ba$

ii) Convert CFG {S → AB, A → BS/*b*, B → SA/*a*} to GNF (Greibach Normal Form).

iii) Construct Turing Machine for checking well formed ness of parenthesis.

Q5) a) Attempt <u>any ONE</u> of the following : **[6]**

i) Construct CFG equivalent to PDA.

$M = (\{q_1, q_2\}, \{0, 1\}, \{R, B\}, \delta, q, R, \phi)$

Where

$\delta\ (q_1, 0, R) = (q_1, BR)$ $\quad \delta\ (q_1, 1, B) = (q_2, \in)$

$\delta\ (q_1, 0, B) = (q_1, BB)$ $\quad \delta\ (q_2, \in, B) = (q_2, \in)$

$\delta\ (q_2, \in, R) = (q_2, \in)$

ii) Construct PDA to accept language $L = \{a^n\ b^m\ c^n / m,n > 0\}$.

b) Attempt <u>any TWO</u> of the following : **[10]**

i) Construct PDA for CFG

$s \rightarrow asa \mid bsb \mid a \mid b$ and trace for string "*ababa*".

ii) Show that complement of CFL may or may not be CFL.

iii) Construct Turing Machine Recognizing language

$L = \{WW^R / W \in (0 + 1)^k\}$

W^R is reverse of W.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P895

[3835] - 401
M.Sc. Tech. - II
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 401 : Topology
(New Course)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***X and Y denote the topological spaces.***

Q1) Answer any eight of the following: **[16]**

a) If $\{\tau_\alpha\}$ is a family of topologies on X.

Is $\bigcup_\alpha \tau_\alpha$ a topology on X? Justify.

b) Define a Hausdorff space. Give an example of non-Hausdorff space.

c) Prove that (0, 1) and [0, 1] are not homeomorphic topological spaces.

d) Is constant map always continuous?

e) Give an example of a topological space which is locally connected but not connected.

f) Write four topologies on the set R of reals.

g) Show that the interval (0, 1] is not compact.

h) State the Tychonoff's Theorem.

i) Is (0, 1) a connected subspace of R_ℓ? Where R_ℓ = set of reals with lower limit topology. Justify.

j) Is arbitrary union of closed set closed? Justify.

Q2) a) Answer any one of the following: **[6]**

i) Show that is β is a basis for a topology on X and is a basis for a topology on Y, then the collection
$D = \{ B \times C \mid B \in \beta$ and $C \in \}$
is a basis for the topology of $X \times Y$.

ii) Show that the topologies of R_ℓ and R_K are not comparable but each is finer than the standard topology on R.

b) Answer any two of the following: **[10]**

i) Show that every order topology is regular.

ii) Prove that (0, 1) is homeomorphic to R.

iii) State and prove the Urysohn's lemma for metric space.

P.T.O.

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

i) Is intersection of two compact sets compact? Justify.

ii) Prove that every finite point set in a Hausdorff space. X is closed. Also show that a sequence of points of X converges to at most one point of X.

b) Answer any two of the following: **[10]**

i) Prove that for functions. f: R $\rightarrow$ R, the $\in - \delta$ definition of continuity implies the open set definition.

ii) State and prove the Tubelemma.

iii) Show that a subspace of a Lindelöf space need not be Lindelöf.

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

i) Prove that the union of a collection of connected subspaces of X that have a point in common is connected.

ii) Show that the one point compactification of R is homeomorphic with the circle $s^{/}$.

b) Answer any two of the following: **[10]**

i) Prove that every metrizable space is normal.

ii) Prove that every locally compact Hausdorff space is regular.

iii) Is intersection of two connected set always connected? Is Union of two connected set always connected? Justify.

Q5) a) Answer any one of the following: **[6]**

i) Let X be any topological space, Y an ordered set with the order topology and let
f, g: X $\rightarrow$ Y be continuous. Show that the set $\{x \in X | f(x) \leq g(x)\}$ is closed in X.

ii) Show that subspace of a regular space is regular, a product of regular spaces is regular.

b) Answer any two of the following: **[10]**

i) Every compact Hausdorff space is normal.

ii) Show that $[0, 1]^{W}$ is not locally compact in the uniform topology.

iii) In the finite complement topology on R, to what point or points does the sequence $x_n = \frac{1}{n}$ converse? Justify.

Total No. of Questions : 5] **[Total No. of Pages : 4**

P898

[3835] - 404

M.Sc. Tech - II

Computer Science

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 404 : Design and Analysis of Algorithm

(New Course) (Sem. - 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 : **[8 × 2 = 16]**

a) Define P & NP class of problem.

b) Name sorting algorithm which use divide & conquer strategy.

c) What is flow network?

d) What is best case & worst case running time for insertion sort?

e) Define articulation point & bridge, edge.

f) Array sorting is an NP class problem true/false and justify.

g) $2^{(n+1)}$ is $O(2^n)$.

h) Partial sol^n obtained during kruskal's algorithm are also tree true/false & justify.

i) Write greedy algorithm.

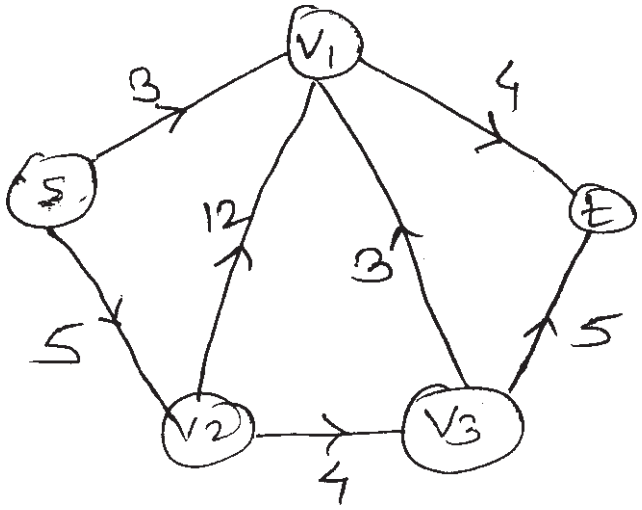
Q2) Attempt any two of the following : **[2 × 8 = 16]**

a) Explain quick sort algorithm. Find complexity in best & worst case running time.

b) What is matrix chain multiplication problem? Apply algorithm to the string of five matrices A_1, A_2, A_3, A_4 & A_5 where $A_1 = 5 \times 10$, $A_2 = 10 \times 10$, $A_3 = 10 \times 5$, $A_4 = 5 \times 20$ & $A_5 = 20 \times 5$. Find minimum number of scalar multiplication required to evaluate the product.

c) Explain Ford-Fulkerson method algorithm to find maximum flow in the network. Illustrate it on the following graph.

P.T.O.



Q3) Attempt <u>any two</u> of the following : **[2 × 8 = 16]**

a) Explain iteration method to solve recurrence relation

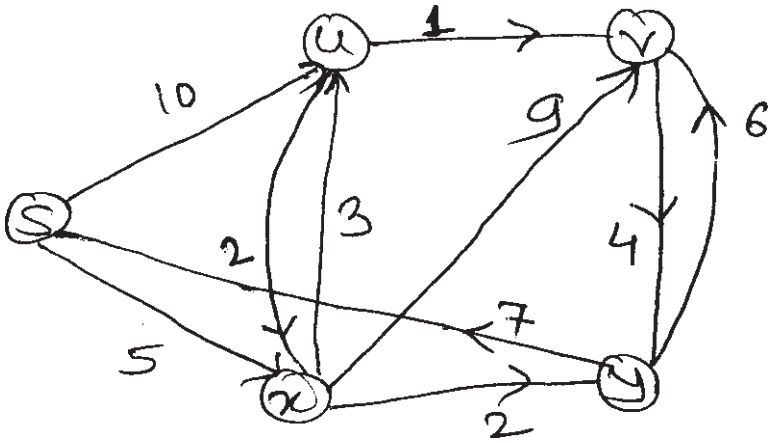
$$T(n) = \begin{cases} T(1) & n = 1 \\ aT(n/b) + f(n) & n > 1 \end{cases}$$

Solve the following recurrence relation using iteration method

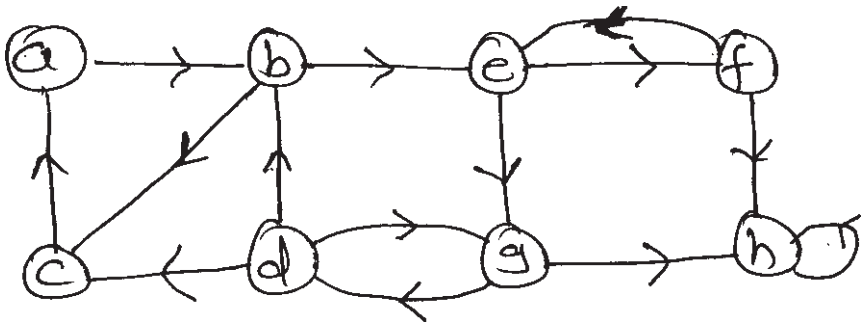
i) $T(n) = T(n / 2) + Cn$

ii) $T(n) = 7T(n / 2) + 18n^2$.

b) Explain & illustrate Dijkstra's algorithm on the following graph.



c) Explain algorithm based on DFS for finding strongly connected components of a directed graph G. Find the strongly connected components of the following graph using the algorithm.



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

a) Define (i) Time complexity (ii) Space complexity (iii) 'O' notation (iv) 'Ω' notation.

b) Illustrate Radix sort algorithm on the following array.

233, 124, 209, 345, 498, 567, 328, 163.

c) Write optimal substructure property for longest common subsequence. Illustrate LCS algorithm on the following sequences

X = < 1, 0, 0, 1, 0, 1 >

Y= < 0, 1, 0, 1, 1, 0 >

d) Apply Huffman's algorithm for the frequencies

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

e) What is satisfiability problem? State Cook's theorem.

f) Write approximation algorithm for vertex-cover. Problem.

Q5) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

a) Write HEAPIFY (A, i) algorithm. Illustrate on the following array. 16, 4, 10, 14, 7, 9, 3, 2, 8, 1 Apply on 4.

b) Write steps to develop algorithm using a dynamic programming.

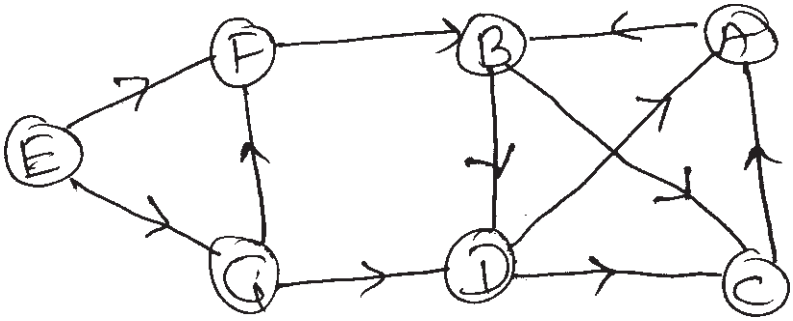
c) Write essential differences of dynamic programming as compair to divide & Conquer & Greedy method.

d) What is activity selection problem? Consider the following problem.

i	1	2	3	4	5	6	7	8	9	10	11
Start time	1	3	0	5	3	5	6	8	8	2	12
Finish time	4	5	6	7	8	9	10	11	12	13	14

Find a largest subset of mutually compatible activities.

e) Compute discovery & finish time for the depth first traversal of the following graph. (start from Ⓐ)



f) Write differences bet^{n} Kruskal's & prims Algorithm.

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Total No. of Questions : 5] **[Total No. of Pages : 5**

P901

[3835] - 501

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 501 : Operations Research

(New Course) (Sem. - V)

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) Explain 'degenaracy' in a transportation problem.

b) What is an assignment problem?

c) Define optimistic time and pessimistic time for a PERT network.

d) Determine the value of the following game :

		Player A			
		I	II	III	IV
Player B	I	20	15	12	35
	II	25	14	8	10
	III	40	2	10	5
	IV	–5	4	11	0

e) Explain the term 'two-person zero sum' game.

f) Define i) Surplus variable ii) Slack variable.

g) Convert the following LPP into standard form :

Max Z = $3x_1 + 5x_2$

Subject to,

$2x_1 + 3x_2 \leq 8$

$2x_1 + 5x_2 \leq 10$

$x_1, x_2 \geq 0.$

P.T.O.

h) Define i) Decision variables ii) Objective function

i) Write the dual of the following LPP :

Max Z = $2x_1 + 3x_2 + x_3$

Subject to,

$4x_1 + 3x_2 + x_3 = 6$

$x_1 + 2x_2 + 5x_3 = 4$

$x_1, x_2, x_3 \geq 0.$

j) Can a LPP have exactly 2 optimum solutions? Justify your answer.

Q2) Attempt <u>any two</u> of the following : **[16]**

a) Use VAM to find starting solution of the following transportation problem :

		To 1	2	3	4	Supply
	1	11	13	17	14	250
From	2	16	18	14	10	300
	3	21	24	13	10	400
Demand		200	225	275	250	

check for the optimality of the solution obtained.

b) i) Explain the least cost method for obtaining an initial solution of a transportation problem.

ii) Solve the following assignment problem :

	I	II	III	IV
1	8	26	17	11
2	13	28	4	26
3	38	19	18	15
4	19	26	24	10

c) Solve the following LPP by simplex method :

Max Z = $4x_1 + 5x_2 + 9x_3 + 11x_4$

Subject to,

$x_1 + x_2 + x_3 + x_4 \leq 15$

$7x_1 + 5x_2 + 3x_3 + 2x_4 \leq 120$

$3x_1 + 5x_2 + 10x_3 + 15x_4 \leq 100$

$x_1, x_2, x_3, x_4 \geq 0$

Q3) Attempt <u>any two</u> of the following : **[16]**

a) Solve the following game graphically :

		B			
		B_1	B_2	B_3	B_4
A	A_1	2	2	3	–2
	A_2	4	3	2	6

b) i) What is an unbalanced transportation problem? How do we balance it?

ii) Explain the Hungarian technique of an assignment problem.

c) A company produces two types of presentation goods A and B that require gold and silver. Each unit of type A requires 3gm of silver and 1gm of gold while each unit of B requires 1 gm of silver and 2gm of gold. The company can produce 9gm of silver and 8gm of gold. If each unit of type A brings a profit of Rs. 40 and that of type B, Rs. 50, determine the number of units of each type that should be produced so as to maximize the profit. (solve it graphically).

Q4) Attempt <u>any four</u> of the following : **[16]**

a) Explain minimax and maximin principle used in theory of games.

b) Explain the following terms for activities in a network :

i) Earliest start time.

ii) Earliest finish time.

iii) Latest start time.

iv) Latest finish time.

c) Find starting solution of the following transportation problem by north west corner rule :

		Destination				
		D_1	D_2	D_3	D_4	Supply
Source	S_1	21	16	15	3	10
	S_2	17	18	14	23	12
	S_3	32	27	18	41	20
Demand		16	10	12	15	

d) Solve the following LPP graphically :

Min Z = $3x_1 + 5x_2$

Subject to,

$-3x_1 + 4x_2 \leq 12$

$2x_1 - x_2 \geq -2$

$2x_1 + 3x_2 \geq 12$

$x_1 \leq 4, x_2 \geq 2$

and $x_1, x_2 \geq 0$

e) Draw a network diagram for the following data :

Activity	Preceded by
A	–
B	–
C	–
D	A,C
E	A,B
F	D,G
G	A

Q5) Attempt <u>any two</u> of the following : **[16]**

a) Find optimum solution of the following Transportation problem :

		Warehouse			
		W_1	W_2	W_3	Supply
Factory	F_1	16	20	12	200
	F_2	14	8	18	160
	F_3	26	24	16	90
Demand		180	120	150	450

(Find initial solution using least cost method).

b) Consider the following LPP :

Max $Z = 5x_1 + 4x_2$

Subject to,

$$3x_1 + 2x_2 \leq 50$$
$$x_1 + x_2 \leq 22$$
$$x_1, x_2 \geq 0$$

The optimum solution is $(x_1, x_2)^T$ and the optimal inverse is $\begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$.

i) Write the optimum simplex table.

ii) Find the new solution when the RHS of the first constraint changes from 50 to 60.

c) For the project consisting of the following activities, determine the critical path, total float for all the activities. Also draw the network diagram.

Activity	1-2	1-3	1-4	2-3	2-4	2-5	3-5	4-5
Duration	5	4	6	7	8	10	11	10

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P901

[3835] - 501
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 501 : Compiler Techniques
(Old Course) (Sem. - V)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Write your assumptions clearly, if any.***

Q1) Attempt any eight of the following : **[16]**

a) Define a compiler.

b) Define the sets generated by regular expressions a* and a^+. What is the relationship between them?

c) List the actions performed by a LR parser during parsing process.

d) What is the need of code optimisation?

e) State the scope rules for a block structured programming language.

f) Which task (s) of a compiler are optional?

g) Define recursion.

h) List LR(O) items generated by the production $A \rightarrow XYZ$.

i) What are L-attributed definitions?

j) 'Top-down parser uses the method of reduction'. Comment on this statement.

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

i) Write a Recursive Descent parser for the following grammar

$S \rightarrow bAB/a$ $A \rightarrow aB/b$ $B \rightarrow bA/a$

ii) Check if the following grammar is LL(1) or not

$S \rightarrow AB/\in$ $A \rightarrow aASa/a$ $B \rightarrow b$

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

i) Explain phase structure of a compiler.

ii) What is a DFA? Explain the role of DFA in scanning.

iii) Explain the conflicts occurring in LR parsing with suitable examples.

P.T.O.

Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) Construct the sets of LR(1) items for the following grammar.

$S \rightarrow A \quad A \rightarrow BCA/a \quad B \rightarrow \in \quad C \rightarrow \in$

ii) Explain how compilation of the if statement and while loop is done.

b) Attempt <u>any two</u> of the following : **[10]**

i) Explain the contents of an activation record.

ii) Draw a Directed Acyclic Graph for the following expression :

$a + a * (b - c) + (b - c) * d$

iii) Explain the intermediate code forms of handling the expressions during compilation process.

Q4) Attempt <u>any four</u> of the following : **[16]**

a) Explain frontend and backend of a compiler.

b) Write a note on input bufferring.

c) 'An SLR (1) grammar can be ambiguous'. Is this statement true or false? Why?

d) Write a note on displays.

e) Explain call-by-reference method for parameter passing.

Q5) Attempt <u>any four</u> of the following : **[16]**

a) Explain bootstrapping and cross compiler.

b) Write a note on static allocation.

c) Explain dead code elimination and frequency reduction methods of code optimisation with suitable examples.

d) Explain the methods of evaluating semantic rules.

e) What are the functions performed by a scanner?

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Total No. of Questions : 5] **[Total No. of Pages : 5**

P902

[3835] - 502

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 502 : Numerical and Statistical Methods

(New Course) (Sem. - 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) Define the terms

i) Sample space

ii) Events

b) Suppose A and B are mutually exclusive events for which P(A) = 0.4, P(B) = 0.3, what is the probability that

i) Either A or B occurs.

ii) A occurs but B does not occur.

c) Define conditional probability of event A given event B and conditional probability of event B given event A.

d) If the probability mass function of a random variable X is given by

$$P(X = x) = \begin{cases} kx^2, & x = 0,1,2,3 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k.

e) State Lack of memory property of exponential distribution.

f) The coefficient of correlation between two variables X and Y is 0.64. Their covariance is 16. The variance of X is 9. What is the standard deviation of Y?

P.T.O.

g) Given $r_{12} = 0.4$, $r_{13} = 0.3$ and $r_{23} = 0.9$, find $r_{12.3}$ and $R_{1.23}$

h) If X is a Poisson variate such that P(X = 0) = 0.2, find E(X) and Var(X).

i) Explain the terms null hypothesis and alternative hypothesis.

j) Distinguish between One way ANOVA and Two way ANOVA.

Q2) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

a) A class contains 5 south Indians, 4 Gujarathis, 8 Maharashtrians and 3 Jains. A student is chosen at random to represent the class. Find the probability that the student is

i) A south Indian

ii) A Maharashtrian or a Jain.

b) Define independence of two events. Show that if A and B are independent events defined of sample space Ω then A^c and B^c are also independent events.

c) If X ~ U(–1, 1), find P(| X | < 0.5) and P($-1/3 < X < 1/8$).

d) On the basis of 500 randomly selected fields about tenancy status of the cultivators of these fields and use of fertilizers collected in an agro-economic enquiry, the following classification was noted

	Owned	Rented
Using fertilizers	208	92
Not using fertilizers	32	168

Would you conclude that owner cultivators are more inclined towards the use of fertilizers at 5% l.o.s.?

e) Define distribution function of discrete random variables. Also, state its properties. Further, explain why distribution function of a discrete random variable is also known as step function.

f) Define Regression coefficients b_{yx} and b_{xy}. State any two properties of Regression coefficients.

Q3) Attempt <u>any four</u> of the following : **[4 × 4 = 16]**

a) In a certain school examination, results showed that 20% students failed in Mathematics, 5% failed in English while 10% failed in both Mathematics and English. Are the two events 'Failing in Mathematics' and 'Failing in English' independent.

b) Let X and Y be two independent variables having binomial distribution with parameters (5, 0.5) and (8, 0.5) respectively. Find $P[(X + Y) \geq 1.5]$ and $P[X = 1 / Y = 3]$.

c) Explain the concepts of multiple correlation and partial correlation. State expressions for multiple correlation coefficient and partial correlation coefficients in case of trivariate data in which X_1 is dependent variable.

d) A manufacturer of light bulbs claims that on an average 2% of the bulbs manufactured by his firm are defective. A random sample of 400 bulbs contained 13 defective bulbs. On the basis of this sample, can you support the manufacturer's claim at 5% l.o.s.?

e) Let X and Y be two independent normally distributed random variables with parameters (μ_1, σ_1^2) and (μ_2, σ_2^2) respectively. Obtain the distribution of (X + Y) and (X – Y).

f) The development engineer is interested in determining whether the cotton weight percentage in a synthetic fiber affects the tensile strength. Analysis of variance for the tensile strength is given below. Find the missing values.

Source of variation	Sum of square	Degree of freedom	Mean Sum of square	F Value
Cotton weight percentage	-	4	-	
Error	161.20	-	8.06	-
Total	636.96	24		

Q4) Attempt <u>any two</u> of the following : **[2 × 8 = 16]**

a) i) Following is the distribution function of a discrete random variable X

X = x	0	1	2	3	4	5
F(x)	0.05	0.20	0.40	0.90	0.99	1.00

Find probability distribution of X and also find

P[(X ≥ 4) / (X > 2)]

ii) A continuous random variable X has the probability density function given by,

$$f(x) = \begin{cases} k(3x^2 + 4), & 0 \le X \le 2 \\ 0 & \text{Otherwise} \end{cases}$$

Find value of k. Also find E(X) and V(X).

b) i) Define the term correlation. Explain the concepts of positive and negative correlation with examples.

ii) For a bivariate data b_{xy} = 1.11, b_{yx} = 0.72, σ_x = 10.5, compute correlation coefficient between X and Y. Also compute variance of Y.

c) i) Explain the procedure of testing $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$ for a large sample, at 5% l.o.s.

ii) In a certain city, 100 students from a sample of 400 students are found to be Non-vegetarians. In another city, the corresponding number was 300 from a sample of 800. Test whether the proportion of Non-vegetarians in the two cities differ significantly at 5% l.o.s.

Q5) Attempt <u>any two</u> of the following : **[2 × 8 = 16]**

a) i) Given the following data, obtain the linear regression estimate of marks in history for 70 marks in English

	Average	Standard deviation
Marks in History	48.4	8.4
Marks in English	35.6	10.5

and correlation coefficient is 0.62.

ii) Explain the least square principle for obtaining equation of regression line of Y on X.

b) i) In a sample of 8 observations the sum of squared deviation of items from mean was 94.5. In another sample of 10 observations the corresponding value was found to be 101.7. Test whether the difference in variances is significant at 10% level of significance.

ii) Describe test procedure of paired t-test with sample size $n_1 = n_2 = n$.

c) i) In a textile factory 500 pieces of cloth were inspected and the number of defects obtained per piece of cloth was recorded as follows,

Number of defects	0	1	2	3 & above
Observed frequency	200	150	90	60
Expected frequency	195.45	146.34	88.12	59.68

Test Goodness of fit at 5% l.o.s.

ii) The distribution function of X is

$$F(x) = \begin{cases} 0 & x < -1 \\ (X^3 + 1)/9 & -1 \le x \le 2 \\ 1 & x > 2 \end{cases}$$

Evaluate $P(0 < x \le 2)$ and obtain the probability density function of X.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P902

[3835] - 502

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 502 : Software Engineering - I

(Old Course) (Sem. - V)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Q1) Attempt any Eight of the following : **[16]**

a) Define : Software.
b) What do you understand by data objects?
c) Define : Structure chart.
d) Define : Use case.
e) Give any two functions of a system analyst.
f) What do you understand by validation testing?
g) Give any 2 advantages of incremental development process.
h) How to calculate the cost of quality?
i) Mention the two components involved in modularity.
j) Define : Coupling.

Q2) Attempt any four of the following : **[16]**

a) Explain : System Development Life Cycle.
b) Explain the difference between Waterfall Model and Prototyping Model.
c) Explain : Feasibility study.
d) What are the characteristics of a good quality design?
e) What are the factors used to construct a system model?

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

a) Discuss the relationship between the concept of information hiding as an attribute of effective modularity and the concept of module independence.
b) Explain the purpose of 'State Diagram' and give suitable example.
c) What are the parameters used to access the quality of a software? Explain in detail.

P.T.O.

Q4) Attempt <u>any two</u> of the following : **[16]**

a) The railway reservation system functions as follows :

The passenger is required to fill in a reservation form giving details of his journey. The counter clerk ensures whether the place is available. If so, entries are made in the register, tickets are prepared, amount is computed and cash is accepted. A booking statement is prepared in triplicate from the reservation register. One copy of it is retained as office copy, the other is pasted on the compartment and the third is passed on to the train conductor. Besides booking statement, cash statement is prepared at the end of each shift. Prepare a data flow diagram to describe this situation.

b) Explain the principles of testing methodology in detail.

c) Income tax deduction is made in the month of March from the salary using the following rules. Prepare the decision table.

i) If the total income is less than Rs. 22,000 then no tax is deducted.

ii) If total income exceeds Rs. 22,000 but does not exceed Rs. 30,000 then the deduction is 20% of the amount which exceeds Rs. 22,000.

iii) If the total income exceeds Rs. 50,000 but does not exceed Rs. 1,00,000 then the tax is Rs. 7600 + 40% of amount which exceeds Rs. 50,000.

iv) If the total income exceeds Rs. 1,00,000 then the tax is Rs. 27,600 + 50% of the amount which exceeds Rs. 1,00,000.

Q5) Attempt <u>any four</u> of the following : **[16]**

a) State the difference between concurrent and component based approach.

b) Explain the different Requirement Analysis methods.

c) Write a brief note on : Abstraction.

d) Explain how SDLC is required to implement systematic system model.

e) Explain RAD model in detail.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P903

[3835] - 503

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 503 : Digital Image Processing

(New Course) (Sem. - V)

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 log table/calculator is allowed.***

Q1) Attempt any eight of the following : **[8 × 2 = 16]**

a) What is a digital image?

b) Define the terms luminance and radiance.

c) What is pseudocolour image processing?

d) State the use of thresholding in segmentation.

e) What is image restoration?

f) State any two sources of noise.

g) What is image histogram?

h) Define the terms mean and standard deviation.

i) What is texture?

j) What is JPEG and TIFF?

Q2) Attempt any four of the following : **[4 × 4 = 16]**

a) Explain with suitable diagram any one type of image acquisition device.

b) Define the terms spatial resolution and intensity level resolution.

c) Explain sampling and quantization of digital image.

d) Discuss the RGB model for colour image.

e) Explain the HIS model and give the conversion of RGB to HIS.

P.T.O.

Q3) Answer any four of the following : **[4 × 4 = 16]**

a) Explain with suitable example the negative image enhancement.

b) Explain the global thresholding algorithm.

c) Explain with suitable example the difference between correlation and convolution.

d) Discuss with necessary diagram the histogram equalisation.

e) Discuss the method of brightness and contrast control. State the advantage of gamma correction.

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

a) Explain the use of image processing in fingerprint identification.

b) Discuss the role of image processing in medical applications.

c) Discuss the image sharpening in the frequency domain.

d) Explain the use of low pass filter for smooting of digital image.

e) Discuss the methods of noise removal from the image data.

Q5) Answer any two of the following : **[2 × 8 = 16]**

a) With the help of neat diagram, illustrate and explain various steps in image processing.

b) Discuss the discrete fourier transform. Explain its use in image processing.

c) With the help of suitable masks explain the following :

i) Point detection.

ii) Line detection.

iii) Edge detection.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P903

[3835] - 503
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 503 : Computer Networks
(Old Course) (Sem. - V)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***

Q1) Attempt any eight of the following : **[16]**

a) State the function of the network layer.

b) What is the role of TTL field in IP?

c) Write the following IP address in the dotted decimal format :

10000000 00000101 00001011 00001111

d) What is the advantage of fiber optic cable over coaxial cable?

e) What is the main difference between link state routing and distance vector routing?

f) How is CSMA classified?

g) List the flags used in TCP packet.

h) What is ESS and BSS?

i) State the purpose of using a bridge in LAN.

j) TCP works faster than UDP. State whether true/false and justify.

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

i) Explain the methods of framing in data link layer.

ii) Explain the services provided by the transport layer.

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

i) What is ICMP? List ICMP error messages.

ii) Write a note on unguided media.

iii) Explain any one controlled access mechanism.

P.T.O.

Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) Explain the process of connection establishment in TCP.

ii) Compare circuit, message and packet switching.

b) Attempt <u>any two</u> of the following : **[10]**

i) Explain FDMA and TDMA.

ii) Explain the role of Hub and Repeater in LAN.

iii) With the help of a diagram, explain 802.11 architecture.

Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Explain the one-bit sliding window protocol.

ii) Explain the architecture of WWW.

b) Attempt <u>any two</u> of the following : **[10]**

i) Write a note on FTP.

ii) Explain various topologies used in LAN's.

iii) Explain the goals and advantages of network.

Q5) Attempt <u>any four</u> of the following : **[16]**

a) A router receives a packet with destination address 192.168.5.10. Show how it delivers the packet to the destination.

b) A signal has a bandwidth of 20KHz. Calculate the data rate if it is encoded as a binary signal and the S/N ratio is 30dB.

c) Draw the manchester, differential manchester and straight binary encoding for : 011010010

d) An organization has 64 customers, each needing128 addresses (IPv4). It has been assigned a class B address 191.100.0.0. Show how the subnet mask is calculated.

e) Draw the UDP datagram and explain its fields.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P904

[3835]-504
M.Sc. Tech.
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 504 : Advanced Operating System
(New Course) (Sem. - V)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Q1) Attempt any eight of the following : **[8 × 2 = 16]**

a) Write a note on file table and user file descriptor table.

b) Explain brelse algorithm.

c) Describe the steps for a context switch.

d) Write a source code to catch signal.

e) Explain different context layers of a sleeping process.

f) Write a source code that will describe the use of "exec" system call.

g) Explain the concept of expansion swap.

h) Give any four functions of line discipline.

i) What is socket? Explain the socket system call.

j) What is RPM? Explain any two options of "rpm". package installation command.

Q2) a) Attempt any one of the following : **[1 × 6 = 6]**

i) Explain with suitable diagram elements of file system layout.

ii) With neat diagram, explain the structure of buffer header.

b) Attempt any two of the following : **[2 × 5 = 10]**

i) Explain the layout of system memory.

ii) Explain the algorithm for writing data to a terminal.

iii) Write one line description for the following functions :

1) bind.
2) listen.
3) connect.
4) accept.
5) shutdown.

P.T.O.

Q3) a) Attempt any one of the following : **[1 × 6 = 6]**

i) Describe the various entries found in the region table.

ii) Write a note on image of an executable file.

b) Attempt any two of the following : **[2 × 5 = 10]**

i) Explain with suitable diagram, the structure of interrupt levels.

ii) Describe several parts of an executable file.

iii) What do you mean by demand paging? Describe the data structures for demand paging.

Q4) a) Attempt any one of the following : **[1 × 6 = 6]**

i) Explain the role of fork in paging system.

ii) Describe the various data structures for shared memory.

b) Attempt any two of the following : **[2 × 5 = 10]**

i) "Kernel can execute growreg ( ) to increase the size of any region". Justify your answer.

ii) Describe the various sequence of operations performed by Kernel for fork ( ) system call.

iii) Describe the use of following bits supported by demand paging :

1) Valid.
2) Reference.
3) Modify.
4) Copy on write.
5) Age.

Q5) a) Attempt any one of the following : **[1 × 6 = 6]**

i) Describe the six operations performed by Kernel on clists and cblocks.

ii) What is service in linux? Describe chkconfig command with all possible options.

b) Attempt any two of the following : **[2 × 5 = 10]**

i) Write a note on rc.init and rc.local.

ii) Explain the structure of debugging process.

iii) Write a program depicting the reason for death of child signal.

Total No. of Questions : 5] **[Total No. of Pages : 3**

P904

[3835]-504
M.Sc. Tech.
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 504 : Computer Graphics
(Old Course) (Sem. - 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) Explain the use of computer graphics in Entertainment.

b) Explain pick function. Which is a true pick device?

c) Explain the terms : Interlacing and Aspect ratio.

d) What are desired characteristics of lines?

e) Explain homogeneous co-ordinate system.

f) 4-connected method may not fill the polygons correctly. Justify.

g) Explain text-clipping strategies.

h) Write the matrix of shear in y-direction by 2 units proportional to x-co-ordinate.

i) Explain different elevations.

j) What are control points?

Q2) a) Attempt any one of the following : **[1 × 6 = 6]**

i) Discuss the different components of a Cathode Ray Tube (CRT).

ii) Explain simple ordered edge list algorithm for scan converting polygons. How can it be made efficient?

b) Attempt any two of the following : **[2 × 5 = 10]**

i) Write a short note on Tablet or digitizer as input device.

ii) Consider the line segment P_1 (– 3, 5) and P_2 (10, 20), clipped to the rectangular window A (0, 0), B (15, 0), C (15, 15) and D (0, 15). Using Cohen-Sutherland algorithm, determine the visibility of the line segment P_1 P_2 with respect to rectangle ABCD.

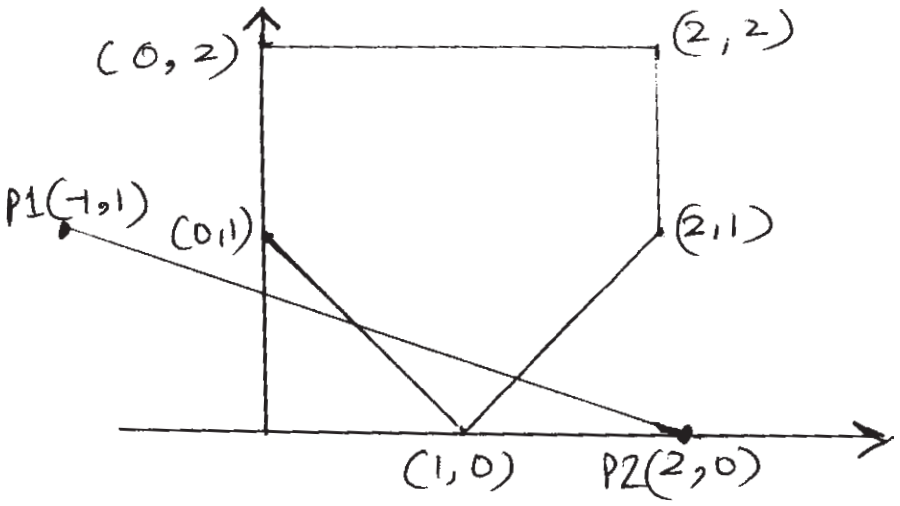
P.T.O.

iii) How random scan line display differs from raster scan line display? Explain Random scan line drawing algorithm.

Q3) a) Attempt <u>any one</u> of the following : **[1 × 6 = 6]**

i) Illustrate the general Bresenham's line drawing algorithm for $P_1 = (-1, 1)$ and $P_2 = (6, 5)$.

ii) A five sided polygonal clipping window is shown below. Illustrate the complete result of the Cyrus-beck algorithm for the line $P_1 (-1, 1)$ and $P_2 (2, 0)$.



b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

i) Explain edge fill algorithm and how it can be improved by using a fence.

ii) Explain midpoint subdivision line clipping algorithm.

iii) Consider an object having its center at (4, 3). Give the transformation matrix for

1) Rotating the object 90^o counterclockwise about its center.
2) Scaling to double the size in both directions about its center.

Q4) a) Attempt <u>any one</u> of the following : **[1 × 6 = 6]**

i) Explain various reflection transformations and give the algorithm for reflection about any arbitrary line.

ii) Discuss the properties of B-spline curves.

b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

i) Explain depth sorting method. Why is it called painter's algorithm?

ii) Write a short note on oblique parallel projections.

iii) Consider the Bezier curve determined by $B_0 (-3, -1)$, $B_1 (2, 3)$ and $B_2 (6, 1)$. Find points on Bezier curve corresponding to $t = 0.4$ and $t = 0.6$.

Q5) a) Attempt <u>any one</u> of the following : **[1 × 6 = 6]**

i) Discuss Area subdivision method for hidden surface elimination.

ii) What are cubic splines? Discuss any two ways of representing Hermite Splines.

b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

i) Write a short note on vanishing points.

ii) Explain the algorithm for General pivot point rotation and General fixed point scaling.

iii) Compare and contrast 'boundary fill' and 'flood-fill' algorithm.

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