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

P1099

[3735] - 101

M.Sc. Tech. - I

MATHEMATICS

Industrial Mathematics with Computer Applications

MIM - 101 : Real Analysis

(Old & New Course) (Semester - I)

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

Instructions to the candidates :

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

Q1) Attempt <u>any eight</u> of the following : **[16]**

a) Let d : R x R $\rightarrow$ R be a function defined by

$$d(x, y) = 0, \quad \text{if } x = y$$
$$= 2, \quad \text{if } x \neq y$$

Is (R, d) a metric space? Justify.

b) Prove that every subset of a discrete metric space is closed.

c) Let f : [0, 1] $\rightarrow$ R be defined by

$$f(x) = 2x + 1, \quad 0 \leq x < \frac{1}{2}$$

$$= 6x - 1, \quad \frac{1}{2} \leq x < 1.$$

Prove that f is uniformly continuous on [0, 1]

d) If p > 1, show that the series $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^p}$ converges.

e) Find the radius of convergence of the power series $\sum_{n=1}^{\infty} \frac{z^n}{n^2} (z \in C)$.

f) If $f \in R(\alpha)$ on $[a, b]$ and if $|f(x)| \leq M$ on $[a, b]$, then show that $\left|\int_a^b f\, d\alpha\right| \leq M[\alpha(b) - \alpha(a)]$.

g) Construct a bounded set of real numbers with exactly three limit points.

h) Let f be differentiable on (a, b). If $f'(x) \geq 0$, for all $x \in (a, b)$, then prove that f is monotonically increasing on (a, b).

P.T.O.

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

j) Show that any open ball in R^k is a convex set.

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

i) Let p be a limit point of a set E in a metric space (X, d). Show that every neighbourhood of p contains infinitely many points of E.

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

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

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

ii) Let $x_n \in R^k$ (n = 1, 2, 3, ...) and $x_n = (\alpha_{1n}, \alpha_{2n}, ..., \alpha_{kn})$. Show that if $\{x_n\}$ converges to $x = (\alpha_1, \alpha_2, ..., \alpha_k)$, then $\lim_{n\to\infty} \alpha_{jn} = \alpha_j,\ 1 \le j \le n$.

iii) Show that if a series $\sum_{n=1}^{\infty} a_n$ converges absolutely, then $\sum_{n=1}^{\infty} a_n$ converges.

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

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

ii) Let $\{p_n\}$ be a sequence of points in a compact metric space X. Show that there exists a subsequence of $\{p_n\}$ which converges to some point of X.

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

i) If $p > 0$ and α is a real number, prove that $\lim_{n\to\infty} \frac{n^\alpha}{(1+p)^n} = 0$.

ii) Let f be a continuous real valued function on a metric space X and let $M = \sup_{x\in X} f(x)$. Prove that there exists a point $p \in X$ such that $f(p) = M$.

iii) Let f be a mapping of a metric space X into a metric space Y. Show that f is continuous on X iff $f^{-1}(F)$ is closed in X, for every closed set F in Y.

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

i) Prove that a continuous map on a compact metric space is uniformly continuous.

ii) Let f be continuous on [a, b]. Let α be monotonically increasing on [a, b]. Prove that $f \in R(\alpha)$ on $[a, b]$.

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

i) Verify the Mean Value theorem for $f(x) = \sin x$, $g(x) = \cos x$ in $\left[0, \frac{\pi}{2}\right]$.

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

iii) Let E = [0, 1] and for each $n \in N$, let $f_n(x) = x^n$, for all $x \in [0,1]$. Let

$f(x) = 0, \quad x \neq 1, x \in E.$

$\quad = 1, \quad x = 1.$

Show that $\{f_n\}$ does not converge uniformly to f on E.

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

a) Let $\sum_{n=1}^{\infty} f_n(x)$ be a series of continuous functions on $E \subseteq R$ such that $\sum_{n=1}^{\infty} f_n(x)$ converges uniformly to $f(x)$ on E. Prove that f is continuous on E.

b) Test uniform convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n^p + n^q x^2}$ on R.

c) Show that every bounded sequence in R^k has a convergent subsequence.

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

e) Let $f(x) = 1$, if x is a rational in [0, 1]

$\quad = 0$, if x is an irrational in [0, 1].

Show that f is not Riemann integrable on [0, 1].

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

P1100 **[3735] - 102**

M.Sc. Tech. - I

MATHEMATICS

Industrial Mathematics with Computer Applications

MIM - 102 : Algebra - I

(Old & 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 <u>any eight</u> of the following : **[16]**

a) Prove that every group of order 5 or 17 is cyclic.

b) Find the order of the permutation σ, where
$\sigma = (1, 2, 3)\ (3, 2)\ (1, 2)$.

c) Prove that every subgroup of an abelian group is a normal subgroup.

d) If G is a group of order 30, and H is a subset of G with seven elements which includes the identity element. Is H a subgroup of G? Justify.

e) Let $\phi : Z \to Z_n$ be a group homomorphism given by $\phi(i) = \bar{i}$. Find kernel of ϕ.

f) Define unit in a ring. Find the units in the ring of integers Z.

g) Give an example of a subring of a ring which is not an ideal.

h) Show that any homomorphism from a field to another ring is either trivial homomorphism or an isomorphism.

i) Show that $x^2 + x + 1$ is irreducible over Z_2.

j) Give an example a non-commutative ring.

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

i) Prove that the necessary and sufficient conditions for a subset H of a group G to be a subgroup is that for all $a, b \in$ H imply $ab^{-1} \in$ H.

ii) If H is a subgroup of a group G, then prove that the relation ~ defined as : For $a, b \in$ G, $a \sim b$ if and only if $ab^{-1} \in$ H is an equivalence relation on G.

P.T.O.

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

i) Let G be a group and $a \in G$, then show that $a^m = e$ if and only if $O(a)$ divides m.

ii) Show that any subgroup of a group of index two is normal subgroup.

iii) Let $\sigma = (2, 3, 1, 4)\ (4, 6)\ (2, 1, 5)$ is a permutation in S_6. Check σ is even or odd permutation.

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

i) State and prove Cayley's theorem for groups.

ii) State and prove the first fundamental theorem of group homomorphism.

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

i) Show that any group of order 15 has a proper normal subgroup.

ii) Define conjugacy class. Find conjugacy classes of S_3.

iii) If H and K are subgroups of a group G, then is it possible that HK is a subgroup of G? Justify.

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

i) Prove that a commutative ring R with unity is integral domain if and only if cancellation laws hold in R.

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

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

i) Show that intersection of any two ideals of a ring is again an ideal. What about the union? Justify.

ii) Find all maximal ideals of Z_{12}.

iii) If R is a ring with unity 1 and ϕ is a homomorphism of R onto R', show that $\phi(1)$ is unity in R'.

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

i) State and prove division algorithm for polynomial ring $F[x]$, where F is a field.

ii) If R is Euclidean ring then prove that every ideal of R is generated by single element.

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

i) Show that the polynomial $3x^4 + 10x^3 + 26x + 50$ is irreducible over Q, the field of rational numbers.

ii) If R is Euclidean ring and $a \in R$, then show that $d(a) = d(1)$ if and only if a is unit in R.

iii) Let $U = \langle x^2 + x + 4 \rangle$ be an ideal of $Z_{11}[x]$ generated by $x^2 + x + 4$. Show that $Z_{11}[x]/U$ is a field.

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

P1101 **[3735] - 103**

M.Sc. Tech. - I
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 103 : Discrete Mathematical Structures - I
(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 <u>any eight</u> of the following : **[16]**

a) Determine whether $(\sim q \wedge (p \to q)) \to \sim p$ is a tautology?

b) Let p : You drive over 65 miles per hour.

q : You get a speeding ticket.

Write the following statement using logical connective 'You will get a speeding ticket if you drive over 65 miles per hour.

c) What is the truth value of $\exists x\, p(x)$ where $p(x)$ is the statement $x^2 > 10$ and the universe of discourse consists of the positive integers not exceeding 4?

d) Determine whether the operation $*$ on z, defined by $a * b = a + b - ab$ is associative.

e) State true or false. Justify.

Union of two sublattices is a sublattice.

f) Find the dual of $\bar{x}.\perp+(\bar{y}+z)$.

g) What values of the Boolean variables x and y satisfy $x \,.\, y = x + y$?

h) How many permutations of the letters ABCDEFGH contain the string ABC?

i) Define

i) Semigroup.

ii) Monoid.

j) Determine whether the poset $\{2, 3, 4, 6\}$ under divisibility is a lattice?

P.T.O.

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

i) Use Rules of inference to show that the hypotheses "Randy works hard", "If Randy works hard then he is a dull boy", "If Randy is a dull boy, then he will not get the job" imply the conclusion "Randy will not get the job".

ii) Prove that in any Lattice, the distributive inequalities

$a \wedge (b \vee c) \geq (a \wedge b) \vee (a \wedge c)$ and $a \vee (b \wedge c) \leq (a \vee b) \wedge (a \vee c)$ hold for any a, b, c.

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

i) Prove that $(p \rightarrow r) \wedge (q \rightarrow r) \equiv (p \vee q) \rightarrow r$.

ii) Translate the following statement into English where C (x) is "x is a comedian" and F(x) is "x is funny" and the domain consists of all people.

A) $\forall x (\mathrm{C}(x) \rightarrow \mathrm{F}(x))$

B) $\forall x (\mathrm{C}(x) \wedge \mathrm{F}(x))$

C) $\exists x (\mathrm{C}(x) \rightarrow \mathrm{F}(x))$

D) $\exists x (\mathrm{C}(x) \wedge \mathrm{F}(x))$

E) $\exists x (\mathrm{C}(x) \wedge \sim \mathrm{F}(x))$

c) Give a proof by contradiction of the theorem : 'If $3n + 2$ is odd, then n is odd'.

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

i) Prove that two lattices L and M are modular if and only if L x M is modular.

ii) Prove that dual of a complete Lattice is complete.

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

i) Determine whether the following relation R on the semigroup S is a congruence relation where S = Z under the operation of ordinary addition and a R b iff $a \equiv b$ (mod 3).

ii) Prove that the homomorphic image of a relatively complemented lattice is relatively complemented.

iii) Show that the binary structure (R, +) with usual addition is isomorphic to the structure (R^+, .) where is usual multiplication.

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

i) Show that in a Boolean algebra, the idempotent laws $x \vee x = x$ and $x \wedge x = x$ hold for every element x.

ii) Find the sum of products expansion for the function $F(x, y, z) = (x + z)y$.

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

i) How many positive integers not exceeding 1000 are divisible by 7 or 11?

ii) What is the minimum number of students required in a discrete maths class to be sure that at least six will receive the same grades A, B, C, D and F. Justify.

iii) Construct a circuit that produce the output $(\overline{xy}) + (\bar{z} + x)$.

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

i) Construct a Karnaugh map for $F(x, y, z) = x\bar{z} + xyz + y\bar{z}$.

ii) Define Boolean function. Find the values of the Boolean function represented by $F(x, y, z) = xy + \bar{z}$.

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

i) Use Karnaugh maps to minimize the sum of product expansion $xy\bar{z} + x\bar{y}\bar{z} + \bar{x}yz + \bar{x}\bar{y}\bar{z}$

ii) Let A = $\{a, b, c\}$

Does the following table define a semigroup or a monoid on A? Justify.

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

iii) Prove that a chain is a distributive lattice.

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

P1101 **[3735] - 103**

M.Sc. Tech. - I
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 103 : Discrete Mathematical Structures - I
(Old 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 <u>any eight</u> of the following : **[16]**

a) Symbolize the expression :

"If 2 + 2 = 5, then I am king of England!".

b) Show that $\left[p \wedge (p \to q)\right] \to q$ is a tautology.

c) Find the complement of the element 5 in D_{15}.

d) Define a monoid. Give an example of a monoid.

e) Obtain the principal disjunctive normal form of the statement $p \to q$.

f) Let (S, ∗) be a semigroup and let 'a' be a fixed element of S - show that $T = \{a^n \mid n \in N\}$ is a subsemigroup of S.

g) Prove that in a distributive lattice, every element has at most one complement.

h) Draw the Karnaugh map for $x\bar{y} + \bar{x}y$ and simplify it.

i) Write the converse, inverse and contra positive of the statement : "The sun shines only if I am happy".

j) Show that every chain is a modular lattice.

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

i) Give a direct proof of validity of the argument :

$p \to (q \vee r),\ s \to -r,\ p \wedge s \vdash q.$

P.T.O.

ii) Denote the connective "NAND" (not and) by $\uparrow$: construct a truth table for $\uparrow$. Show further that

$(p\uparrow q)\uparrow(p\uparrow q)\equiv p\wedge q$ and $p\uparrow(q\uparrow q)\equiv p\rightarrow q$.

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

i) Express each of the following statements using quantifiers. Form the negation of each statement and express it in simple English :-

α) No lion knows cycling.

β) All chimps are monkeys.

ii) Test the validity of the following argument by using indirect proof :

$p\rightarrow r,\ \sim q\rightarrow p,\ \sim r \vdash q$.

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

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

i) Prove that for any commutative monoid (M, $*$) the set of idempotent elements of M forms a submonoid of M.

ii) Let (S, $*$) and (T, $*$) be monoids with identities e and e' respectively. Let $\phi:\mathrm{S}\rightarrow\mathrm{T}$ be an isomorphism. Prove that $\phi(e)=e'$.

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

i) Consider the semigroup (Z, +) and the equivalence relation R on Z defined by $a\mathrm{R}b\leftrightarrow a\equiv b(\mathrm{mod}\ n),\ n\in\mathrm{N}$. Is R a congruence relation? Justify.

ii) Let E be the set of even integers. Show that the semigroups (Z, +) and (E, +) are isomorphic.

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

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

i) Prove that the product of two lattices is a lattice.

ii) Show that the dual of a complemented lattice is complemented.

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

i) Draw the Hasse diagram for the lattice $D_8 \times D_{27}$.

ii) Show that the homomorphic image of a modular lattice is modular.

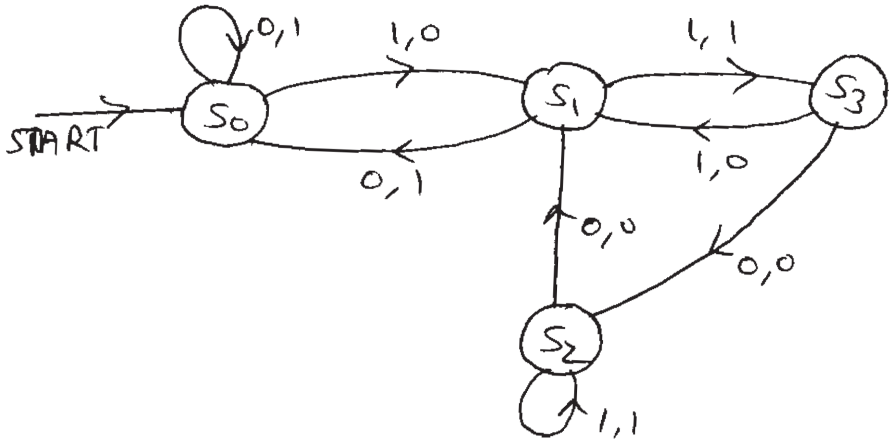
iii) Let B be a Boolean algebra. For $x, y, z \in B$, prove that

(α) $(x \vee y)' = x' \wedge y'$

(β) $y \wedge x = z \wedge x$ and $y \wedge x' = z \wedge x' \Rightarrow y = z$.

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

a) Construct a state table for the finite state machine shown in the following figure :



Find the output generated by this machine, if the input string is 10110111001101.

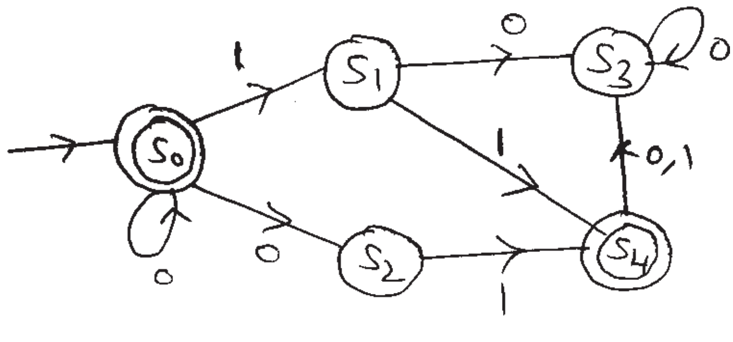
b) Determine whether the string 10101 is in each of the following sets.

α) {01}*

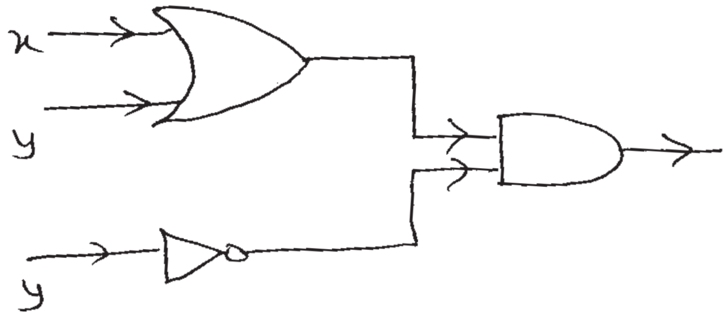
β) {10}*

c) Prove that any two Boolean algebras, each having n elements, are isomorphic.

d) Find the language recognized by the following NDFA :



e) Find the output of the following circuit :



f) Find the sum-of-products expansion for the function $F(x, y, z) = (x + y)\,\bar{z}$.

✦✦✦✦

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

P1102 **[3735] - 104**

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 104 : Programming in C

(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 <u>any eight</u> of the following : **[16]**

a) Compare the following statements :

include < stdio.h >

include “stdio.h”

b) Explain the following statement

int $*p$[10];

c) What is the difference between putc ( ) & putch ( ).

d) Can we add one pointer to another pointer? If yes give the eg.

e) State whether the following are valid declarations?

int f1 (int a[ ] [ ], char C);

f2 (struct temp {int a, int b});

f) Explain the use of Unary operator.

g) Compare the member selection operators ‘.’ and ‘s’.

h) Justify whether the following is true.

“A function can return an array”.

i) What are the various file opening modes?

j) Give the prototype of following functions a to i ( ), ab_{s} ( ).

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

a) Write function subprograms

i) To determine whether a square matrix is symmetric.

ii) To find the rowwise and columnwise sum of the matrix.

P.T.O.

b) Write a program to accept two arrays of integers. Sort these arrays and then merge them into the third array of integers which is also sorted?

c) Write a program that reads contents of two files and concatenates them into a third file. (All filenames are given from the command line).

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

a) Write a short note on "C-Preprocessors".

b) What is the difference between struct and Union? Explain with the help of example.

c) Explain the difference between "Call by value" and "Call by reference". With the help of an example.

d) Explain in short Malloc and Calloc.

e) Write a short note on pointer arithmetic in C.

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

a) What is the meaning of the following declarations?

i) int *p [ ];

ii) int *p (char *);

b) What is the output of the following code?

```
int i;
void main (void)
{
   int j = i * 5;
   printf("%d  %d", i, j);
}
```

c) Trace the output if the program is correct.

```
# include <stdio. h>
Void main (Void)
{
   Char * t = "Hello World";
   Char * s = {t, t + 1, t + 2, t + 3, t + 4};
   int i = 0;
   while (i < 5)
         printf("%s \n", 5[i++]);
}
```

d) State whether the following is a valid declaration.

Struct pair {int *a*, int *b*;} *f*(int *a*, int *b*);

e) Explain the use of function : fread ( );

f) State the use of the static variable.

g) Justify the following :

"main ( ) function does not have any argument".

h) Trace the output if the program is correct

```
Void main (Void)
{
   int k = 30;
   printf("%d", f1(k));
}
int f1 (int i);
{
   return (i > 40)? 1 : 0;
}
```

i) What is the function prototype?

j) Explain the use of file pointer.

Q5) a) Attempt <u>any two</u> of the following : **[8]**

i) Write a note on multi-dimensional array in C.

ii) Explain the different storage class specifiers.

iii) Explain enum with the help of the example.

b) Attempt <u>any two</u> of the following : **[8]**

i) Write a program using function and pointer to determine whether a given string is pallindrome.

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

iii) Write a program to reverse the number

Eg : No is 1234.

Output 4321.

✦✦✦✦

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

P1102 **[3735] - 104**

M.Sc. Tech.

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) ***Figures to the right indicate full marks.***

Q1) Attempt <u>any eight</u> of the following : **[16]**

a) State whether given identifiers is valid or invalid.

i) 6^{th} pay.

ii) +5.

iii) *abcd*.

iv) 123.

b) Find the output of the following code

Char *x*;

x = 67;

printf ("*%d %c*", *x, x*);

c) Declare a union with one integer and one character type variable.

d) Compare the bitwise operator ¦ with ^.

e) Explain the use of cast operator.

f) State the meaning of the following :

Struct *s*1 {int *a, b* :} *f*1(int, int);

g) What is the meaning of following code

Char $*p$ = "Hello",

$p--$;

$--p$;

printf("*%d*", *p*);

P.T.O.

h) State the precedence of bitwise operators.

i) Find the value of x in following code

int x, a[20];

x = size of (a);

j) If $a = 1$, $b = 2$, $c = 3$, $d = 4$ find the value of following expression.

$a \%b * a - c \%d$.

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

a) Write a program which reads an integer from the user & calls the recursive function to add the digits of a number.

b) Write a program to accept e-no., e-name, basic salary, da & hra of n employees and display net-sal & salary slip of each employee.

c) Write a function to find whether one string is a substring of another string. Use this function to find number of occurrences of this string in a given string.

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

a) Explain nested structures with the help of the example.

b) Write a short note on dynamic memory allocation.

c) Explain pointer arithmetic in C.

d) Write a note on external storage specifier.

e) Write a note on multi-dimensional array.

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

a) Trace the output of following code.

```
main ( )
{
    int i = 0, x = 0;
do {
    it (i %4 = = 0)
    { x ++;
            printf("%d", x);}
        ++i;
} while (i < 16);}.
```

b) Explain continue statement with the help of the example.

c) Find the output of following code

```
int i = 10;
printf("%d", i = 12);
```

d) Find the output of following code

```
char *p = "Exam";
printf("%c", * (p + 3));
```

e) Trace the output if the program is correct.

```
#include < stdio.h >
int f( )
{
    printf("I am inside function");
    return 1;
}
int a = f( );
    Void main ( )
    {
       printf("I am in main %d", a);
    }.
```

f) Define structure having two members, first is array of 80 char & second of type integer. Define pointer p to 100 students.

g) The value of expression 127 & 63 is ___________.

h) Find the output of following code

```
Void main ( )
{
      int a  = 40, b = 60;
      printf("%# 0 \ n  %x", a, b).
}
```

i) If A = 1234 then the value of A >> 3 is __________.

j) Explain the following statement

int a = 20; float x = 0.5; (a + x)++;

Q5) a) Attempt <u>any two</u> of the following : **[8]**

i) Compare while & do-while control structure.

ii) Write a short note on conditional statement.

iii) Write a short note on unions in C.

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

i) Write a recursive function to check whether a given string is pallindrome.

ii) Write a program to find whether the triangle is right angle triangle.

iii) Write a program to solve foll. equations

$a_1x + b_1y = c_1; \quad a_2x + b_2y = c_2.$

✦✦✦✦

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

P1103 **[3735] - 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) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt <u>any eight</u> of the following : **[8 x 2 = 16]**

a) Give the features of binary number system.

b) State the types of storage devices.

c) State any two differences between ROM and RAM.

d) State the function of compiler.

e) Give any two differences between mainframe and micro computer.

f) State the main features of hexadecimal number system.

g) What is BCD?

h) State any two applications of internet.

i) State the important parts of CPU.

j) State the function of LAN.

Q2) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) State the types of digital computer. Give the features of personal computer.

b) Explain with suitable example the method of conversion of decimal number into hexadecimal number.

c) Explain with neat diagram the Von Neumann model of computer.

d) Convert the decimal number 23 into binary, BCD and hexadecimal.

e) Explain with necessary diagram the principle of working of Ink-Jet printer.

P.T.O.

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

a) Explain with diagram the working principle of optical mouse.

b) Distinguish between the impact and non-impact printer.

c) Explain with neat diagram the operation of Laser printer.

d) Explain with neat diagram the operation of video display unit.

e) Distinguish between compact disk and DVD.

Q4) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) State the types of primary memory. Explain any one type in detail.

b) Explain with a neat diagram the operating principle of floppy disk drive.

c) Distinguish between optical and magnetic storage devices.

d) What is an ASCII code? Give its features.

e) Discuss with a neat diagram the operation of flat bed scanner.

Q5) Attempt <u>any two</u> of the following : **[2 x 8 = 16]**

a) Discuss with a neat optical ray diagram the working of CD ROM drive.

b) What is Operating System? Give the main features of WINDOWS operating system.

c) Explain with diagram the types of network topology. State the types of network devices.

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

P1103 **[3735] - 105**

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 105 : Computer Architecture

(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) ***Use of log table / calculator is allowed.***

Q1) Attempt <u>any eight</u> of the following : **[8 x 2 = 16]**

a) What do you mean by Synchronization?

b) State the function of stack pointer.

c) State one application of logical AND gate.

d) State the De-Morgan's second theorem.

e) State the use of stack memory.

f) Give the difference between binary and BCD.

g) State the different type of basic logic gates.

h) State the purpose of 'Data bus' in microprocessor.

i) Draw a logic symbol of XOR gate and give its truth table.

j) Give the function of Instruction pointer.

Q2) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) Explain with neat logic diagram the working of Half adder.

b) Discuss the message passing model of parallel computer.

c) Explain the working and truth table of R - S flip-flop.

d) Give construction and working of XOR gate using basic gates.

e) Draw the logic diagram for the expression :

$$Y=(A+B).(C+D)$$

P.T.O.

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

a) Distinguish between Impact and Non-impact printers.

b) Explain with neat diagram the operation of flat bed scanner.

c) Write a short note on optical mouse.

d) Discuss with necessary sequence of diagrams the working of LASER Printer.

e) Explain with neat block diagram the operating principle of VDU monitor.

Q4) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) Discuss with neat diagram the Von-Neumann model of computer system.

b) Write a note on Load balancing in parallel programming.

c) Discuss with neat diagram the concept of distributed and shared memory.

d) Explain with necessary diagram 'SIMD' and 'MIMD' type of parallel computer.

e) Draw a logic diagram for the expression.

$$Y = \left(\overline{A} + \overline{B}\right) + \left(\overline{A + B}\right).$$

Q5) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) Discuss with neat optical ray diagram the working of CD-ROM drive.

b) Explain the features of Intel 80486 microprocessor.

c) Distinguish between static and dynamic memory.

d) Explain with suitable example the instruction pipelining.

e) Explain with necessary diagram the architecture of generic microprocessor.

✦✦✦✦

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

P1104

[3735] - 201

M.Sc. Tech. - I

MATHEMATICS

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 201 : Real and Complex Analysis

(Old & New Course) (Sem. - II)

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

Instructions to the candidates :

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

Q1) Attempt <u>any eight</u> of the following : **[16]**

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

b) If $x \in R$, show that m*$\{x\} = 0$.

c) Let f, g be measurable, real valued functions defined on the same domain. Prove that $f + g$ is measurable.

d) Let X = $\{a, b\}$, Let $\mathcal{A}$ = P(x). Show that $\mathcal{A}$ is an algebra.

e) Give an example, with necessary verification of a function which is Lebesgue - integrable, but not Riemann - integrable.

f) Show that for all $z_1, z_2 \in C$, $|z_1 + z_2| \le |z_1| + |z_2|$.

g) Find $v(x, y)$ such that $f(z) = u + iv$ is analytic in C, where $u(x, y) = x(1 - y)$.

h) Define winding number of a closed contour γ around the point z_0, where $z_0 \notin \gamma$.

i) If C is the arc of the circle $|z| = 2$, from $z = 2$ to $z = 2i$ that lies in the first quadrant, show that $\left| \int_C \frac{z+4}{z^3 - 1} dz \right| \le \frac{6\pi}{7}$.

j) Find the residue of the function $f(z) = \frac{1}{z + z^2}$ at $z = 0$.

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

i) Let $a \in R$. Prove that (a, ∞) is a measurable set.

ii) Let A be any set and $E_1, E_2, \ldots\ldots\ldots\ldots E_n$ a finite sequence of disjoint measurable sets. Show that $m^*\left[A \cap \left(\bigcup_{i=1}^{n} E_i\right)\right] = \sum_{i=1}^{n} m^*(A \cap E_i)$.

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

i) If E_1 and E_2 are measurable sets, prove that $E_1 \cup E_2$ is a measurable set.

ii) Prove that the empty set ϕ and the set of reals R are measurable sets.

iii) Let f and g be bounded measurable functions defined on a set E of finite measure. If $f = g$ almost every where on E, prove that $\int_E f \leq \int_E g$.

Hence show that $\left|\int_E f\right| \leq \int_E |f|$.

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

i) Let $\{E_n\}$ be an infinite decreasing sequence of measurable sets in R. Let mE_1 be finite. Prove that $m\left(\bigcap_{n=1}^{\infty} E_n\right) = \lim_{n\to\infty} mE_n$.

ii) If $A \subseteq R$, $x \in R$, show that $m^*(A + x) = m^*A$.

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

i) If $v(x, y)$ and $V(x, y)$ are harmonic conjugates of $u(x, y)$ in a domain D, prove that $v(x, y)$ and $V(x, y)$ differ by an additive constant in C.

ii) Let $f(z) = \dfrac{\mathrm{Im}(z^2)}{|z|^2}$, $(x, y) \neq (0, 0)$

$= 0$, $(x, y) = (0, 0)$,

Show that the real and imaginary parts of $f(z)$ satisfy the Cauchy - Riemann equations, yet f is not differentiable at $z = 0$.

iii) Show that a power series $\sum_{n=0}^{\infty} a_n z^n$ and the k-times derived series $\sum_{n=k}^{\infty} A_n z^{n-k}$, where $A_n = \dfrac{n!}{(n-k)!} a_n$, have the same radius of convergence.

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

i) State and prove Morera's theorem.

ii) State and prove the sufficient conditions for the differentiability of the complex function $f(z) = u(x, y) + iv(x, y)$ at a point

$z_0 = x_0 + iy_0 \in C$.

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

i) Let $f(z)$ be analytic in a domain D. If arg $f(z)$ is constant in D, prove that $f(z)$ is a constant function in D.

ii) State Laurent's Theorem. Obtain a Laurent series expansion for the function

$$f(z)=\frac{z}{(z-1)(z-3)} \text{ in } 0<|z-1|<2.$$

iii) Evaluate $\int_C \frac{z+6}{z^2-4}dz$ where C is the circle $|z-2|=1$.

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

i) Prove that cross ratio is invariant under Möbius transformation.

ii) State and prove Rouche's Theorem.

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

i) Obtain a Maclaurin series expansion about $z = 0$ for $f(z) = \cos z$.

ii) Prove that every non-constant polynomial $P(z)$ has at least one zero in C.

iii) Evaluate, using Residue Theorem, $\int_0^{2\pi} \frac{d\theta}{1+a\cos\theta}$, $-1 < a < 1$.

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

P1105 **[3735] - 202**

M.Sc. Tech. - I
MATHEMATICS
Industrial Mathematics with Computer Applications
MIM - 202 : Algebra - II
(Old & 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 <u>any eight</u> of the following : **[16]**

a) Show that intersection of two submodules is again a submodule.

b) Show that the vectors (1, 1, 0, 0), (0, 1, –1, 0), (0, 0, 0, 3) are linearly independent in R^4.

c) If V is an inner product space over F (F may be R or C), then for *w, u, v* $\in$ V and $\alpha, \beta \in$ F, show that $(u, \alpha v + \beta w) = \overline{\alpha}(u, v) + \overline{\beta}(u, w)$.

d) If T : V $\rightarrow$ W is a homomorphism, then show that kernel of T is a subspace of V.

e) Find an eigenvector corresponding to the maximum eigenvalue of $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$.

f) State only the rank - nullity theorem for linear transformations.

g) Define field extension and degree of extension.

h) Show that $1 + \sqrt[3]{5}$ is algebraic over Q.

i) If E is a finite extension of a field F and [E : F] is prime then show that $E = F(\alpha)$ for some $\alpha \in E, \alpha \notin F$.

j) Find the splitting field of $x^3 - 1$ over Q.

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

i) If V is a vector space, then prove that $0.u = 0$ for all $u \in$ V and K$u = 0$ if and only if either $k = 0$ or $u = 0$.

ii) If T: V $\rightarrow$ U is a linear transformation and dim V = n. Then prove that $n =$ dim ImT + dim Ker T.

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

i) If T: V $\rightarrow$ U is a linear transformation then prove that T is 1 to 1 if and only if Ker T = $\{0\}$.

ii) If W_1 and W_2 are subspaces of a vector space V, then show that $W_1 + W_2$ is a subspace of V containing $W_1 \cup W_2$.

iii) Let S = $\{v_1, v_2, \ldots\ldots\ldots\ldots, v_n\}$ be a set of vectors in a vector space V. Show that S is linearly dependent if and only if one of the vectors in S is a linear combination of the remaining vectors in S.

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

i) State and prove Cauchy - Schwarz's inequality.

ii) If V is finite dimensional vector space and W is a subspace of V, then prove that $\dim\left(V/W\right) = \dim V - \dim W$.

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

i) If V is finite dimensional and $v_1 \neq v_2$ are in V, then prove that there is $f \in \hat{V}$ such that $f(v_1) \neq f(v_2)$.

ii) Consider the vectors $v_1 = (3, 0, 4)$, $v_2 = (-1, 0, 7)$ and $v_3 = (2, 9, 11)$ in R^3 equipped with usual inner product. Apply Gram-Schmidt process to obtain an orthonormal set.

iii) Let $A = \begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$. Find the basis and dimension of the eigenspace corresponding to the greatest eigenvalue.

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

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

ii) Let E be an extension of F and $a \in$ E is algebraic over F. Show that the map $\psi : F[x] \rightarrow E$ defined by $\psi(h(x)) = h(a)$ is a homomorphism. What is Kernel of ψ?

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

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

ii) If $f(x) \in F[x]$, then prove that there is an extension E of F in which $f(x)$ has a root.

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

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

i) If E is a finite extension of a field F of degree m and K is a finite extension of E of degree n, then prove that $[K : F] = mn$.

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

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

i) Show that K is a normal extension of F if and only if K is a splitting field for some polynomial over F.

ii) Construct a field with eight elements. Let $p(x) = x^3 + x^2 + 1$ be a polynomial over Z_2. Is $p(x)$ irreducible over Z_2? What is characteristic of ideal generated by $p(x)$ in $Z_2[x]$?

iii) Does there exist a linear transformation $T : R^3 \to R^2$ such that $T(1, -1, 1)) = (1, 0)$, $T(1, 1, 1) = (0, 1)$? Justify.

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Total No. of Questions : 5] **[Total No. of Pages : 6**

P1106 **[3735] - 203**

M.Sc. Tech. - I
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 203 : Discrete Mathematical Structures - II
(Old & New) (Sem. - II)

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

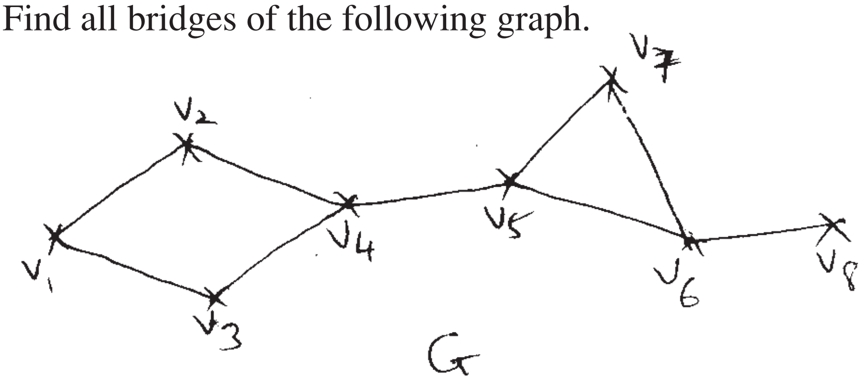
Instructions to the candidates :

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

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

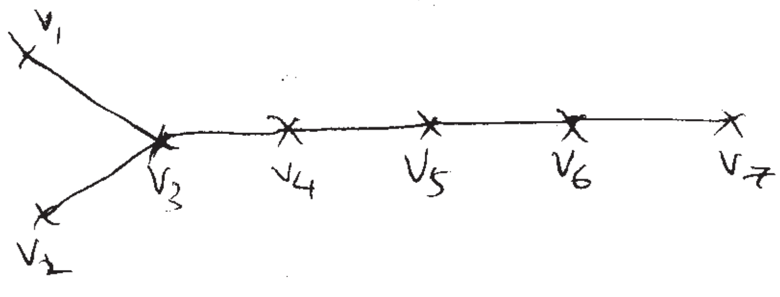
a) Draw a simple 2-regular graph on 6-vertices.

b) Find all bridges of the following graph.



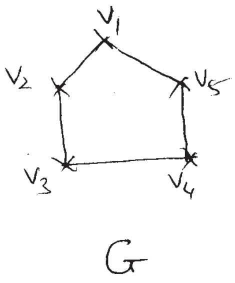
c) Find the vertex connectivity and edge connectivity of kg.

d) Find all centres for the graph G below :

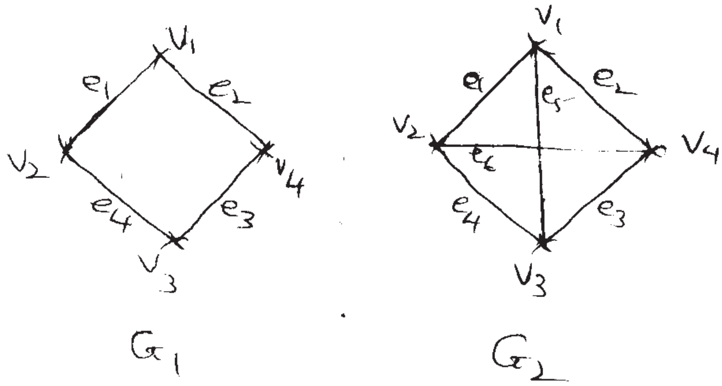


e) Define bipartite graph.

f) Find the complement of the following graph



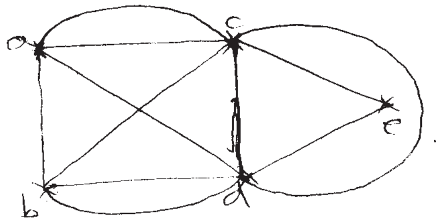
g) Find the ring sum of two graphs below :



h) Define : Planar graph.

i) Define : K - chromatic graph.

j) Write the Euler line of the following graph.



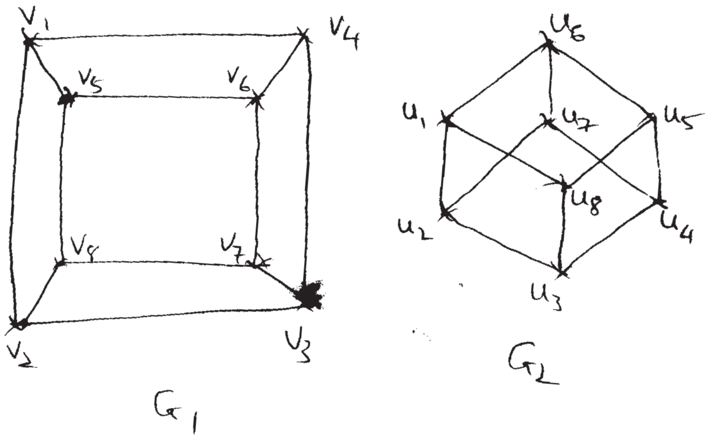
Q2) a) Attempt <u>any one</u> of the following : **[6]**

i) Prove that a given connected graph G is an Euler graph if and only if all vertices of G are of even degree.

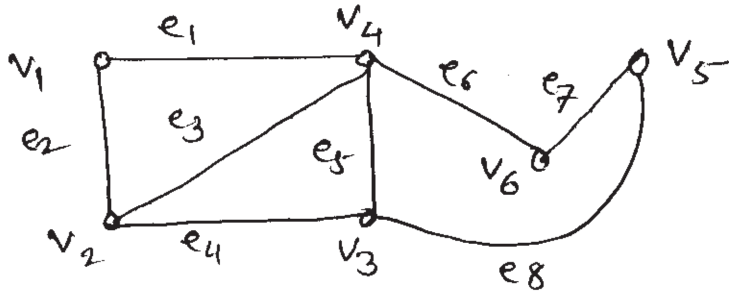
ii) Prove that, there is one and only one path between every pair of vertices in a tree T.

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

i) Show that the following two graphs are isomorphic



ii) Write down the adjacency and incidence matrices for G, where G is



'G'

iii) Prove : Let G be a simple graph with n-vertices and k-components then G has atmost $\frac{(n-k)(n-k+1)}{2}$ edges.

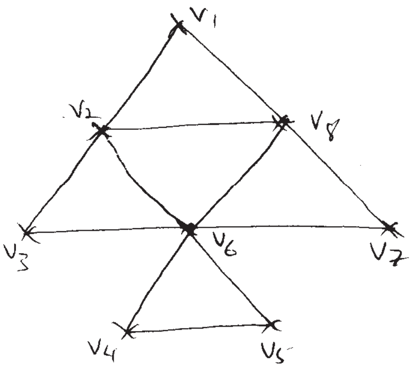
Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) State and prove Euler formula for a connected planar graph.

ii) Define rooted tree. Show that the number of vertices 'n' of a binary tree is always odd.

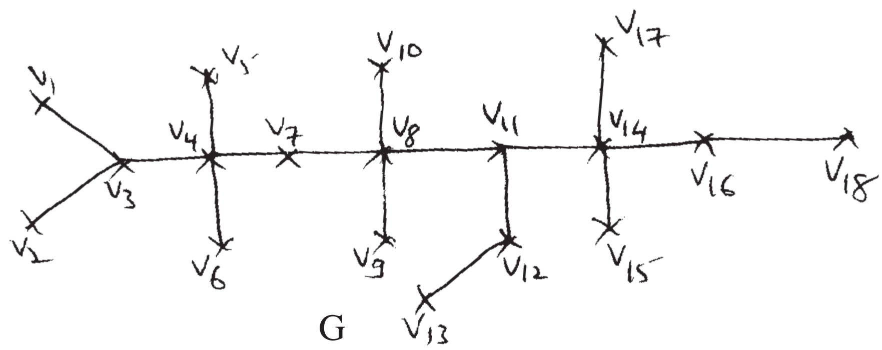
b) Attempt <u>any two</u> of the following : **[10]**

i) Using Flery's Algorithm find an Euler line in the following graph



G

ii) Find radius and diameter of the following graph.



G

iii) Find Maximum and Minimum height of binary tree with 13 vertices and draw the trees.

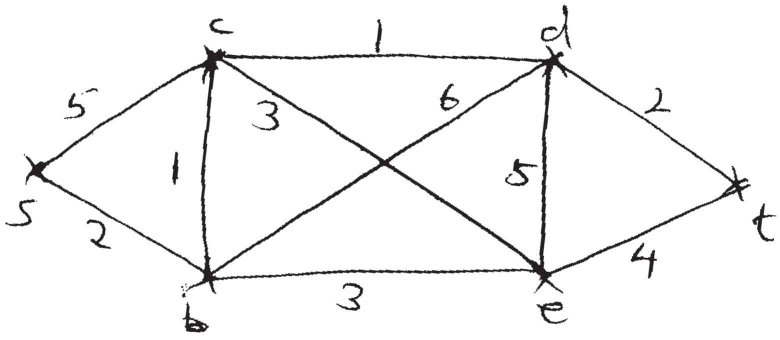
Q4) a) Attempt <u>any one</u> of the following : **[6]**

i) Prove that in a connected graph G, any minimal set of edges in G is a cut set if it contains atleast one branch of every spaning tree of G.

ii) Show that, in a connected simple planar (p, q) graph, $q \leq 3p-6$ $(p \geq 3)$.

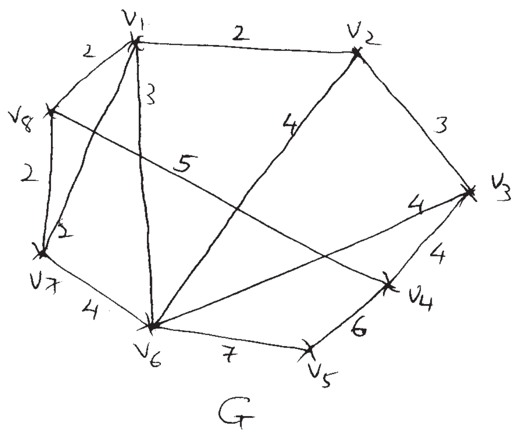
b) Attempt <u>any two</u> of the following : **[10]**

i) Using Dijkstra's algorithm, find the shortest path between the vertices *s* and *t* of the following weighted graph.

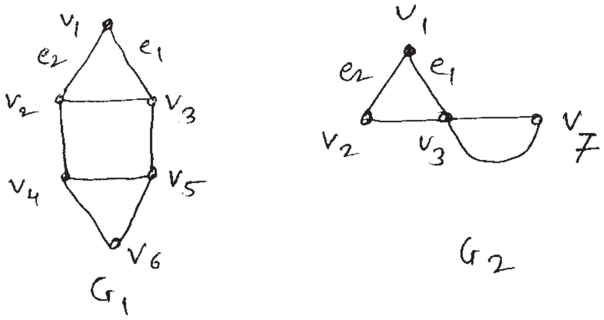


'G'

ii) Find a minimal spanning tree in the following graph using Kruskal's algorithm.

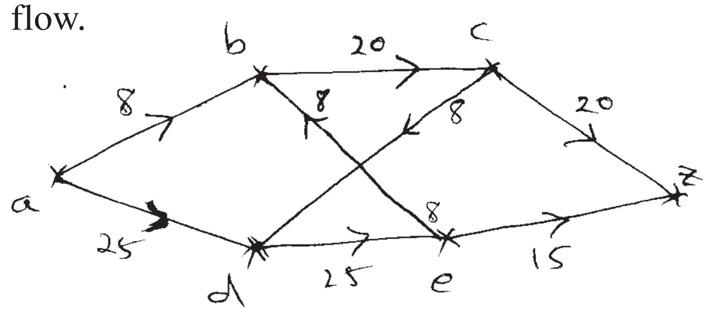


iii) Find $G_1 \cup G_2$, $G_1 \cap G_2$ for the graphs shown below.

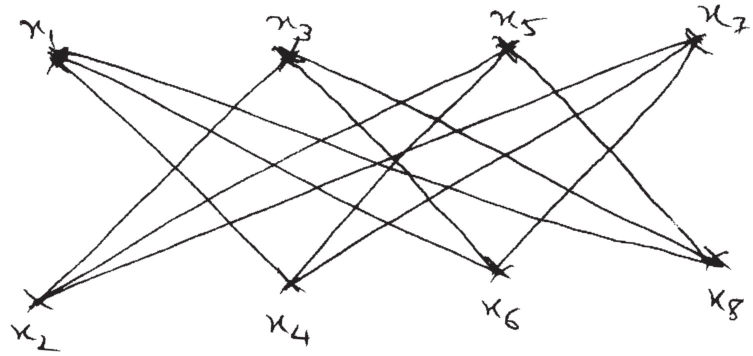


Q5) a) Attempt <u>any one</u> of the following : **[6]**

i) By using Ford and Fulkerson algorithm to determine the maximal flow in the network given below, Also find the value of the maximal flow.



ii) Find a colouring of the regular bipartite graph G of the following figure using the simple sequential colouring algorithm on the list $x_1, x_2, \ldots\ldots\ldots\ldots, x_8$ as indicated. Find a colouring of G by also using the smallest-last sequential algorithm.



G

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

i) Draw the arborescence and write in polish notation the expression :

$$\frac{(3a+b)^5}{(2a+b)}$$

ii) Define :

1) Balanced digraph.

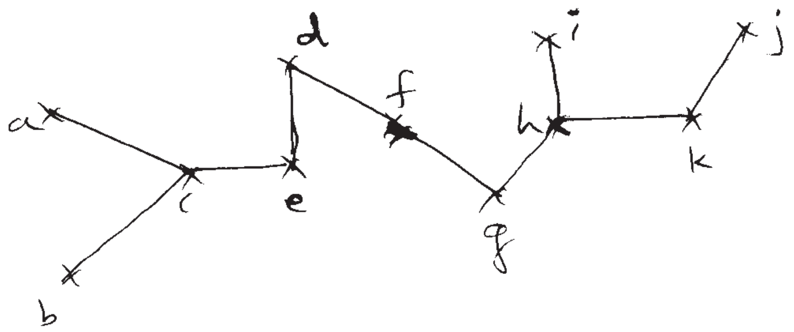
2) Weakly connected digraph.

3) Regular digraph.

4) Euler digraph.

5) Symmetric digraph.

iii) Illustrate depth-first search algorithm for the following graph.



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

P1107 [3735] - 204

M.Sc. Tech. - I

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204 : Database Fundamentals

(New Course) (Sem. - II)

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

Instructions to the candidates :

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

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

a) What is DBMS? Give two advantages of DBMS.

b) How weak entity set is indicated in E-R diagram?

c) Explain relationship with example.

d) List different DDL statements.

e) Define - Foreign key.

f) What is the use of select & project operation in relational Algebra?

g) Explain group by, Having clause used in SQL.

h) What is integrity constraint?

i) What is use of triggers?

j) What is candidate key?

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

a) What is the difference between Generalization and specialization used as extended features to the E-R diagram?

b) Explain logical connections. (AND, OR, NOT) used in SQL.

c) Write short note on - Hierarchical model.

d) Give different symbols used in E-R diagram with their meanings.

e) Explain different types of database system users.

Q3) a) Solve any one : **[6]**

i) Draw E-R diagram for the given case study. “Star” is an agency for flat booking & it has number of builders & agents who are jointly working. A customer can get a flat for residential or commercial purpose. If customer is approached through an agent the agency & builders are giving some commission to the agent. Agent shows various location.

ii) Write short note on - Normalization & it’s forms. (1NF, 2NF, 3NF).

P.T.O.

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

i) Explain the following terms required for relational data model.

1) Relation.

2) Tuple.

3) Attribute.

4) Cardinality.

5) Primary key.

ii) Explain the outer join operation with it's three types.

iii) Write short note on - Decomposition.

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

a) What is data abstruction? Explain levels of abstraction.

b) What is cursors? Explain two types of cursors.

c) Write short on Functional dependency.

d) Explain the problems caused by redundancy.

e) Explain the following operations used in relational Algebra -

i) Cartesion Product.

ii) Union Operation.

Q5) Attempt <u>any two</u> of the following : **[10]**

a) i) Consider the following database.

Employee

F_name	MINIT	L_name	SSN	B_date	Addr	Sex	Salary	D_No.	Super SSN

Department

D name	D number	Mgr SSN	Mgr Start date

Dept - Locations

D_number	D_Location

Project

P_name	P_number	Plocation	Dnum

Works on

ESSN	P_No	Hours

Dependent

ESSN	Dep_name	Sex	B_date	Relation

Write the SQL statements for the following queries.

1) Retrieve the birthdate & address of employee whose name is "John B. Smith".
2) Retrieve the name & address of all employee who work for research department.
3) For every project located in "Pune" list the project number & controlling dept. number & department manager's name.
4) Select all employee SSN's.
5) Retrieve the salary of every employee.

ii) What is the difference between Relational calculus & Relational Algebra?

iii) Consider the database.

Branch (br-name, br-city, Assets).

Account (Acc-no., Balance).

Customer (Cust-name, Cust-city, Cust-sheet).

Loan (Loan-no, Amt.).

Write the relational Algebra expressions for the following queries.

1) Select a record from relation loan where branch is "JM Road".
2) Find names of all customers who have either a loan or an account.
3) Find all customers of the bank who have an account but not a loan.
4) Find name of all branches in the loan relation.
5) Find customers who have both a loan & an account.

b) Attempt any two of the following : **[6]**

i) Write short note on - Aggregate functions used in SQL.

ii) Explain mapping constraints.

iii) List the reasons why NVLL values, Not NULL values introduced in the database.

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

P1107 **[3735] - 204**

M.Sc. Tech. - I

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204 : Programming in C with ANSI features - II

(Old Course) (Sem. - II)

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

Instructions to the candidates :

1) ***All questions are compulsory.***

2) ***Figures to the right indicate full marks.***

Q1) Attempt <u>any eight</u> of the following : **[16]**

a) What is preprocessor? How it works?

b) What are operations on a file?

c) State true or false

i) The selection of record is called its layout.

ii) An index file helps faster search of data.

d) Define

fseek ( ), ftell ( ).

e) Define Macro. Give an example.

f) List the fonts that can be used in C graphics.

g) Define clustered index. Give an example.

h) State the meaning of following modes of file can be opened.

i) “a”.

ii) “Wt”.

i) Explain following functions :

– getchar ( ), – putchar ( ).

j) What will be the output of following program

```
main ( )
{
   char str [ ] = “computer”;
   printf (“%S\n  %8.4S”, Str, Str);
}
```

P.T.O.

Q2) Attempt <u>any two</u> : **[16]**

a) Write a program to copy the content of one text file V using command line argument to other text file.

b) Write a program to count number of words, consonants & vowel in a file.

c) Write a program in C to divide screen into 4 quadrants & draw a rectangle & a circle in any 2 quadrants.

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

a) Write short note on B+ tree indexing.

b) What are three different levels of Architecture?

c) Explain different types of file organization.

d) What is physical data independance & logical data independance.

e) Write short note on ISAM.

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

i) Explain field structure in brief.

ii) What is command line argument. Explain with syntax & how to access command line argument.

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

i) Explain :

- Dynamic Hashing.
- Static Hashing.

ii) What is file? Define logical & physical files.

iii) What are advantages & disadvantages of index file organization.

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

a) Explain role of DBA in Database Management System.

b) What are special characters in files.

c) State the differences between text & graphics mode with example.

d) State the difference between spanned & unspanned records.

e) Explain different types of macros.

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

P1108 **[3735] - 205**

M.Sc. Tech. - I

COMUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 205 : Data Structures using C

(Old & 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) "Parenthesis can overrides the operator precedence". Justify your answer with suitable example.

b) What is queue? Explain with suitable diagram the primitive operations on queue.

c) Show the contents of recursive stack for evaluating fact (3).

d) What do you mean by ADT? State any two examples.

e) What is graph? Explain the term isolated vertex.

f) Write a function to display preorder traversal of a binary tree.

g) Define priority queue. Also explain the working of apq (ascending priority queue) and dpq (descending priority queue).

h) Transform the following infix expression to the postfix expression
$A + ((B - C) * (D + E * (F - G) - A) * B)$.

i) Write a short note on polish notations.

j) Write a short note on insertion sort.

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

a) Write a C program to reverse each word of the sentence. Also write a function to check word is palindrome or not.

For example :

Input : Everyone should respect mom and dad.

Output : enoyrevE dluohs tcepser mom dna dad.

Palindrome strings (words) : mom dad.

b) Write a 'C' program to implement circular queue.

c) Write a program to construct adjacency matrix for a graph. Also calculate indegree and outdegree for each vertex.

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

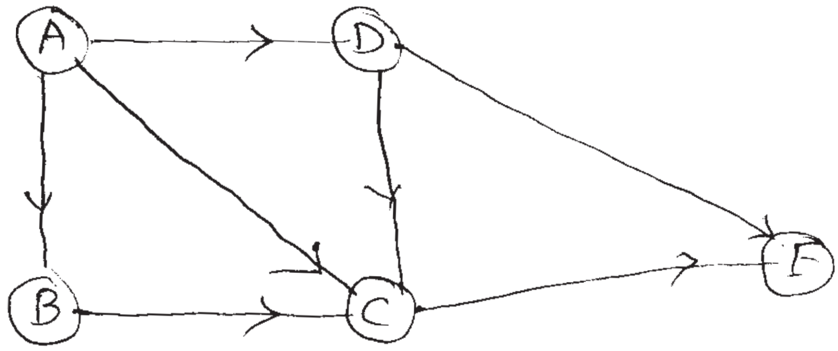
a) Write a short note on implementation of linked list using array.

b) Write a program to implement "push" and "pop" operation of stack using linked list.

c) Write an algorithm to convert an infix expression to its postfix form.

d) Explain the binary tree representations using array.

e) Construct the adjacency list for the following graph.



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

a) Write a program in which there are two linked lists. Read 10 integers from user. Put all positive numbers in one list and all negative numbers in another list. Display the contents of both linked list.

b) Explain the terms :-

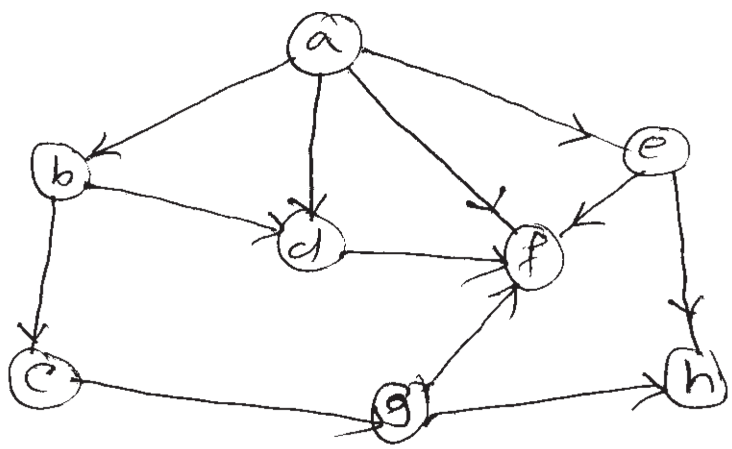
i) degree

ii) siblings

iii) depth of tree and

iv) forest.

c) Give nodes visited in case depth first traversal and breadth first traversal for the following graph. (Traversal starts from a)



d) Write short note on tree as an ADT.

e) Write a C program to implement bubble sort. Also display swap count and compare count.

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

a) Write a C program to insert and delete and display an element in doubly linked list.

b) Write a short note on adjacency multilist.

c) Write a C program to merge two given sorted arrays into a sorted array.

d) Write an algorithm to implement binary search tree.

e) Write a program to check whether the given input expression has balanced parenthesis or not.

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

P1109 **[3735] - 301**

M.Sc. Tech. - II
MATHEMATICS
Industrial Mathematics with Computer Application
MIM - 301 : Numerical Analysis
(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) ***Use of non-programmable scientific calculator is allowed.***

Q1) Attempt <u>any eight</u> of the following : **[16]**

a) Find the fixed point, if any, of $g(x)=1+x-\dfrac{x^2}{4}$.

b) Find the absolute error and relative error in the approximation of $x = 3.141592,\ \bar{x}=3.14$.

c) Find the real root of equation $x^2 - 64 = 0$, by Bisection method, which lies in [5, 9].

d) Write formula for Lagrange interpolating Polynomial through the Points (x_0, y_0), (x_1, y_1) and (x_2, y_2).

e) Define a Householder matrix.

f) Show that matrix $A=\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ is orthogonal.

g) Does the function $f(x) = e^x - 2 - x$ have a root in the interval [1.0, 1.8]? Justify.

h) Discuss court decomposition of a square matrix.

i) Write first two Newton-cotes quadrature formulas.

j) Write down the equivalent system of two first order equation of initial value problem.

$x''(t)+4x'(t)+5x(t)=0$ with $x(0) = 3,\ x'(t)=-5$.

Q2) a) Attempt <u>any one</u> 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 fixed point iteration $p_{x+1} = g(p_x)$.

P.T.O.

ii) Let $P(x) = ((x^3 - 3x^2) + 3x) - 1$ and $Q(x) = ((x - 3)x + 3) - 1$
Use three digit rounding arithmetic to compute approximations to P(2.19) and Q(2.19). Compare them with the true value
P(2.19) = Q(2.19) = 1.685159.

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

i) Let $f(x) = \cos x + 1 - x = 0$, start with $[a_0, b_0] = [0.8, 1.6]$ (x is in radians) and perform four iterations of False Position method.

ii) Start with $f(x) = x^3 - A$, where A is any real number and derive the recursive formula.

$$P_x = \frac{2P_{k-1} + A/P_{k-1}^2}{3};\ k = 1, 2, \ldots\ldots\ldots\ldots$$

for finding the cube root of A.

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

$$f_1(x, y, z) = x^3 - y^3 + y - z^4 + z^2, f_2(x, y, z) = xy + yz + zx,\ f_3(x, y, z) = \frac{y}{xz}.$$

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

i) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 4 \\ 2 & 4 & 7 \end{bmatrix}$. Also check your answer by computing the product AA^{-1}.

ii) Solve LY = B, UX = Y and verify that B = AX for

A) $B^T = (-4, 10, 5)$

B) $B^T = (20, 49, 32)$ Where A = LU is

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

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

i) Let $f(x) = 2\sin\left(\frac{\pi x}{6}\right)$ where x is in radians. Use cubic Lagrange interpolation based on nodes $x_0 = 0$, $x_1 = 1$, $x_2 = 3$ and $x_3 = 5$, to approximate $f(x)$.

ii) Let $f(x) = 3 \times 2^x$. Compute the divided difference table for tabulated function

x :	-1	0	1	2	3
$f(x)$:	1.5	3	6	12	24

iii) 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 $h = 0.01$ compare your result with true value $f''(0.8)=-\cos(0.8)$.

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

i) Assume that $x_j = x_0 + h_j$ are equally spaced nodes and $f_j = f(x_j)$. Derive the Quadrature formula

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

ii) Use Euler's method to solve the initial value problem $y' = t^2 - y$ over [0, 0.2] with $y(0) = 1$. Compute y_1, y_2 with $h = 0.1$.

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

i) Use the composite trapezoidal rule to compute an approximation to the integral of $f(x) = \sin x$ taken over $\left[0, \frac{\pi}{2}\right]$. (Dividing the range into six equal parts).

ii) Use Runge-Kutta method of fourth order to solve Initial Value problem : $y' = 2 + y^2$ over [0, 0.2] with $y(0) = 1$.

iii) Evaluate the integral $\int_0^1 \sin(\pi x)\,dx$, using Simpson's $\frac{3}{8}^{\text{th}}$ rule taking step size $h = \frac{1}{3}$.

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

i) Use power method to find the largest eigen value and the corresponding eigen vector of the matrix.

$$\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

Start with $x^{(0)} = [1, 0, 0]^T$ and perform three iterations.

ii) Use Householder's method to reduce the following symmetric matrix to tridigonal form.

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

iii) Use Jacobi's method to find eigen pairs of the matrix.

$$\begin{bmatrix} -2 & -2 & 6 \\ -2 & 3 & 4 \\ 6 & 4 & -1 \end{bmatrix}.$$

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

P1109

[3735] - 301

M.Sc. Tech. - II

MATHEMATICS

Industrial Mathematics with Computer Applications

MIM - 301 : Topology

(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 <u>any eight</u> of the following : **[16]**

a) State :

i) Schroeder Bernstein theorem.

ii) Well-ordering theorem.

b) Find all discrete and indiscrete topologies on the set X = $\{a, b\}$.

c) Show that the collection $B=\{(a,b) \mid a< b\}$ of subset of R is a basis for a topology on R.

d) Show that in the plane R^2, the set $\{x\times y \mid x\geq 0 \text{ and } y\geq 0\}$ is closed.

e) Define : Locally path connected space with example.

f) State the tube lemma.

g) Show that a regular space is Hausdorff.

h) State the Urysohn lemma.

i) State the Tychonoff theorem.

j) Is the set R $\times$ R countable? Justify.

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

i) Prove that countable union of countable sets is countable.

ii) If $x = \{a, b, c\}$, let $\tau_1 = \{\phi, x, \{a\}, \{a,b\}\}$ and $\tau_2 = \{\phi, x, \{a\}, \{b,c\}\}$. Find the smallest topology containing τ_1 and τ_2.

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

i) Let X and Y be topological spaces, let f : X $\rightarrow$ Y. Prove that if f is continuous then for every subset A of X, $f(\overline{A})\subset\overline{f(A)}$.

P.T.O.

ii) Let Y be a subspace of X, prove that if U is open in Y and Y is open in X then U is open in X.

iii) Show that the product of two Hausdorff spaces is Hausdorff.

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

i) Show that the topologies R_l and R_k are strictly finer than the standard topology on R.

ii) Consider the set Y = [–1, 1] as subspace of R. Which of the following sets are open in Y? Which are open in R? Justify.

$$A=\left\{x \,\middle|\, \frac{1}{2}<|x|<1\right\}$$

$$B=\left\{x \,\middle|\, \frac{1}{2}<|x|\leq 1\right\}$$

$$C=\left\{x \,\middle|\, \frac{1}{2}\leq|x|\leq 1\right\}$$

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

i) State and prove pasting lemma.

ii) Prove that a finite cartesian product of connected spaces is connected.

iii) Is the function $f : R \to R$ given by $f(x) = 3x + 1$ homeomorphism.

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

i) Prove that every compact subspace of a compact space is compact.

ii) Show that [0, 1] is not limit point compact as a subspace of R_l.

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

i) Prove 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.

ii) Show that $R_l \times R_l$ is not Lindelöf.

iii) Define quotient topology. Give an example.

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

i) Let X be a topological space and one point sets are closed in X. Prove that X is regular if and only if given a point x of X and a neighbourhood U of X there is a neighbourhood V of x such that $\overline{V} \subset U$.

ii) Prove that every metrizable space is normal.

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

i) Is the space R_l normal? Justify.

ii) Let A be a subset of the topological space X and A' be the set of all limit points of A. Prove that $\overline{A} = A \cup A'$.

iii) Give an example of a space which is completely regular but not normal. Justify.

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

P1110 **[3735] - 302**

M.Sc. Tech. - II

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 302 : Software Engineering (OOSE)

(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.***

Q1) Attempt <u>any eight</u> of the following : **[16]**

a) What is Object Oriented Software Engineering?

b) Give the attributes of a good software.

c) Define system dependability.

d) List different process models.

e) What is technical feasibility?

f) Give two advantages of object oriented design.

g) What is component testing?

h) What is software inspection?

i) Choose the correct option.

Context models are used to illustrate.

i) the boundaries of the system.

ii) the scope of the system.

iii) the performance of the system.

iv) the security of the system.

j) What is the UI Design principles?

Q2) Attempt <u>any four</u> of the following : **[16]**

a) Explain the different challenges facing Software Engineering.

b) Write short note on - Socio-technical system.

c) How software processes are helpful. Explain.

d) What is functional & non functional requirements? Give difference between them?

e) Write short note on - Behavioural model.

P.T.O.

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

a) Explain the concept of client-server Architecture.

b) What is design evolution in object oriented design?

c) Explain object & class with example.

d) Explain user - Interface Design Process.

e) Write short note on - RAD Model.

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

a) What is user Interface Prototype?

b) Explain System Analysis.

c) What are the different data models? Explain any one.

d) Explain the concept of Distributed object architecture.

e) Why user Analysis is important? Explain.

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

a) How verification & validation techniques are useful in system?

b) List different types of testing. Explain any one?

c) Write short note on - Agile Method.

d) What is Data Flow Diagram (DFD)? Explain with example.

e) Explain spiral model.

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

P1110 **[3735] - 302**

M.Sc. Tech. - II

COMPUTER SCIENCE

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 <u>any eight</u> of the following : **[16]**

a) Define : Primary key.

b) What do you mean by functional dependency?

c) What are the datatypes in SQL?

d) Define : Super Key for a relation.

e) State the purpose of 'π' operator.

f) State the needs of cursors.

g) What do you mean by 'Mapping Co-ordinates' or 'Mapping Cardinality' in ER - diagram?

h) List the different DML Statements.

i) Define : Bucket in hashing.

j) What are multivalued attributes?

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

i) An university decides to computerise their operations. Following are the major requirements :

A) Courses along with subjects.

B) Faculty details.

C) Student information who have enrolled for courses.

– a course can have many subject.

– student enrolls for a single course.

– A faculty can teach multiple subjects.

Draw an ER diagram for the above. Make assumptions if any.

ii) Explain B^+ tree index structure.

P.T.O.

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

i) State possible levels for the 'RAISE' statement.

ii) Explain database system architecture.

iii) How does the tuple relational calculus differ from domain relational calculus?

Q3) a) Attempt <u>any two</u> of the following : **[10]**

i) Write a note on trigger.

ii) Define : Dependency Preservation. Explain non-trivial dependency with an example.

iii) Explain with the suitable example "Discretionary access method".

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

i) What is 'Normalization'? Explain 1, 2 and 3 NF with example.

ii) Consider the following entities and their relationship.

Company (name, address, city, phone, share value)

Person (Person_name, Person_city)

Comp_person (name, person_name, Number of share)

Write a PL/SQL block to display citywise total - share value of the company with respective their investments.

Eg. :

Company_name	City_name	Total_share_value
A	Pune	1,00,000
B		
C		

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

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

ii) Explain the following relational algebra operators with an example

A) division.

B) intersection.

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

i) Explain the role of DBA.

ii) Explain any 4 sql functions with an example.

iii) Using relations, Generate following queries in Relational Algebra :

Employer (empno, name)

Project (project_no, Proj_name, Manager)

Assigned (project_no, empno)

A) List the name of employees who are not assigned with any project.

B) List the managers along with their project name.

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

a) Explain trivial dependency with an example.

b) Explain the difference between File systems Vs. Databases.

c) How do DDL and DML statements differ with their Operational Commands?

d) Explain group By and order By statements with an example.

e) Explain Aggregation with an example.

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

P1111

[3735] - 303

M.Sc. Tech. - II

COMPUTER SCIENCE

Industrial Mathematics with Computer Applications

MIM - 303 : Object Oriented Programming in JAVA

(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 <u>any eight</u> of the following : **[16]**

a) State any four features of JAVA.

b) What is the role of JVM?

c) What are command line arguments?

d) Explain private access specifier.

e) Use of final keyword.

f) What is the purpose of rollback ( ) method?

g) Describe wrapper classes.

h) What do you mean by casting a value?

i) Explain the use of instance of operator in Java.

j) State the syntax of Create Statement ( ).

Q2) Answer the following :

a) Explain JDBC Architecture. **[6]**

OR

Write a program which will explain the concept 'Nesting of methods'.

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

i) What is package? How to create package and access classes from it with the help of an example.

ii) What is an Exception? State different 5-exception types and its meaning with program.

iii) Explain core collection Interfaces.

Q3) Answer the following :

a) Describe JDBC driver models. **[6]**

OR

What is method overloading? Explain with the help of an example.

P.T.O.

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

i) What is stream? State different types of streams and five classes of each.

ii) Write a program using treeset class which uses all the required methods and explain it.

iii) Explain Border Layout manager using program.

Q4) Answer the following :

a) Explain the use of 'super' keyword with the help of program. **[6]**

OR

Explain final classes, methods and variables.

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

i) With the help of program, how to use the concept of interfaces in JAVA?

ii) Write a program using linked list class which will create a list of flowers and also adds and removes flowers to and from it.

iii) Explain the concept of polymorphism.

Q5) Answer the following :

a) Explain any 4-controls supported by AWT. **[6]**

OR

Explain Event Listener interfaces and its methods in brief.

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

i) Write short note on Adapter classes.

ii) Differentiate between AWT and swing.

iii) What is constructor? Write a program to calculate area of rectangle.

✦✦✦✦

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

P1111

[3735] - 303

M.Sc. Tech. - II

COMPUTER SCIENCE

Industrial Mathematics with Computer Applications

MIM - 303 : Object Oriented Programming in C++ - II

(Old 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 <u>any eight</u> of the following : **[16]**

a) Define class and object.

b) What is pure virtual function?

c) What is mean by overloading?

d) Define friend function.

e) What are different ways of opening a file?

f) Define exception in C++.

g) What are benefits of Object Oriented Programming?

h) What is garbage collector?

i) Explain concept of polymorphism.

j) What is 'this pointer'? What is the application of this pointer?

Q2) Attempt <u>any four</u> of the following : **[16]**

a) What is Inheritance? Explain any one the type of inheritance with example.

b) What is operator overloading? Explain Unary & binary operators.

c) Create a class student that contains a student name, roll no, marks of three subjects. Include member function called getdata ( ) to get the data from the user & another function called putdata ( ) to display data. The main program should create an array of type student.

d) Explain static function in C++. With example.

e) What is Constructor? Explain types of constructor.

P.T.O.

Q3) Attempt <u>any two</u> : **[16]**

a) Create a class Bank which consist accnt-no, name & balance and member function. Perform following operations

i) To accept the values.

ii) To display values.

iii) To withdraw an amount.

iv) To deposite an amount.

b) Write a program for addition of two complex numbers, including two member functions get ( ), put ( ).

c) Create a string class which consists string as a member & overload the following operators.

i) +, S3 = S1 + S2 find union of two strings.

ii) –, S3 = S1 – S2 find different of two strings.

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

a) Distinguish between the terms class template and template class.

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

c) Write a C++ program which performs string operations like reverse, and concatenate through member functions.

d) Explain : Memory allocation operators new, delete.

e) Explain concept of call by reference with example.

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

a) State atleast four rules of operator overloading.

b) Explain exception handling with example.

c) State features of Object Oriented Programming. What are applications of OOPS.

d) What is friend function? Give one example on it.

e) Write a program in C++ for matrix addition.

✦✦✦✦

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

P1112 **[3735] - 304**

M.Sc. Tech. - II

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 304 : Operating Systems (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) Define context switch.

b) What is 'thread cancellation'? List the two scenarios of thread cancellation.

c) What is a Semaphore?

d) Name the different scheduling queues.

e) What is 'frame'? State the use of frame table.

f) What is lazy swapper?

g) Define :

i) Seek time.

ii) Rotational Latency.

h) Define logical address and physical address.

i) What is a process? List different process states.

j) List the attributes of a file.

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

i) Consider the following snapshot of a system.

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

Available		
A	B	C
3	3	2

P.T.O.

At time t_0 the resource A has 10 instances, B has 5 instances and C has 7 instances.

1) What are the contents of array need?

2) Check whether the system is in safe state.

ii) Consider head of a moving disk with 200 tracks numbered from 0 to 199 is currently at 80.

Consider the queue of requests as follows -

100, 40, 25, 60, 120, 90, 110.

Compute the total head movements using SSTF & Look algorithm.

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

i) Explain contigeous file allocation method in disk based system.

ii) Describe the structure of Process Control Block (PCB).

iii) Explain multithreading model.

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

a) Consider following job queue.

Job	Memory	Time
1	80 K	9
2	110 K	4
3	20 K	18
4	60 K	5
5	40 K	10

Show the memory map of various stages by using MVT (Multiprogramming with Variable number of Tasks) scheduling.

Assumption : Total memory is of 400K and monitor of 100K and all jobs are arrived at the same time.

b) Explain producer / consumer problem.

c) Write a note on virtual memory concept.

d) Distinguish between Long Term Scheduler and Short Term Scheduler.

e) Explain functioning of multilevel queues.

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

a) Explain the criteria used in judging the performance of a CPU scheduling algorithm.

b) Write a note on swapping.

c) Describe the services provided by an Operating System.

d) What is fragmentation? Explain its type with an example.

e) Consider the following page referencing string.

1, 2, 3, 4, 2, 1, 6, 5, 1, 2, 1, 3, 7, 6, 3, 2, 1, 2, 3, 6.

How many page fault would occur for the following replacement algorithm assuming 5 frames. All frames are initially empty.

i) LRU.

ii) FIFO.

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

a) Consider the following snaphshot

Process	Burst Time
P_1	10
P_2	1
P_3	2
P_4	1
P_5	5

i) Draw Gantt chart using non-premptive SJF algorithm and Round Robin (Time quantum = 1).

ii) Calculate Average Turn Around Time for SJF and RR.

b) Explain demand paging with steps in handling a page fault.

c) Write a note on DMA (Direct Memory Access).

d) What is an Operating System? What are the purposes of an Operating system?

e) List the types of threads. State the benefits of multithreaded programming.

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

P1112 **[3735] - 304**

M.Sc. Tech. - II

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 304 : Operating Systems - I (Old)

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

Instructions to the candidates :

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

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

a) What do you mean by pre-emptive scheduling?

b) Define overlays.

c) Define degree of multiprogramming.

d) What are the methods to detect deadlock?

e) What is 'Page fault'?

f) What is a semaphore?

g) List the attributes of file.

h) State the contents of PCB (Process Control Block).

i) What is the purpose of system calls?

j) What is 'Lazy Swapper'?

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

i) Consider a system with three resource types A, B & C with 7, 2, 6 instances respectively. Consider following snaphshot of the system.

Process	Allocation			Request		
	A	B	C	A	B	C
P_0	0	1	0	0	0	0
P_1	2	0	0	2	0	2
P_2	3	0	3	0	0	1
P_3	2	1	1	1	0	0
P_4	0	0	2	0	0	2

P.T.O.

Answer the following questions using Banker's Algorithm.

1) What does available contain?

2) Is there any deadlock?

ii) Consider the segment table.

Seg. No.	Base	Length
0	4000	1000
1	6000	500
2	6500	500
3	5000	500

What are the physical addresses for following logical addresses?

1) 0, 450.

2) 2, 300.

3) 1, 600.

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

i) What is fragmentation? Explain the types of fragmentation.

ii) Tree is the most common directory structure. Discuss.

iii) What is memory compaction? How is it used?

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

a) Consider a disk queue with requests for following cylinders
86, 147, 91, 170, 95, 130, 102, 70

Suppose that the disk has 200 cylinders numbered 0 to 199 and head is presently at cylinder 125.

Find the total head movement using

i) FCFS disk scheduling.

ii) SSTF disk scheduling.

b) Discuss the methods for preventing deadlock situation.

c) What is an interrupt? Discuss the various types of interrupt.

d) Explain the 'Second Chance' page replacement algorithm.

e) Explain First Come First Served (FCFS) scheduling algorithm.

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

a) What is 'dispatcher'? Explain its functions.

b) Explain free space management techniques used in file system.

c) Write a note on race condition.

d) Describe services provided by an operating system.

e) Five jobs arrive at time 0, in the order given.

Job	Burst Time
1	10
2	29
3	3
4	7
5	12

Considering FCFS, RR (Time quantum = 10) Scheduling algorithm for this set of jobs,

i) Draw Gantt chart for FCFS, RR.

ii) Calculate Average Waiting time for FCFS, RR.

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

a) Assume virtual paging system has three real page frames. Simulate the effect of LRU, FIFO and optimal policies for page replacement for the following sequences,

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

b) Write a note on Swapping.

c) When do page fault occur? Describe the actions taken by operating system, when page fault occurs?

d) Explain critical section problem.

e) State the advantages and disadvantages of linked memory allocation method.

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

P1113 **[3735] - 305**

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 305 : Theoratical Computer Science

(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.***

Q1) Attempt <u>any eight</u> of the following : **[8 x 2 = 16]**

a) Define the terms : Symbol, Alphabet and Language.

b) Consider the language S*, where S = {*ab, ba*}. Give smallest length string in S* and smallest length string not in S*.

c) Given $\Sigma=\{a,b,c\}$, give the strings in the language L = {all strings of length atmost five with prefix and suffix as '*ab*'}.

d) Give any four identities for regular expressions.

e) Give context free grammar for the language

$$L=\{a^m b^n \mid m>n\geq 0\}$$

f) Let G be the grammar $\{S\rightarrow abSc/A,\ A\rightarrow cAd/cd\}$, give a derivation of *ababccddcc*.

g) Define regular grammar, give example of a grammar that is not regular.

h) What is a two-way tape Turing Machine?

i) What are useful symbols?

j) What is an ambiguous grammar? Show that the grammar

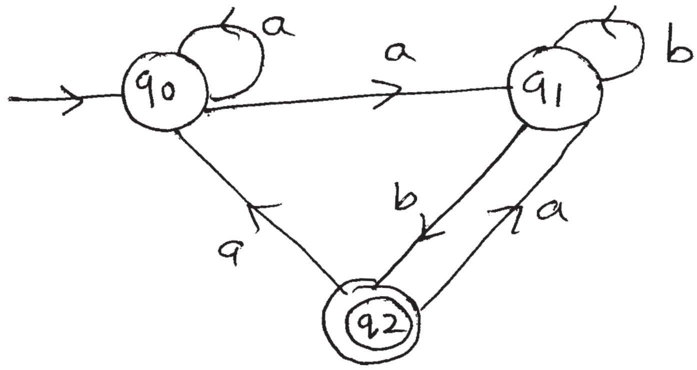
$\{S\rightarrow SA/b,\ A\rightarrow AS/a\}$ is ambiguous.

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

i) Define mealy machine. Design a Mealy machine for 1's complement of an input binary string. Convert it to a Moore machine.

P.T.O.

ii) Let M be the NFA given by following transition diagram.



Construct transition table for M and convert NFA to DFA.

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

i) Construct DFA for the language accepting strings over {0, 1} which treated as binary numbers are divisible by 5.

ii) Consider the following $\in$ - NFA given by transition table

	$\in$	a	b	c
$\rightarrow p$	$\{q, r\}$	ϕ	$\{q\}$	$\{r\}$
q	ϕ	$\{p\}$	$\{r\}$	$\{p, q\}$
$*r$	ϕ	ϕ	ϕ	ϕ

Compute $\in$ - closure of each state, convert the automation to DFA.

iii) Show that $\mathrm{L}=\left\{a^p / p \,\text{is prime}\right\}$ is not regular.

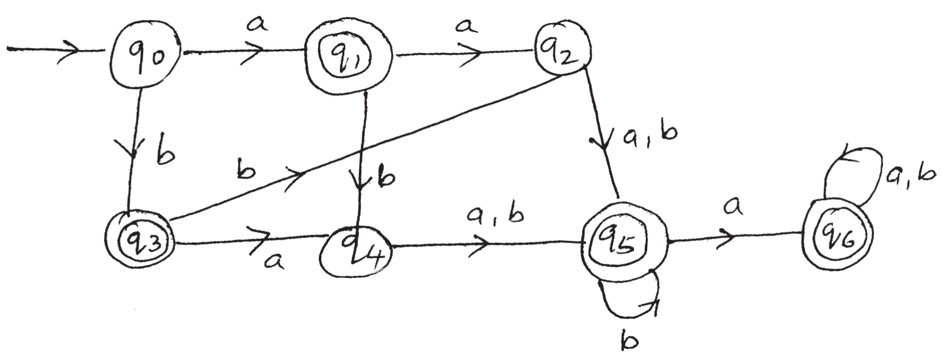
Q3) a) Attempt <u>any one</u> of the following : **[1 x 6 = 6]**

i) Construct the DFA for the language over the alphabet {0, 1} with an even number of 0's and odd number of 1's. Construct a regular grammar from DFA.

ii) Show that context free grammars are closed under union, concatenation and Kleen closure.

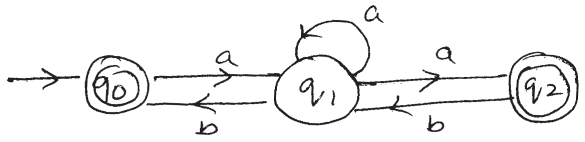
b) Attempt <u>any two</u> of the following : **[2 x 5 = 10]**

i) Minimize the following FA.



ii) Prove that language with equal number of a's, b's and c's is not context free language.

iii) Let M be the NFA



Construct a regular grammar for the language generated by M and give a regular expression for the same.

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

i) What are chain rules? What is the advantage of removing chain rules? Remove chain rules from the grammar

$\{A \rightarrow aA / a / B, B \rightarrow bB / b / c, C \rightarrow cC / c\}$

ii) Construct an equivalent grammar after removing useless symbols for the grammar

$\{S \rightarrow ACH / BB, A \rightarrow aA / aF, B \rightarrow CFH / b, C \rightarrow aC / DH, D \rightarrow aD / BD / Ca, F \rightarrow bB / b, H \rightarrow dH / d\}$

b) Attempt any two of the following : **[2 x 5 = 10]**

i) Convert the grammar $\{S \rightarrow aAbB / ABC / a, A \rightarrow aA / a, B \rightarrow bBaC / b, C \rightarrow abc\}$ to chomsky normal form.

ii) Construct a Greibach normal form equivalent to $\{S \rightarrow aAb / a, A \rightarrow SS / b\}$.

iii) Construct a Turing Machine recognising the language

$L = \{WCW^R / W \in \{a, b\}^*$ and W^R is reverse of $W\}$.

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

i) Construct a CFG equivalent to PDA

$M=(\{q_0,q_1\},\{0,1\},\{Z,B\},\delta,q_0,Z,\phi)$ where

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

$\delta(q_0,1,B)=(q_1,B)$ $\quad$ $\delta(q_1,0,B)=(q_1,\in)$

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

ii) Construct PDA for the language

$L = \{0^m 1^n 2^{m+n} \mid m,n \geq 1\}$

b) Attempt any two of the following : **[2 x 5 = 10]**

i) Construct a PDA for CFG $\{S \to aS \,/\, aSbS \,/\, a\}$ and trace all computations of string *aaaba* in M.

ii) Explain chomsky Hierarchy.

iii) Show that if L_1 is CFL and L_2 is CFL, $L_1 \cap L_2$ may or may not be CFL.

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

P1113 **[3735] - 305**

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 305 : Design and Analysis of Algorithms - 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 <u>any eight</u> of the following : **[8 x 2 = 16]**

a) Define O notation, give a sorting algorithm of $O(n^2)$.

b) What is heap? What is heap property?

c) Explain multipop operation. What is its time complexity?

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

e) What is precondition for counting sort? What is its time complexity?

f) What are the three properties satisfied by flow in a flow network?

g) What is optimal substructure property?

h) What is negative weighted cycle? How it affects shortest path calculation?

i) Explain fractional knapsack problem.

j) Explain the terms articulation point and bridge.

Q2) Attempt <u>any two</u> of the following : **[2 x 8 = 16]**

a) What is amortized analysis? Explain any two methods of amortized analysis for k-bit binary counter with increment operation.

b) Explain 'Divide and conquer strategy'. Show how it is applied in Merge sort algorithm. Derive its time complexity.

c) State and prove Master's theorem.

Q3) Attempt <u>any two</u> of the following : **[2 x 8 = 16]**

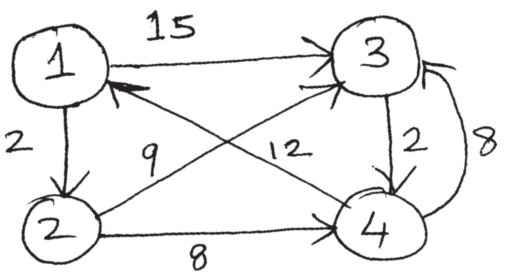
a) Explain how matrix chain problem solution is constructed using dynamic programming. Illustrate it on matrix chain product whose sequence of dimensions is (5, 10, 10, 20, 10).

P.T.O.

b) What are prefix codes? Explain Huffman coding algorithm for constructing optimal prefix codes. Obtain optimal Huffman codes for the following set of frequencies for punctuation marks occurring in a file.

Comma	Colon	Semicolon	Dot	Dash
70	20	10	120	5

c) Explain all pair shortest path algorithm. What is its time complexity? Run it on the directed graph given below showing the matrices for each iteration of the loop.



Q4) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) Compare and contrast Prim's and Kruskal's algorithm.

b) Explain Dijkstra's algorithm. What is its time complexity?

c) If $f(n)$ and $g(n)$ are asynplotically nonnegative functions then prove that $\max(f(n), g(n)) = \theta(f(n) + g(n))$.

d) What are strongly connected components? Give the algorithm to compute strongly connected components of a digraph based on DFS.

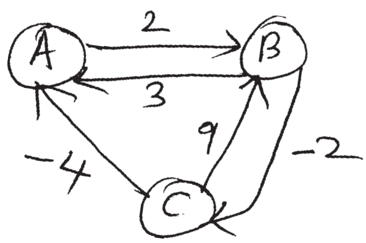
e) Explain Longest common subsequence problem. Obtain the recurrence relation for solving the problem using dynamic programming.

f) Write the partition algorithm used in quick sort. What is its time complexity?

Q5) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) Show with an example that the running time complexity of Ford-Fulkerson algorithm depends on the choice of argumenting path.

b) Illustrate Floyd Warshall algorithm on the following graph.



c) Explain classification of edges using BFS.

d) Explain Depth first traversal algorithm.

e) Explain activity selection problem. Describe the greedy strategy that can be applied to solve the problem.

f) Explain Radix - sort algorithm. What is its time complexity?

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

P1114 **[3735] - 401**

M.Sc. Tech. - II
MATHEMATICS
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) Write four topologies on the set R of reals.

b) If X is any set, show that the collection of all one point subsets of X is a basis for the topology on X.

c) Show that the projection map $\pi_1 : X \times Y \to X$ is a open map.

d) Define a Hausdorff space. Give one example.

e) Show that a constant map between two topological spaces is continuous.

f) Show that the subspace Y = [–1, 0) ∪ (0, 1] of the real line R is not connected.

g) Show that the interval (0, 1] is not compact.

h) Is the real line R separable? Justify.

i) State the Urysohn Lemma.

j) Is the set $\overset{\infty}{\underset{n=1}{\pi}}\left[-n, n\right]$ compact in product topology? Justify.

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

i) Define a basis for a topology on the set X. Prove that the topology generated by a basis B equals the collection of all unions of elements of B.

ii) Prove that if A is a subspace of X and B is a subspace of Y then the product topology on A x B is the same as the topology A x B inherits as a subspace of X x Y.

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

i) Let X be a set and let

J = { U⊆X : X – U is either countable or is all of X}.

Then show that J is a topology on X.

P.T.O.

ii) Show that the countable collection

B = {(*a*, *b*) | *a* < *b*, *a* and *b* rational} is a basis that generate the standard topology on R.

iii) Consider the set Y = [–1, 1] as a subspace of R. Which of the following sets are open in Y? Which are open in R?

$$A = \left\{ x \,\middle|\, \frac{1}{2} < |x| < 1 \right\}$$

$$B = \left\{ x \,\middle|\, \frac{1}{2} < |x| \le 1 \right\}$$

$$C = \left\{ x \,\middle|\, \frac{1}{2} \le |x| \le 1 \right\}$$

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

i) 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.

ii) Suppose $f : X \to Y$ be a mapping between topological spaces then prove that the following are equivalent.

A) f is continuous.

B) For every subset A of X, one has $f(\overline{A}) \subseteq \overline{f(A)}$.

C) For every closed set B of Y, the set $f^{-1}(B)$ is closed in X.

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

i) Show that the function $F : (-1, 1) \to R$ defined by $F(x) = \dfrac{x}{1 - x^2}$ is a homeomorphism.

ii) Prove that for functions $f : R \to R$, the $\in - \delta$ definition of continuity implies the open set definition.

iii) Show that the subspace [*a*, *b*] of R is homeomorphic with [0, 1].

Q4) a) Answer <u>any one</u> 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) Let Y be a subspace of X. Then prove that Y is compact if and only if every covering of Y by sets open in X contains a finite subcollection covering Y.

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

i) Is the space R_l connected? Justify your answer.

ii) Show that the cartesian product R^w in the box topology is not connected.

iii) Show that a finite union of compact subspaces of X is compact.

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

i) Prove that a topological space X is regular if and only if given a point x of X and a neighbourhood U of x, there is a neighbourhood V of x such that $\overline{V} \subseteq U$.

ii) Prove that every metrizable space is normal.

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

i) Show by an example that the product of two Liudelöf spaces need not be Liudelöf.

ii) Show that every order topology is regular.

iii) Show that a closed subspace of a normal space is normal.

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

P1114 **[3735] - 401**

M.Sc. Tech. - II

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 <u>any eight</u> of the following : **[16]**

a) Prove that norm is continuous function.

b) State the Hahn - Banach theorem.

c) Prove that in any normed linear space N,

$\big|\|x\|-\|y\|\big|\leq\|x-y\|\;\forall\, x, y\in \mathrm{N}$.

d) If x and y are any two orthogonal vectors in a Hilbert space, prove that $\|x-y\|^2=\|x\|^2+\|y\|^2$.

e) State the uniform Boundedness theorem.

f) If B is a Banach space, prove that B is reflexive then B* is reflexive.

g) Is the following statement true? Justify

"Every Banach space is Hilbert space".

h) Define

i) Inner product space.

ii) Self-adjoint operator.

i) If S is non-empty subset of a Hilbert space show that $\mathrm{S}\cap\mathrm{S}^{\perp}\subseteq\{0\}$.

j) If T_1 and T_2 are operators in B(H), where H is a Hilbert space, prove that $(T_1T_2)^* = T_2^* T_1^*$.

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

i) Let M be a closed linear subspace of a normed linear space N. Let the norm of a coset x + M in the quotient space N/M be defined by

$\|x+\mathrm{M}\|=\inf\left\{\|x+m\| / m\in\mathrm{M}\right\}$.

Prove that N/M is a normed linear space.

P.T.O.

ii) State and prove Hölders inequality.

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

i) Let N and N' be normed linear spaces and T : N $\rightarrow$ N' be linear transformation, prove that T is continuous if and only if T is continuous at the origin in the sense that $x_n \rightarrow 0 \Rightarrow T(x_n) \rightarrow 0$.

ii) Let M is a closed subspace of a normed linear space N and x_0 is a vector not in M, prove that there exist a function f_0 in N* such that $f_0(M) = 0$ and $f(x_0) \neq 0$.

iii) Prove that a normed linear space N is separable if its conjugate space N* is.

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

i) State and prove Open Mapping theorem.

ii) Let T be a linear transformation of B into B' where B and B' are Banach spaces, prove that if T is continuous then its graph is closed.

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

i) Prove that a non-empty subset X of a normed linear space N is bounded if and only if $f(X)$ is bounded set of numbers for each f in N*.

ii) Let T be an operator on a Banach space B. Show that T has an inverse T^{-1} iff T* has an inverse $(T^*)^{-1}$.

iii) Define a Hilbert space and give an example of Hilbert space with justification.

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

i) If x and y are any two vectors in a Hilbert space then prove that $|< x, y >| \leq \|x\|\|y\|$.

ii) Prove that in any Hilbert space the inner product is related to the norm by the identity :

$$4\langle x, y\rangle = \|x + y\|^2 - \|x - y\|^2 + i\|x + iy\|^2 - i\|x - y\|^2.$$

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

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

ii) If S is a non-empty subset of a Hilbert space H, show that $S^{\perp} = S^{\perp\perp\perp}$.

iii) Let X = R^2. Find $M^{\perp}$ if $M = \{(x, y) \in R^2 \,|\, (x, y) \neq (0, 0)\}$.

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

i) For the adjoint operation $T \rightarrow T^*$ on B(H), where H is a Hilbert space, Prove that :

A) $(T_1 + T_2)^* = T_1^* + T_2^*$

B) $\|T^*\| = \|T\|$

C) $\|T^*T\| = \|T\|^2$

ii) If T is a operator on a Hilbert space H, which $\langle Tx, x\rangle = 0 \ \forall x \in H$ then show that T = 0.

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

i) Let A_1 and A_2 are self-adjoint operators on a Hilbert space H. Prove that A_1A_2 is self-adjoint if and only if $A_1A_2 = A_2A_1$.

ii) Prove that an operator T on a Hilbert space H is self-adjoint if and only if $\langle Tx, x\rangle$ is real for all x.

iii) Show that for any arbitrary operator T on H; $I + T^*T$ and $I + TT^*$ are non singular.

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

P1115 **[3735] - 402**

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 402 : Computer Networks

(New Course) (Sem. - IV)

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

Instructions to the candidates :

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

Q1) Attempt any eight : **[16]**

a) What is signalling? Explain about analog & digital signals.

b) What is the function of transport layer?

c) What are applications of transport layer?

d) What is internetworking? What are network layer protocols?

e) What is Sampling? Define PAM.

f) State the comparison of the OSI & TCP/IP reference model.

g) State the purpose of using a device like a bridge in a network.

h) List the fields in the IP datagram which are used for fragmentation.

i) State how collision is avoided in CSMA / CD.

j) What are the different layers in the OSI ref. Model.

Q2) a) Attempt any one : **[6]**

i) Explain the network layer design issues.

ii) What is Channelization? Explain concept of FDMA and TDMA.

b) Attempt any two : **[10]**

i) Explain Bluetooth Architecture.

ii) Explain transport layer protocol TCP.

iii) What is routing algorithm? Explain shortest path routing.

Q3) a) Attempt any one : **[6]**

i) Explain the concept of framing & error control in Data link layer.

ii) What is ethernet? Explain any two types of ethernet.

b) Attempt any two : **[10]**

i) Explain following Devices :

- Hubs
- Repeater.

P.T.O.

ii) Explain the concept of element of transport protocols.
- Addressing
- Connection Establishments.

iii) Explain the following protocols :
- IP
- ICMP.

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

i) What is one-bit sliding window protocol?

ii) Explain circuit, message & packet switching.

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

i) Explain Routing techniques.
1) Next hop routing.
2) Network specific routing.

ii) Explain :
1) Guided Media.
2) Unguided Media.

iii) What is virtual LAN?

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

i) Explain two methods of controlled Access.

ii) What are transport service primitives.

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

i) A signal has bandwidth of 20Hz. The highest frequency is 60 Hz. What is the lowest frequency? Draw the spectrum if the signal contains all internal frequencies of the same amplitude.

ii) Change the following IP address from binary notation to dotted decimal notations.
1) 10000001 00001011 00001011 11101111
2) 11111001 10011011 11111011 00001111

iii) A router outside the organization receives a packet with destination address 190.240.7.91. Show how it finds the network address to route the packet.

✦✦✦✦

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

P1115 **[3735] - 402**

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 a feasible solution of a LPP.

b) Explain the need of an artificial variable in solving a LPP.

c) What is an unbalanced Transportation Problem?

d) What is the problem of degeneracy in solving a Transportation Problem?

e) Define an assignment problem.

f) Define a two person zero sum game.

g) Define earliest start time and earliest finish time in a network.

h) Solve the following game :

$$\begin{array}{ccc} & & B \\ & & \begin{array}{cc} B_1 & B_2 \end{array} \\ A & \begin{array}{c} A_1 \\ A_2 \end{array} & \begin{bmatrix} 10 & 4 \\ 7 & 8 \end{bmatrix} \end{array}$$

i) What is sensitivity analysis?

j) Explain the Fulkerson's rule of numbering the events in a network.

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

a) Solve the following LPP using Simplex method :

Max $Z = x_1 + 2x_2$

Subject to,

$x_1 \leq 4$

$x_2 \leq 3$

$x_1 + 2x_2 \leq 8$

$x_1, x_2 \geq 0.$

P.T.O.

b) Show that the following LPP has no feasible solution using Simplex method :

Max $Z = 2x_1 + 3x_2$

Subject to,

$$x_1 + 2x_2 \leq 3$$

$$3x_1 + 4x_2 \geq 12$$

$$x_1,\ x_2 \geq 0.$$

c) Solve the following Transportation problem by finding the initial solution using least cost method :

	D_1	D_2	D_3	D_4	Available
O_1	1	2	1	4	30
O_2	3	3	2	1	50
O_3	4	2	5	9	20
Requirement	20	40	30	10	

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

a) Write the dual of the following LPP and solve the dual using graphical method :

Min $Z = 10x_1 + 6x_2 + 2x_3$

Subject to,

$$-x_1 + x_2 + x_3 \geq 1$$

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

$$x_1, x_2, x_3 \geq 0.$$

b) Explain the following :

i) Northwest corner rule for finding an initial solution of a Transportation problem.

ii) Hungerian Technique of an assignment problem.

c) i) Explain the minimax principle with an illustration.

ii) Solve the following game using rule of dominance.

$$\begin{array}{ccc} & & \text{B} \\ & & \begin{array}{ccccc} \text{I} & \text{II} & \text{III} & \text{IV} & \text{V} \end{array} \\ \text{A} & \begin{array}{c} \text{I} \\ \text{II} \\ \text{III} \\ \text{IV} \end{array} & \begin{bmatrix} 3 & 5 & 4 & 9 & 6 \\ 5 & 6 & 3 & 7 & 8 \\ 8 & 7 & 9 & 8 & 7 \\ 4 & 4 & 8 & 5 & 3 \end{bmatrix} \end{array}$$

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

a) Draw a network diagram from the following information and calculate

i) Earliest start and finish time.

ii) Latest start and finish time.

Name	A	B	C	D	E	F	G	H	I	J
Activity	1-2	1-3	1-4	4-5	2-6	3-6	3-5	3-7	5-7	6-7
Duration (in hours)	5	8	9	4	7	6	9	12	3	10

b) Solve the following assignment problem for maximization :

	I	II	III	IV
A	42	35	28	21
B	30	25	20	15
C	30	25	20	15
D	24	20	16	12

Find alternative solution if it exists.

c) Solve the following game using graphical method :

$$\begin{array}{ccc} & & \text{B} \\ & & \begin{array}{ccc} \text{I} & \text{II} & \text{III} \end{array} \\ \text{A} & \begin{array}{c} \text{I} \\ \text{II} \end{array} & \begin{bmatrix} 2 & 3 & 11 \\ 7 & 5 & 2 \end{bmatrix} \end{array}$$

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

a) A small project is composed of 7 activities whose time estimates in hours are given below :

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
a	1	1	2	1	2	2	3
b	7	7	8	1	14	8	15
m	1	4	2	1	5	5	6

i) Draw the project network.

ii) Find the expected duration and variance of each activity.

iii) Determine the critical path.

b) Find the initial solution of the following Transportation problem using Vogel's Approximation method.

Check for the optimality of the solution obtained :

	D_1	D_2	D_3	Capacity
O_1	8	16	16	152
O_2	32	48	32	164
O_3	16	32	48	154
Requirement	144	204	82	

c) Consider the following LPP :

Max $Z = 5x_1 + 3x_2$

Subject to

$3x_1 + 5x_2 \leq 15$

$6x_1 + 2x_2 \leq 24$

$x_1, x_2 \geq 0.$

Optimal solution is $(x_2, x_1)^T$ and the optimal inverse is $\begin{bmatrix} 1/4 & -1/8 \\ -1/12 & 5/24 \end{bmatrix}$.

Find the new solution when the RHS of constraint $\perp$ changes from 15 to 20.

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

P1116 **[3735] - 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 MIME?

b) Give two advantages of HTML.

c) What is pattern matching in java script?

d) What is the extension for perl source code file?

e) What is the difference between “echo” & “print” in PHP?

f) Define

i) CGI ii) CSS.

g) How do you parse / validate the XML document?

h) What is session?

i) What is Web browser?

j) Give two advantages of servlets.

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

a) Give difference between XML & HTML.

b) Explain scalar variable used in perl with example.

c) What is CGI PM module?

d) Write short note on servlet life cycle.

e) Explain XSLT style sheets.

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

a) Explain the concept of constructor using java script with example.

b) What is XML Name space? Explain.

c) Why primitive type used in java script? List different primitive data types.

P.T.O.

d) What is the output of following code?

```
<? php
// Get host name from URL
Preg- match("@^(?:http://)?([^/]+@i',
"http://www.php.net/index.html]",
$ matches), $ host = $ matches [1];
// get last two segments of host name
preg-match("/[^.]+\.[^.]+$/',$ host,
                                   $ matches);
echo "domain name is :{$ matches [0]}\n",
?>
```

e) Explain the concept of reading servlet parameters.

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

a) What are java script function? Write Syntax of creating a function?

b) Give example of Handling HTML forms with PHP. (With two input fields, one radio box group & text area for comments).

c) Explain Http servlet request handling.

d) Explain Http response.

e) Write short-note on Cookies.

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

a) Write a program in perl using hash array for displaying the following output.

- Bird is swan.
- Fish is Trout.

b) Write short note on DTD. (Document type defination.)

c) What is session-tracking? What are the common mechanisms used for session-tracking?

d) Write short note on - XML processor.

e) Explain any one control statement with example used in PHP.

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

P1116 **[3735] - 403**

M.Sc. Tech. - II

COMPUTER SCIENCE

Industrial Mathematics with Computer Applications

MIM - 403 : Object Oriented Programming with JAVA

(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) Answer <u>any eight</u> of the following : **[16]**

a) Explain the use of dot operator in JAVA.

b) Define the term throws.

c) State difference between checked and unchecked exception.

d) Can garbage collection gaurantee that a program will not run out of memory? Justify.

e) Explain the term 'Cookie'.

f) What are java byte codes?

g) State methods of Window Listener ( ) interfaces.

h) What is Object? How it is created?

i) What are protected variables?

j) Name different Layout managers.

Q2) Answer the following : **[6]**

a) What is an exception? State its types and catch any one exception using program.

OR

Write a program which will catch any one exception using multiple catch statements.

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

i) Explain the types of servlet. Write the syntax of doGet and doPost method of servlet.

ii) What is an interface? How is it created? Explain the use with a suitable example.

P.T.O.

iii) How does an applet differ from an application? How to execute it? What are advantages of an applet?

Q3) Answer the following : **[6]**

a) Differentiate between throw and throws.

OR

Explain Applet Life Cycle.

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

i) How do you create multiple threads in JAVA? How they are scheduled? Explain.

ii) Explain the architecture of JDBC.

iii) Describe Session Tracking.

Q4) Answer the following : **[6]**

a) Explain Life Cycle of thread with the help of diagram.

OR

Explain the usage of Cookies in JAVA.

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

i) Write a program which explains the concept 'Nesting of methods'.

ii) Create two packages; package 1 contains two classes manager and clerk. Both classes have method to accept corresponding information. Package2 contains class Employee with method accept information. Write a JAVA program to display all information.

iii) How to implement Runnable interface with example?

Q5) Answer the following : **[6]**

a) Explain method overriding with example.

OR

State the significance of Finalize ( ).

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

i) Explain Remote Method Interface Architecture.

ii) How can you define your own exception.

iii) What is the difference between suspending and stopping of threads?

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

P1117 **[3735] - 404**

M.Sc. Tech. - II

COMPUTER SCIENCE

Industrial Mathematics with Computer Applications

MIM - 404 : Design and Analysis of Algorithms

(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 x 2 = 16]**

a) Define O notation. Show that $2 + 5n^2 = O(n^2)$.

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

c) What is time complexity and space complexity of an algorithm?

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

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

f) Radix sort makes d calls to a sorting algorithm. Which sorting algorithm is the right choice? Why?

g) Define tree edge and back edge.

h) What is a flow network? What is a cut of a flow network?

i) Define P and NP class.

Q2) Attempt any two of the following : **[2 x 8 = 16]**

a) State Master's theorem. Solve the following recurrence relations using Master's theorem.

i) $T(n) = 9T\left(n/3\right) + n^2$

ii) $T(n) = 7T\left(n/2\right) + n^2$

b) What is multi-pop operation? What is its complexity? Explain the accounting method of amortized analysis and illustrate it on data structure stack with push, pop and multi-pop operations.

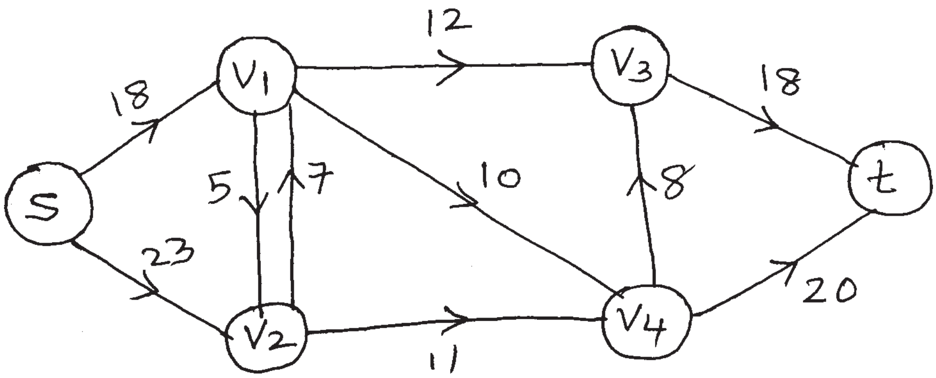
P.T.O.

c) What is a heap? Explain how 'Heapify' algorithm is used to maintain heap property. What is its time complexity? Explain how 'heapify' is used in building the initial heap from an array.

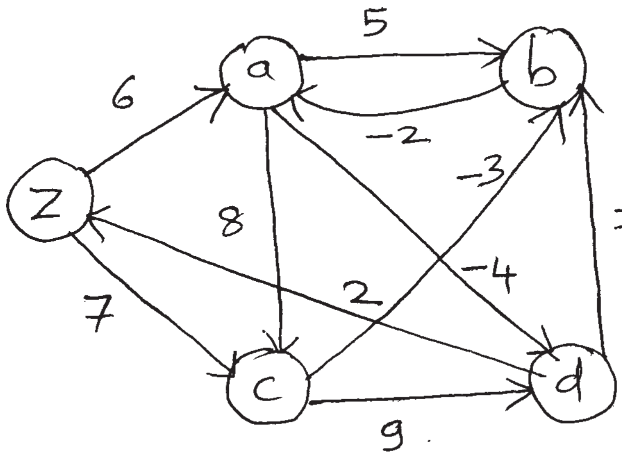
Q3) Attempt <u>any two</u> of the following : **[2 x 8 = 16]**

a) What is longest common subsequence problem? Show that it satisfies optimal substructure property. Give the recurrence relation and the algorithm based on dynamic programming to compute length of LCS.

b) What is flow conservation property? Explain Ford Fulkerson algorithm to find maximum flow in a network. Illustrate it on the following network where '*s*' is the source and '*t*' is the sink.



c) What is a negative weighted cycle? Explain Bellman ford algorithm for calculating shortest path. Illustrate it on the following graph to compute the length of shortest path from source 'Z' to all the vertices.



Q4) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

a) Explain counting sort algorithm. What is its time complexity?

b) Explain divide and conquer strategy. Show how it is applied in merge sort algorithm.

c) What are prefix codes? Explain Huffman coding algorithm.

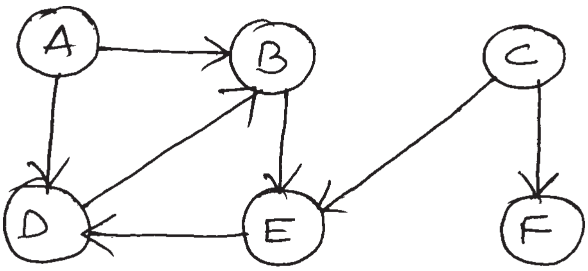
d) Consider the following instance of the knapsack problem $n = 4$, $m = 20$ $(p_1, p_2, p_3, p_4) = (25, 24, 15, 12)$ and $(w_1, w_2, w_3, w_4) = (18, 15, 10, 4)$. Illustrate compulation of optimal solution using greedy strategy.

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

f) What greedy strategy is used in activity selection problem? Prove that it always gives optimal solution.

Q5) Attempt <u>any four</u> of the following : **[4 x 4 = 16]**

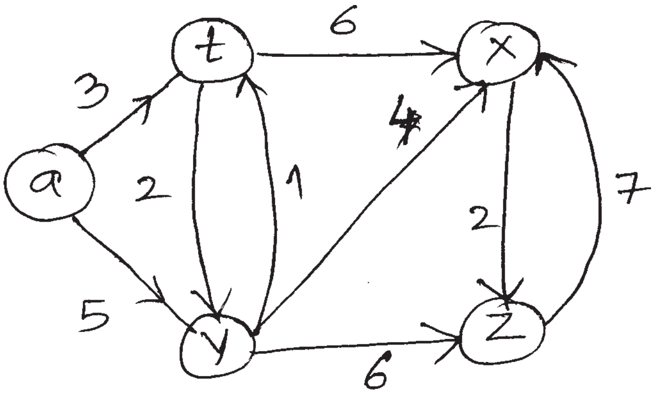
a) Compute discovery and finishing time for the depth first traversal of the following graph.



b) Suppose $n = 4$, $(p_1, p_2, p_3, p_4) = (100, 10, 15, 27)$ and $(d_1, d_2, d_3, d_4) = (2, 1, 2, 1)$ where p-profit, d-deadline, n-jobs in job sequencing with deadlines. Find an optimal solution for the above problem using greedy strategy.

c) What are strongly connected components? Give the algorithm to compute strongly connected components of a diagraph based on DFT.

d) Illustrate Dijkstra's algorithm on the following graph.



e) Explain vertex cover problem and give a greedy approximation algorithm for the same.

f) Define satisfiability problem. Show that it is NP.

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

P1117 **[3735] - 404**

M.Sc. Tech. - II
COMPUTER SCIENCE
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 : **[8 x 2 = 16]**

a) What is stream?

b) What is use of fsck ( )?

c) List any four system calls for accessing existing files.

d) What is use of –eq and –z operators in shell programming?

e) Give syntax of ioctl ( ).

f) What is shell? What are different shells available in UNIX?

g) Which are 2 different parts of a buffer?

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

i) State the 2 types of page fault the system can incur.

j) Explain following shell commands -

i) cat

ii) *ls*.

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

a) Explain various categories of file system calls.

b) Explain open ( ) system call with proper example.

c) What is directory? What read, write and execute permissions for directory signifies?

d) Explain allocation and freeing of swap space.

e) Explain any 2 scenarios of getblk ( ) algorithm with proper diagrams.

P.T.O.

Q3) Attempt any four of the following : **[4 x 4 = 16]**

a) Write short note on Superblock.

b) Write a shell program to generate first *n* terms of Fibonacci series.

c) Explain how crossing of mount point is handled by kernel.

d) What is distributed system? What are its advantages?

e) Write short note on Table of contents of UNIX system V.

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

a) Explain how the list of free disk blocks is maintained in a super block.

b) Distinguish between named pipe and unnamed pipe.

c) Write a shell program for accepting a number as command line argument and check whether it is even or odd.

d) Explain architecture of UNIX Operating System.

e) Write algorithm for block read ahead.

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

a) What are C lists? Describe operations performed on C lists.

b) What is incore inode? Explain different fields of incore inode.

c) Write a shell script for counting number of '.C' files in the current directory and show their contents.

d) Explain following shell commands

i) sleep.

ii) cal.

e) Explain working of page stealer.

✦✦✦✦

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

P1118 **[3735] - 45**

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 405 : Design and Analysis of Algorithms - II

(Old Course) (Semester - IV)

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

Instructions to the candidates :

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

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

a) What is a comparator? What is a comparison network?

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

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

d) State and prove cancellation lemma.

e) Define Euler's phi function. What is $\varphi(p)$ if p is prime?

f) What is a digital signature?

g) How to determine whether consecutive segments turn left or right?

h) Define P and NP class.

i) What is TSP problem? What is triangle inequality for the TSP problem?

j) What is point value representation of a polynomial? How many point value representations can there be?

Q2) a) Attempt any one of the following : **[1 x 6 = 6]**

i) State and prove zero-one principle.

ii) Explain list ranking problem and give EREW algorithm for the same. Show that it requires O(log n) time.

b) Attempt any two of the following : **[2 x 5 = 10]**

i) What is Bitonic sequence? If the input to a half cleaner is bitonic sequence of 0's and 1's, prove that both halves in the output are Bitonic and at least one half is clean.

ii) Explain CREW algorithm for finding roots of each node in a forest of trees.

iii) Explain the algorithm to find LV decomposition of the given matrix. What is its time complexity?

Q3) a) Attempt any one of the following : **[1 x 6 = 6]**

i) What is discrete fourier transform of coefficient vector $(a_0, a_1, \ldots, a_n)$. Explain recursive FFT to calculate DFT of a coefficient vector.

ii) Trace the computation steps in Strassem's algorithm to compute the matrix product

$$\begin{bmatrix} 5 & 4 \\ -3 & 2 \end{bmatrix} \begin{bmatrix} 3 & 4 \\ 2 & -2 \end{bmatrix}$$

b) Attempt any two of the following : **[2 x 5 = 10]**

i) Explain Bit reverse copy and its significance in iterative FFT.

ii) Explain the RSA cryptosystem.

iii) Give Euclid's algorithm and show that consecutive Fibonocci numbers is a worst case input for Euclid.

Q4) a) Attempt any one of the following : **[1 x 6 = 6]**

i) Give modular equation solver algorithm and use it to solve equation $14x = 30 \bmod 100$.

ii) State Chinese remainder theorem and use it to find all solutions to the equations.

$x = 6 \bmod 7$ and $x = 7 \bmod 11$.

b) Attempt any two of the following : **[2 x 5 = 10]**

i) What is valid shift? Explain the naive string matching algorithm.

ii) Explain good suffix heuristic and give the algorithm to calculate good suffix function.

iii) Explain the KMP matcher algorithm.

Q5) a) Attempt any one of the following : **[1 x 6 = 6]**

i) Explain the algorithm to find whether the given pair of lines intersect or not.

ii) What is vertex cover problem? Write the approximation algorithm for vertex cover. Prove that it is a polynomial time 2-approximation algorithm.

b) Attempt any two of the following : **[2 x 5 = 10]**

i) Define reduction function. Prove that if $L_1, L_2 \in \{0, 1\}^*$ are languages such that $L_1 \leq_P L_2$, then $L_2 \in P$ implies $L_1 \in P$.

ii) Explain Rabin Karp string matching algorithm.

iii) Prove that satisfiability for Boolean formulas is NP-complete.

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

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M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 501 : Compiler Techniques

(New Course) (Semester - 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) Write a regular expression to accept all string starting with 0, ending with 1 over {0, 1}.

c) List the LR(O) items produced by production $A \rightarrow XYZ$.

d) What is an attribute grammar?

e) 'It is not possible to begin with a new activation of a procedure before earlier one is over'. Comment on this statement.

f) What is an ambiguous grammar?

g) 'A node in a directed acyclic graph can have multiple parent'. Is this statement true or false? Why?

h) Is it possible to access a variable in a block which is not declared in it? Why?

i) What is the purpose of code optimisation?

j) What is sentinel?

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

i) Write a Recursive Descent Parser (RDP) for the following grammar.
$S \rightarrow abA / adb$ $\quad$ $A \rightarrow aA / b$

ii) Check if the following grammar is LL(1) or not
$S \rightarrow AB / \in$ $\quad$ $A \rightarrow aASa / a$ $\quad$ $B \rightarrow b$

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

i) Explain frontend and backend of a compiler briefly.

ii) Define a DFA. Explain the role of a DFA in scanning with suitable example.

iii) Explain conflicts in Bottom-up parsing with suitable example.

P.T.O.

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

i) Check if the following grammar is SLR(1) or not.

$S \rightarrow A/a \qquad A \rightarrow a$

ii) Explain how compilation of the following is done.

A) if statement.

B) while loop.

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

i) Explain various methods for evaluating semantic rule.

ii) Explain the approaches used for implicit deallocation of dynamic memory allocation method.

iii) Explain the scope rules of a block structured programming language with suitable examples.

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

a) Explain the drawbacks of Top-Down parsing with backtracking.

b) Explain the functions performed by a scanner.

c) Write a note on code generation phase of a compiler.

d) Explain 'Call by reference' parameter passing method.

e) Explain the use of display vector with suitable example.

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

a) Explain bootstrapping and cross compiler.

b) What is the purpose of the following fields of an activation record :

i) access link.

ii) control link.

c) Convert following expressions into postfix form

i) $(a + b) * c - d/e$

ii) $x + y * z + v - t/u$.

d) Explain syntax directed definitions.

e) Write a note on static storage allocation.

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

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M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 502 : Software Engineering

(Semester - V)

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

Instructions to the candidates :

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

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

a) Define : Software.

b) What do you mean by data objects?

c) Define : Cohesion.

d) State any two functions of a System Analyst.

e) Define : Cardinality in data modeling.

f) How to calculate the cost of quality?

g) Define : 4GL approach.

h) What is the purpose of feasibility study?

i) State any two differences between System software and Embedded software.

j) List all the names of the phases in Spiral Model.

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

a) Explain the different categories of a computer software.

b) Explain : Prototyping Model in detail.

c) Explain : System Development Life cycle.

d) Explain the characteristics of a good quality design.

e) Write a note on Information hiding and Abstraction concept in data modeling.

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

a) What are the factors used to access the quality of a software? Explain in detail.

b) Draw a data flow diagram for Sales Accounting System. The focal point in the sales accounting system, is the sales ledger, which is a subsidiary ledger consisting of accounts related to each customer, to whom sales are made on credit basis. The Sales Invoices (Receipts) are posted into the sales journal and from the journal to the sales ledger accounts. Sales journal is a day book to record the daily credit sales. The credit total of the sales journal is posted to the Sales Account. Cash receipts from customers are also incorporated into the sales ledger, from the Cash book. Returns from customers are also incorporated into sales ledger from the sales return book. Invoices corrections are also incorporated in sales ledger. The possible entities in the system are

Sales - invoice, Sales - voucher, Debit - note, Credit - note, ledger - accounts, customer.

c) State all the design elements in the design model and explain in detail the deployment level design element with an example.

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

a) Draw the decision table for the following system.

A marketing scenario is described as follows : The company wishes to construct a decision table to decide how to treat clients according to three characteristics. Gender, City-dweller and age group : A (under 30), B (between 30 and 60), C (over 60). The company has four products (W, X, Y and Z) to test market. Product W will appeal to female city dwellers. Product X will appeal to young females. Product Y will appeal to male middle aged shopkeepers who do not live in cities. Product Z will appeal to all but older females.

Identify conditions and actions.

b) Explain the "Concurrent Development Model". State its advantages.

c) Explain the principles of testing methodology in detail.

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

a) Explain how RAD model is used to achieve rapid system development.

b) Explain decision tree with an example.

c) Write a note on : Deployment level design element.

d) Explain the components in state diagram and its usage with an example.

e) Explain the concept of 'modularity' in a system.

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

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M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 503 : Computer Networks

(Semester - 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 <u>any eight</u> of the following : **[16]**

a) Calculate the maximum data rate for a noiseless channel with bandwidth 3KHz which sends a binary signal.

b) State the purpose of the TTL field in an IP datagram.

c) What is the significance of twisting in a twisted pair cable?

d) State the difference between ESS and BSS.

e) Find out errors (if any) in the following IPv4 addresses.

 i) 92.55.305.1

 ii) 221.32.7.100.20.

f) What are well-known and ephemeral ports?

g) What is the difference between ARP and RARP?

h) How is collision avoided in CSMA / CA?

i) Link state routing is better than distance vector Routing. State whether True / False and Justify.

j) UDP works faster than TCP. State whether True / False and Justify.

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

 i) Explain any one multiplexing techniques giving advantages and disadvantages.

 ii) Explain the process of connection establishment using TCP.

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

 i) State advantages and disadvantages of using fiber optic cables.

 ii) Explain in brief the concept of polling.

 iii) Explain how a bridge works with the help of an example.

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

i) Explain the architecture of 802.11.

ii) Explain various strategies used for framing in Data Link Layer.

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

i) Write a short note on CSMA / CD.

ii) Explain the concept of piggybacking.

iii) List the goals and advantages of networks.

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

i) Explain how fragmentation and reassembly takes place in IPv4.

ii) Explain the process of sending and receiving e-mail.

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

i) Compare packet switching and circuit switching.

ii) Write a short note on FTP.

iii) Compare selective Repeat and go-back-n protocols.

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

a) An ISP is granted a block of addresses starting with 190.100.0.0 / 16. the distribution is to be done as follows :

i) 64 customers each needing 256 addresses.

ii) 128 customers each needing 128 addresses.

Design the subblocks and address ranges.

b) Draw the structure of an VDP datagram and explain the fields.

c) In an IPv4 packet, the value of HLEN is 5, total length = 100, M = 1 and offset = 0. Calculate the total data length. Is this the first / middle / last datagram? Justify.

d) Show the Manchester, Straight binary and RZ coding for the stream : 10011010.

e) State the purpose of ICMP and test the ICMP error messages.

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

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M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 504 : Computer Graphics

(Semester - V)

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

Instructions to the candidates :

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

Q1) Attempt <u>any eight</u> of the following : **[8 x 2 = 16]**

a) Name any four input devices which are generally used in computer graphics.

b) What is horizontal retrace and vertical retrace?

c) Write the transformation matrix for shearing in X - direction by 2 units.

d) What are affine transformations? Give examples of affine transformations.

e) Explain Text - clipping.

f) Define forshortening factor. What is foreshortening factor for isometric projection.

g) Write the transformation matrix for scaling to double size in X-direction and 1/2 size in Y-direction.

h) What is the knot vector for uniform B-spline curve?

i) Explain the terms centre of projection and plane of projection.

j) What is a frame buffer? What is a display file?

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

i) Explain the components of a cathod ray tube.

ii) Explain cohen sutherland algorithm used for line clipping.

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

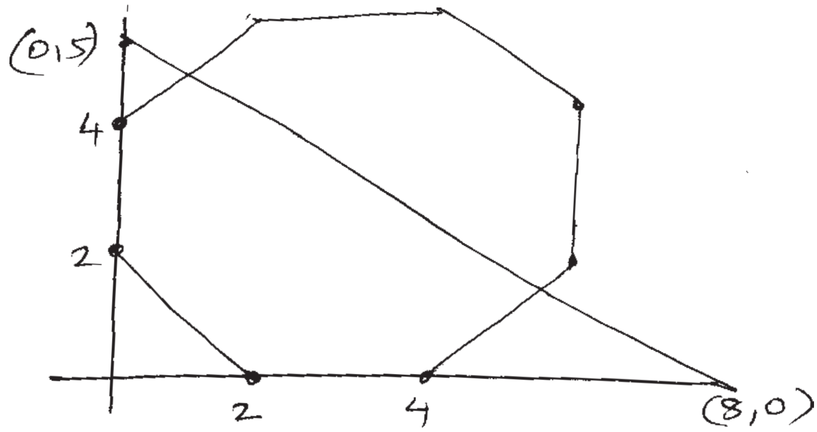
i) Explain DDA algorithm. Why is it not efficient?

ii) Discuss the flood-fill algorithm for polygonal domains.

iii) Illustrate Bresenham line generating algorithm for generating line between $P_1(2, 5)$ and $P_2(8, 15)$.

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

i) An eight sided polygonal clipping window is given below. A line $P_1(0, 5)$ to $P_2(8, 0)$ is to be clipped to this window. Illustrate complete results of cyrus beck algorithm.



ii) Explain reflection about different axis. Give the algorithm to reflect an object in 2-dimensions about any arbitrary line.

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

i) Explain Area-subdivision method for hidden surface elimination.

ii) Explain cabinet and cavalier projection.

iii) Consider a unit square with end points (1, 1) and (3, 3). Give the transformation matrix and transformed co-ordinates on rotating the square about its centre by an angle of 90º.

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

i) What are cubic splines? Discuss any two ways of representing Hermite splines.

ii) If $B_0[1, 1]$, $B_1[2, 3]$, $B_2[2, 5]$, $B_3[5, 5]$ are the vertices of Bezier polygon, then determine the point P(.5) on the Bezier curve.

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

i) Discuss the properties of Bezier curve.

ii) Write a note on open and non open B-spline curves.

iii) Write a note on Z-buffer algorithm.

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

i) Explain Depth-buffer algorithm and discuss its advantages and disadvantages.

ii) Explain Sutherland Hodgman polygon clipping algorithm.

b) Attempt any two of the following : **[2 x 5 = 10]**

i) Write a short note on use of computer graphics in entertainment and training.

ii) Explain the four logical properties of interactive graphics devices.

iii) Write a note on vanishing points.