Total No. of Questions : 5]

SEAT No. :

P595

[Total No. of Pages : 3

[4241] - 101

M.Sc. Tech.

MATHEMATICS

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 101: Real Analysis

(2008 Pattern) (Semester - I)

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

Instructions to the candidates:

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

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

a) For $x \in R$ and $y \in R$ define. $d(x, y) = |x - 2y|$. Determine if $d(x, y)$ is a metric or not.

b) Construct a bounded set of real numbers with exactly one limit point.

c) Is (0, 1) an open subset of R^2? Justify.

d) Is [0, 1] a compact subset of R? Justify.

e) Find the radius of convergence of the following power series. $\sum_{n=1}^{\infty} \frac{z^n}{n!}$.

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

g) Let f be a continuous real function on a metric space X. Let Z (f) be the set of all points $P \in X$ at which $f(p) = 0$. Prove that Z(f) is closed.

h) Let $f: R \to R$ where $f(x) = x|x|$. Show that $f(x)$ is differentiable at 0.

i) Let $f: [-1, 1] \to R$ where $f(x) = x^2$. Is $f(x)$ uniformly continuous on $[-1, 1]$? Justify.

j) If $\lim_{n\to\infty} a_n = 0$, then does it imply that $\sum_{n=1}^{\infty} a_n$ is convergent? Justify.

P.T.O.

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

i) Prove that a set E is open if and only if its complement is closed.

ii) If X is a metric space and $E \subseteq X$, then prove that $\overline{E}$ is closed.

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

i) Let E be a non empty set of real numbers which is bounded above. Let Y = sup E. Then prove that $Y \in \overline{E}$.

ii) Prove that for any finite collection $G_1, G_2, \ldots\ldots\ldots G_n$ of open sets, $\bigcap_{i=1}^{n} G_i$ is open.

iii) Prove that $\lim_{n\to\infty} \sqrt[n]{n} = 1$.

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

i) If $\{I_n\}$ is a sequence of intervals in R^1 such that $I_n \supseteq I_{n+1}$ (n = 1, 2, 3, ...), then prove that $\bigcap_{n=1}^{\infty} I_n$ is non - empty.

ii) Suppose $a_1 \geq a_2 \geq a_3 \geq \ldots\ldots \geq 0$. Then prove that the series $\sum_{n=1}^{\infty} a_n$ converges if and only if the series $\sum_{k=0}^{\infty} 2^k a_2 k$ converges.

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

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

ii) Prove that if $\sum_{n=1}^{\infty} a_n$ converges absolutely, then $\sum_{n=1}^{\infty} a_n$ converges.

iii) Let f be a function defined on (a, b). Define discontinuity of the first kind and discontinuity of the second kind. Give an example of each.

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

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

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

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

i) Let f : R $\rightarrow$ R be defined as $f(x) = \begin{cases} x\sin\frac{1}{x} & if\ (x \neq 0) \\ 0 & if\ (x = 0) \end{cases}$

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

ii) Show that the sequence $\{f_n\}$ where $f_n(x) = x^n$ is uniformly convergent on $[o, k]$ if $k <|$.

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

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

i) State and prove the Fundamental theorem of Calculus.

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

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

i) Let $S_{m,n} = \dfrac{m}{m+n}$ where m, n $\in$N

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

ii) If $C_0 + \dfrac{C_1}{2} + ... + \dfrac{C_{n-1}}{n} + \dfrac{C_n}{n+1} = 0$ where C_0, C_1, ..., C_n are real constants then prove that the equation

$C_0 + C_1 x + ... + C_{n-1} x^{n-1} + C_n x^n = 0$ has at least one real root between 0 and 1.

iii) Let $\{P_n\}$ be a sequence in a metric space X. Prove that if $\{P_n\}$ converges, then $\{P_n\}$ is bounded.

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Total No. of Questions : 5]

SEAT No. :

P600

[Total No. of Pages : 3

[4241] - 201

M.Sc. Tech.-I

Industrial Mathematics With Computer Applications

MIM - 201: Real and Complex Analysis

(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

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

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

a) Define outer measure of a set A and find outer measure of the set A = {1, 2, 3}

b) Let $f : [-1, 2\pi] \to R$ be a function defined as :

$$f(x) = x^3 \quad ; \quad -1 \le x \le \pi$$
$$= \sin x \; ; \quad \pi < x \le 2\pi$$

Find f^+ and f^-

c) Show that, if outer measure of a set is zero then it is measurable set.

d) Consider a set A = $\{\phi, \{x \in Z \mid x \text{ is even}\}, \{x \in Z \mid x \text{ is odd}\}, Z\}$. Is A an algebra ?

e) If A and B are disjoint measurable sets then prove that $\int_A f + \int_B f = \int_{A \cup B} f$.

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

g) Let $f(z)$ be analytic in a domain $D \subseteq C$, such that the real part of $f(z)$ is constant. Show that $f(z)$ is a constant function on D.

h) Find radius of convergence of the complex series $\sum_{n=1}^{\infty} nz^n$.

i) Show that the function $v(x, y) = e^{-y} \sin x$ is harmonic; and find an analytic function $f(z) = u + iv$.

j) Obtain the residues of $f(z) = \dfrac{1}{(z^2+1)^3}$ at each of its poles.

P.T.O.

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

i) Let $\{A_n\}$ be a countable collection of sets in R. Prove that $m^*\left[\bigcup_{n=1}^{\infty} A_n\right] \le \sum_{n=1}^{\infty} m^* A_n$.

ii) Let a ∈ R. Prove that [a, ∞) is a measurable set.

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

i) Let $<E_n>$ be an infinite decreasing sequence of measurable sets. *i.e.* $E_{n+1} \subset E_n$, $\forall$ n. Let mE_1 be finite. Prove that $m\left(\bigcap_{i=1}^{\infty} E_i\right) = \lim_{n\to\infty} mE_n$.

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

iii) Let *f* be a non - negative function which is integrable over a set E⊆R. Prove that for every ∈ > 0, there exists δ > 0 such that for every set A⊆E with m A < δ, then $\int_A f < \in$.

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

i) State and prove Fatou's lemma.

ii) State and Prove Bounded Convergence theorem.

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

i) Prove that outer measure of the closed interval [*a*, *b*] is b-a.

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

iii) Prove that if $m^*(B) = 0$ then $m^*(A \cup B) = m^* A$

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

i) Let $f(z) = u + iv$ be a complex valued function defined on a domain D. Let $Z_0 = x_0 + iy_0 \in D$. Let $f(z)$ be differentiable at Z_0. Show that the Cauchy - Riemann equations are satisfied at $Z_0 = x_0 + iy_0$. i.e. $u_x = v_y$ and $u_y = -v_x$ at (x_0, y_0).

ii) Let D be a simply connected domain and γ a closed rectifiable curve in D, then Prove that in usual notation, for an analytic function *f* and a ∈ D\ {γ}, $f(a).n(\gamma;a) = \frac{1}{2\pi i}\int_\gamma \frac{f(z)}{z-a}dz$.

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

i) Find $\int_{\gamma} \frac{z+6}{z^2-4}\, dz$ where,

1) γ is a circle $|z| = 1$
2) γ is a circle $|z+2| = 1$

ii) Show that any zero of an analytic function is isolated in the set of its zeros.

iii) Let $f : C \to C$ be continuous at $z_0 \in C$,

if $g : C \to C$ be continuous at $f(z_0) \in C$, then show that the composition function gof : $C \to C$ is continuous at $z_0 \in C$.

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

i) State and prove Laurent's theorem.

ii) Show that the composition of two Möbius transformations is also a Möbius transformation.

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

i) Obtain Laurent's series expansion for $f(z) = \frac{z^2-1}{(z+2)(z+3)}$

in the region

1) $2 < |z| < 3$

2) $|z| > 3$.

ii) Using Cauchy's Residue theorem, evaluate $\int_C \tan z\, dz$, where C is the circle $|z| = 2$

iii) Show that a dilation maps a straight line onto a straight line and a circle onto a circle.

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Total No. of Questions : 5]

SEAT No. :

P601

[Total No. of Pages : 3

[4241] - 202

M.Sc.Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 202 : Algebra - II

(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

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

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

a) Show that (1, 2, 3), (0, 3, 5), (0, 0, –7) is a basis of R^3.

b) Define an inner product space.

c) Consider $v_1 = (-4,3), v_2 = (3,4) \in R^2$ with usual inner product. Compute the angle between v_1 and v_2.

d) If W_1, W_2, are subspaces of a vector space V and $W_1 \cup W_2$ is a subspace of V then show that either $W_1 \subset W_2$ or $W_2 \subset W_1$.

e) If $A = \begin{bmatrix} -2 & 2 & 3 \\ -2 & 3 & 2 \\ -4 & 2 & 5 \end{bmatrix}$ then find the characteristic polynomial of A.

f) Give an example of an irreducible polynomial of degree 2 over Z_2.

g) Let $f(x) = x^2 + 1 \in Z_7 [x]$. If F denotes the splitting field of $f(x)$ then determine the number of elements in F.

h) Find the minimal polynomial of $-2 + 3i$.

i) Determine the splitting field of the polynomial $x^4 + x^2 + 1 \in Q[x]$.

j) Show that C/R is a Galois extension.

P.T.O.

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

i) Let V be a vector space over a field F spanned by $v_1, v_2, \dots, v_m$. Show that any linearly independent subset of V is finite and contains at mots m elements.

ii) Let V be an inner product space. For any two vectors, $\alpha, \beta \in V$, prove that $\|\alpha+\beta\|^2 + \|\alpha-\beta\|^2 = 2\|\alpha\|^2 + 2\|\beta\|^2$.

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

i) Let T be the linear operator on R^3, the matrix of which in the standard ordered basis is

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

Find a basis for the range of T and a basis for the null space of T.

ii) Let T be the linear operator on R^3, the matrix of which in the standard ordered basis is

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

Find the matrix P which diagonalizes A.

iii) Let $V = \{(x, y) \in R^2 \mid x, y > 0\}$. For $u = (x_1, y_1)$ and $v = (x_2, y_2) \in V$, $k \in R$ define + and $\cdot$ operations as $u + v = (x_1x_2, y_1y_2)$ and $k \cdot u = (x_1^k, y_1^k)$. Show that V is real vector space with respect to these operations.

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

i) Let $T : V \to W$ be a linear transformation and V be a finite dimensional vector space. Show that rank (T) + nullity (T) = dim(V).

ii) Let V be an inner product space and $\beta_1, \dots\dots, \beta_n$ be a linearly independent set in V. Prove that one can construct $\alpha_1, \dots\dots, \alpha_n$ in V such that for each $k = 1, \dots\dots, n$ the set $\{\alpha_1, \dots\dots, \alpha_k\}$ is a basis of the vector space spanned by $\beta_1, \dots\dots, \beta_n$

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

i) Let $\alpha = (1, 0, -1)$, $\beta = (1, 1, 1)$, $\gamma = (2, 2, 0)$ be a basis of C^3. Find the dual basis of $\{\alpha, \beta, \gamma\}$.

ii) Let V be an inner product space and $x, y \in V$. Show that $\|x + y\| = \|x\| + \|y\|$ if and only if one is non-negative multiple of the other.

iii) Let $v_1 = (1, 2, 3)$, $v_2 = (2, 3, 1)$, $v_3 = (3, 1, 2)$. Show that the set $S = \{v_1, v_2, v_3\}$ is a basis for R^3. Find the coordinate vector of the vector $v = (9, 4, 11)$ w.r.t. S.

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

i) If K/F and F/E are finite extensions, then show that K/E is a finite extension. Further show that [K : F][F : E] = [K : E].

ii) Let F be a field and $f(x) \in F[x]$ be a non-constant polynomial. Prove that the splitting field of $f(x)$ is of degree at most $n!$. Give example of polynomials $f(x)$ and $g(x)$ over Q of degree 3 such that the splitting field of $f(x)$ is of degree 3 while the splitting field of $g(x)$ is of degree 3!.

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

i) Let F be a finite field of characteristic p. Show that F has p^n elements.

ii) Let p denote a prime and $f(x) = x^p - 1$. Let K denote the splitting field of $f(x)$ over Q. Find Galois group of K/Q.

iii) Let $f(x) = x^2 - 2 \in Q[x]$ and K be a splitting field of $f(x)$. Let $g(x) = x^2 - \sqrt{2} \in K[x]$ and F be a splitting field of $f(x)$. Is F/Q a normal extension? Justify!

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

i) Let K/F be a Galois extension with Galois group G and H be a subgroup of G. If $E = \{x | f(x) = x \text{ for all } f \in H\}$ then show that K/E is a Galois extension.

ii) Prove that any algebraic extension of a field F of characteric 0 is a separable extension.

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

i) Let $K = Q[\sqrt{2}, \sqrt{5}]$. Find $\alpha \in K$ such that $K = Q[\alpha]$.

ii) Give an example of an inseparable extension. Justify!

iii) Find all the conjugates of $\sqrt{1 + \sqrt{2}}$ over Q.

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Total No. of Questions : 5]

SEAT No. :

P608

[Total No. of Pages : 3

[4241] - 304

M.Sc.Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATION

MIM - 304 : Operating Systems

(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*

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

a) List 2 common modes of interprocess communication.

b) What read next and write next operations signify in sequential file access.

c) List necessary conditions for occurance of deadlock.

d) What are CPU bound and I/O bound processes.

e) What are thread libraries? List any two commonly used thread libraries.

f) What are synchronous and asynchronous devices?

g) What is logical and physical address?

h) What is cooperating and non-cooperating process?

i) Define :

i) Through put. ii) Response time.

j) Define :

i) Prepaging. ii) System call.

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

i) Consider the following page reference string 4, 7, 0, 7, 1, 0, 1, 2, 1, 2, 7, 1, 2. How many page faults would occur for the following page replacement algorithms with 3 frames.

A) FIFO B) Second-chance

C) Optimal

P.T.O.

ii) Consider a file currently consisting of 100 blocks. Assume that there is no room to grow at the beginning but there is room to grow at the end. Calculate how many disk I/O operations are required for contiguous allocation if

A) The block is added at the beginning

B) The block is added in the middle

C) The block is added at the end

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

i) What are system programs? Explain various categories of system programs.

ii) What is Readers-Writers problem? Explain how semaphore can be used as a synchronization tool for the same.

iii) Given five memory partitions of 100 kB, 500 kB, 200 kB, 300 kB, and 600 kB (in order). How would the first-fit, best-fit and worst-fit algorithm place processes of 212 kB, 417 kB, 112 kB and 426 kB? Which algorithm makes the most efficient use of memory?

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

a) What is the purpose of the command interpreter? Why is it usually separate from the kernel?

b) What is file? Explain 6 basic file operations.

c) Explain how Resource-Allocation Graph can be used for describing deadlock.

d) What is scheduler? Differentiate between short-term and long-term scheduler.

e) Explain thread cancellation issue with multithreaded programs.

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

a) Explain the concept of blocking and non blocking I/O.

b) Consider the following snapshot of a system

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

Available

A	B	C	D
1	5	2	1

Answer the following questions using Banker's Algorithm :

- Find Need.
- Is the system in a safe state?

c) Why are segmentation and paging sometimes combined into one scheme?

d) Explain Dual-mode operation of operating system with suitable diagram.

e) Give benefits of multithreaded programming.

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

a) Explain various registers of the I/O port.

b) Consider the following set of processes

Process	A.T.	CPU Burst	Priority
P_1	1	10	1 (high)
P_2	0	1	2
P_3	2	2	2
P_4	3	1	3
P_5	4	5	4 (low)

Calculate Average Turn Around Time and Average Waiting Time by applying preemptive priority.

c) Explain concept of shared pages.

d) Give peterson's solution for critical-section problem.

e) Explain any two schemes for defining the logical structure of a directory.

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Total No. of Questions : 5]

SEAT No. :

P597

[Total No. of Pages : 3

[4241] - 103
M.Sc. Tech.
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM-103 : Discrete Mathematical Structures - I
(2008 Pattern) (Semester-I)

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

Instructions to the candidates:

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

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

a) Translate the following sentence into a logical expression?

"you can access the Internet from campus only if you are a Computer science major or you are M.Tech student".

b) Show that $((p \to q) \wedge p) \to q$ is a tautology.

c) A coin is flipped eight times. How many possible outcomes contain at most three heads?

d) Show that among 100 people there are at least 9 who were born in the same month.

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

f) State the Distributive laws in a Boolean algebra.

g) State true or false : "The binary operation of subtraction on Z is commutative". Justify your answer.

h) State true or false : "Every poset has a maximal element". Justify your answer.

i) Define a convex sublattice.

j) Draw the diagram of the lattice of factors of 20, under divisibility.

P.T.O

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

i) Show that $\forall x(P(x) \wedge Q(x))$ and $\forall x P(x) \wedge \forall x Q(x)$ are logically equivalent.

ii) Prove that $\sqrt{2}$ is irrational by giving a proof by contradiction.

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

i) State the converse, contrapositive and inverse of the following conditional statement :

"Today is Friday only if 2 + 3 = 5".

ii) Using quantifiers and predicates reduce the following statement in the simplified form which does not contain negation ($\neg$) :

"$\neg \forall \in > 0 \exists \delta > 0 \forall x (0 < |x - a| < \delta \rightarrow |f(x) - L| < \in)$".

iii) Show that the hypothesis "It is not sunny this afternoon and it is colder than yesterday". "We will go swimming only if it is sunny." "If we do not go swimming, then we will take a canoe trip," and " If we take a canoe trip, then we will be home by sunset" lead to conclusion "We will be home by sunset".

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

i) In any lattice L, Prove that

$(a \wedge b) \vee (b \wedge c) \vee (c \wedge a) \leq (a \vee b) \wedge (b \vee c) \wedge (c \vee a)$, for all a, b, c $\in$ L.

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

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

i) Prove that if two lattices L and M are modular then L $\times$ M is modular.

ii) Use K-maps to minimize the sum-of-products expansions:

$xyz + x\overline{y}\overline{z} + xy\overline{z} + \overline{x}\overline{y}z + \overline{x}\overline{y}\overline{z}$

iii) Let (S,$*$) and (T,$*'$) be monoids with identities e and e' respectively. If f : S $\rightarrow$ T is an isomorphism then prove that f(e) = e'.

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

i) Explain the Quine-McCluskey method.

ii) Define direct product of two semigroups. Show that the direct product of two semigroups is also a semigroup.

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

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) Show that (D_{24}, 1), forms a Boolean algebra. Find its atoms.

iii) Let $f : S \rightarrow T$ be a homomorphism of the semigroup (S,*) onto the semigroup $(T,*')$. Let R be the relation on S defined by $a^R b$ if and only if $f(a) = f(b)$, for a and b in S. Then show that R is a congruence relation.

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

i) Each user on a computer system has a password, which is six to eight character long, where each character is an uppercase letter or a digit. Each password must contain at least one digit. How many possible passwords are there?

ii) Show that among any n+1 positive integers not exceeding 2n there must be an integer that divides one of the other integers.

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

i) How many solutions does

$$x_1+x_2+x_3=11$$

have, where x_1, x_2 and x_3 are non negative integers with $x_1 \leq 3$, $x_2 \leq 4$ and $x_3 \leq 6$?

ii) Describe the quotient semigroup for S = Z with ordinary addition and R defined by $a^R b$ if and only if a = b (mod 5).

iii) Show that union of two sublattices may not be a sublattice.

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Total No. of Questions : 5]

SEAT No. :

P598

[Total No. of Pages : 3

[4241] - 104

M.Sc. Tech.-I

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-104 : 'C Programming'

(2008 Pattern) (Semester-I)

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

Instructions to the candidates:

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

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

a) Define array.

b) Write the syntax of a function which is used to allocate memory.

c) Explain the use of continue statement.

d) Define macro.

e) What happens if we open existing file in write mode?

f) How constants are defined in a program?

g) Write the prototype of : fscanf(). Explain its use.

h) Write the output of

```
#include <stdio.h>
main()
{ int a = 10;
printf("%d%d", ++a, a++);
}
```

i) Write the output of

```
#include <stdio.h>
main()
{int cnt=1;
    while(cnt!=20)
        {printf("%d", cnt++);
            if(cnt%5==0)
                break;
            }
        }
```

j) Define recursion.

P.T.O

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

a) Write a program to accept a file name: print the contents of the file and also print the count of lines in the file.

b) Write a program to accept 1-dimensional array elements. Print each alternative number from the array.

c) Write a program to define a structure for a student (Roll-No, Name). Accept 'n' records of student from the user and display all the records.

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

a) Explain any four data types in C.

b) Write the use of pointer. Give suitable example.

c) What is the difference between pass-by-value and pass-by-reference of parameters to the function. Give suitable example.

d) Explain different looping structures in C. Explain any one in detail.

e) Write a note on union.

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

a) Explain the syntax of if-else statement.

b) State true/false: 'C is high level language'. Justify.

c) Define interpreter.

d) Explain the use of logical operators.

e) What is random access file?

f) List out different escape sequences.

g) Explain the use of switch statement.

h) Explain the function of concatenate two strings.

i) Write the different functions used to display output on the console.

j) What is the append mode to open a file.

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

a) Write a note on the scope of variable.

b) Explain any four standard library functions. With the use and syntax.

c) Write a program to print the following pattern. Accept 'n' from the user.

```
A
A B
A B C
A B C D
```

Here n = 4

d) State true/false : 'C is strongly typed language'. Justify.

e) Write a program to add the digits of a number and print the result. Ex : i/p : 1234 o/p : 1+2+3+4 = 10

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Total No. of Questions : 5]

P602

SEAT No. :

[Total No. of Pages : 4

[4241] - 203

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-203 : Discrete Mathematical Structures - II

(2008 Pattern) (Sem.-II)

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

Instructions to the candidates:

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

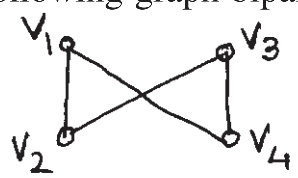
Q1) Attempt <u>any eight</u> of the following: **[8 × 2 = 16]**

a) Define complete graph and give an example of a complete graph.

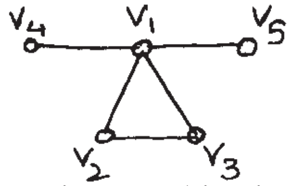
b) Draw a simple z-regular graph on 5-vertices.

c) Show that there does not exist a simple graph with 8 - vertices and 29-edges.

d) Is the following graph bipartite? Justify.



e) Find the complement of the following graph.



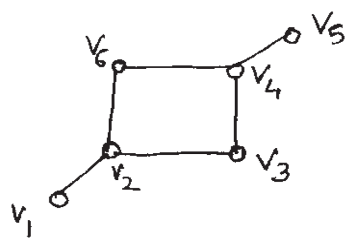
f) Find all non isomorphic simple graphs on 3 - vertices.

g) Draw a binary tree of maximum height with n=15 vertices.

h) Define Planar Graph.

i) Define K-chromatic graph.

j) Draw any two spanning trees of the following graph.



P.T.O.

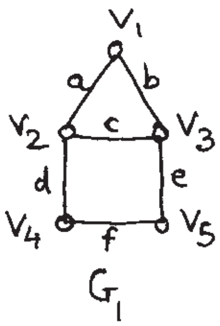
Q2) a) Attempt <u>any one</u> of the following: **[6]**

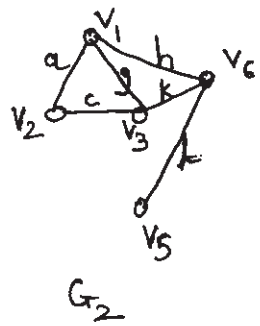
i) Prove that the number of vertices of odd degree in a graph is always even.

ii) Prove that a connected graph G is an Euler graph if and only if it can be decomposed into circuits.

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

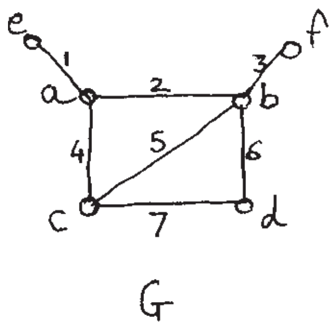
i) The two graphs G_1 and G_2 are given below. Find $G_1 \cup G_2$ and $G_1 \cap G_2$





ii) Show that K_5 is not planar.

iii) The graph G is given below. Find the graph obtained if the vertices *a* and *b* in G are fused.



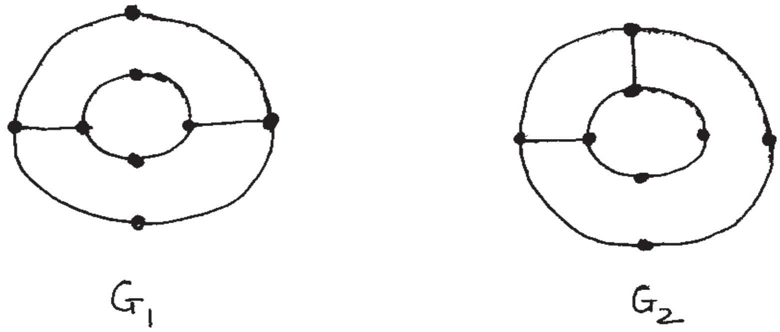
Q3) a) Attempt <u>any one</u> of the following : **[6]**

i) Prove that a simple graph with n - vertices and k - components can have atmost $\frac{(n-k)(n-k+1)}{2}$ edges.

ii) Prove that a graph G with n - vertices, n-1 edges, and no circuits is connected.

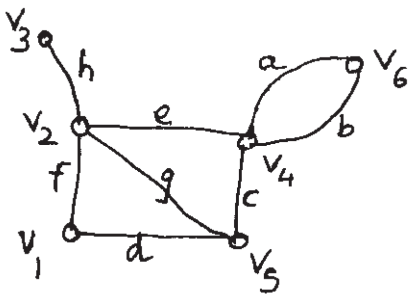
b) Attempt <u>any two</u> of the following: **[2 × 5 = 10]**

i) The two graphs G_1 and G_2 are given below. Are G_1 and G_2 isomorphic? Justify.



ii) Find the number of cycles in the following two graphs G_1 and G_2

iii) Write down the incidence matrix for G, where G is



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

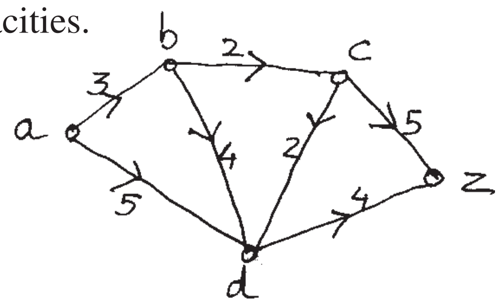
i) Prove that a tree with n - vertices has (n-1)-edges.

ii) Prove that a connected planar graph with n - vertices and e - edges has e - n + z regions.

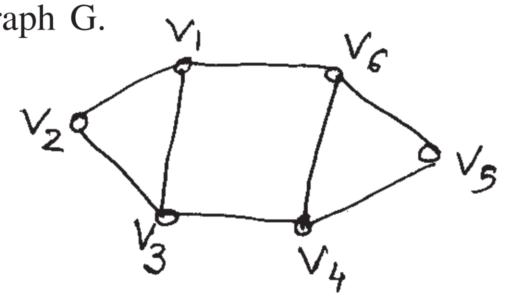
b) Attempt <u>any two</u> of the following : **[2 × 5 = 10]**

i) Write a short note on the Chinese Postman Problem.

ii) Using Ford and Fulkerson algorithm determine the maximal flow in the network given below. The numbers assigned to the edges give their capacities.



iii) Find the vertex connectivity and edge connectivity of the following graph G.



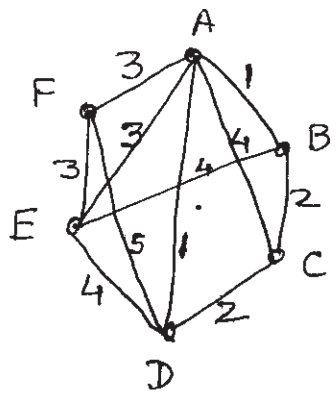
Q5) a) Attempt <u>any one</u> of the following: **[6]**

i) Prove that if in a graph G there is one and only one path between every pair of vertices, then G is a tree.

ii) Prove that every tree has either one or two centers.

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

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



ii) Give an example of a graph which is arbitrarily traceable from each vertex. Also give an example of a graph which is not arbitrarily traceable from any of its vertex.

iii) Find the smallest integer n such that K_n has atleast 600 edges.

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Total No. of Questions : 5]

SEAT No. :

P604

[Total No. of Pages : 2

[4241] - 205

M.Sc. Tech.

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-205 : Data Structures Using 'C'

(2008 Pattern) (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.***
3) ***All questions carry equal marks.***

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

a) What is DEQUEUE? State the two types of DEQUEUE.

b) Define the term : ADT

c) Discuss the node structure of doubly linked list.

d) Write in short about multidimensional array.

e) Define : infix and postfix expression.

f) Consider following set of elements: 11, 12, 5, 6, 9, 15, 20. Construct the binary search tree. Assume the root is 11.

g) Define graph and isolated vertex.

h) What is priority queue? State the two types of priority queue.

i) Match the following:

	Side A		Side B
1)	Bubble sort	a)	O(log n)
2)	Merge sort	b)	$O(n^2)$
3)	Linear search	c)	O(n log n)
4)	Binary search	d)	O(n)

j) What is the advantage of circular linked list over singly linked list?

P.T.O.

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

a) Write a 'C' program to create two sorted linked list. Also write a function to merge these two list in sorted order.

b) Write a 'C' program to implement binary search (recursive) on sorted array.

c) Write a 'C' program to implement queue (use static method of implementation).

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

a) Write a note on FCFS CPU scheduling algorithm.

b) Discuss inorder and preorder traversal techniques.

c) Explain linear and non-linear data structures with suitable example.

d) Write a function to delete in between node from the singly linked list.

e) Explain the different techniques of declaring an array.

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

a) Discuss the various cases to delete a node from Binary Search Tree.

b) How stack is used to evaluate postfix expression? Give example.

c) Sort the following data using insertion sort method :- 21, 3, 5, 12, 11, 17, 26

d) State the drawbacks of linear queue. What is solution to overcome such drawbacks?

e) Write a algorithm for implementation of DFS.

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

a) Write a function to create and display doubly linked list.

b) Explain the push and pop operations of stack using linked list.

c) Define the following:

   i) Siblings

   ii) Leaf node

   iii) Ancestor node

   iv) Degree of a node

d) Discuss the efficiency of bubble sort algorithm.

e) Explain the linked representation of binary tree.

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Total No. of Questions : 4]

SEAT No. :

P617

[Total No. of Pages : 3

[4241] - 504

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICAL WITH COMPUTER APPLICATIONS

MIM-504 : Advanced Operating Systems

(2008 Pattern) (Sem.-V)

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

Instructions to the candidates:

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

SECTION - I

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

a) Define a ill-conditioned system.

b) Evaluate the Jacobian matrix $J(x,y,z)$ for the functions.

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

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

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

c) What is the condition under which the Jacobian method has a unique solution?

d) State the Runge-kutta formula of oreder N = 2 to solve an initial value problem

e) Explain the concept of adaptive quadrature.

f) Does $g(x) = \cos x$ has a unique fixed point in [0, 1]? Justify your answer.

g) If $x = 3.141592$ and $\hat{x} = 3.14$, which is an approximation to x. What

P.T.O

is the relative error in the approximation?

h) Let $\{x_n\}$ and $\{y_n\}$ be two sequences Let $x_n = \frac{n^2-1}{n^3}$, $n \geq 1$

What is the sequence $\{y_n\}$ such that xn + $O(y_n)$?

i) If μ and δ are difference operators show that $\mu^2 = 1 + \frac{\delta^2}{4}$

j) Solve the differential equation to find the general solution

$$\frac{dy}{dx} = -k(y-A)$$

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

i) Assume that $g \in C[a, b]$, g' is defined over (a, b) and a positive constant K exists with $|g'(x)| \leq K < 1$, $\forall x \in (a,b)$

Then show that g has unique fixed point P in [a, b].

ii) Assume that $f \in C$ [a, b] and that there exists a number $r \in [a, b]$ such that f(r) = 0. If f(a) and f(b) have opposite sings, and $\{c_n\}_{n=0}^{\infty}$ represents the sequence of midpoints generated by the bisection process then $|r - c_n| \leq \frac{b-a}{2^{n+1}}$ for n = 0,1,....

Prove that the sequence $\{c_n\}_{n=0}^{\infty}$ converges tot he zero, x = r; that is

$$\lim_{n\to\infty} C_n = r$$

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

i) Use Newton Raphson's method to find the real root of equation $3x = \cos x + 1$ using initial approximation $x_o = 0.6$ upto first two iterations.

ii) Use Regular falsi method to determine the root of the equation $\cos x - xe^x = 0$ in[0, 1] upto first 3-iterations.

iii) Suppose that the bisection method is used to evaluate the zero of f(x) in the interval [2, 7]. How many iterations are required to guarantee the approximation of C_N has an accuracy of 5×10^{-9}?

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

i) Assume that $f \in C^2[a, b]$ xo, x1 are nodes in [a, b] and L1(x) is the Lagrangian polynomial approximation to f(x) on [a, b] then show that the error term is : $E_1(x) = \frac{(x-x_0)(x-x_1)}{2!}.f^{(2)}(C)$

ii) State and prove composite trapezoidal rule.

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

i) Find the divided difference interpolating polynomial of degree 3 or less which passes through the points

x	0	2	3	4
y	2	6	20	50

ii) If Δ represents the difference operator then show that

$$\Delta^n u_{x-n} = u_x - nu_{x-1} + \frac{n(n-1)}{2}u_{x-2} + ... + (-1)^n u_{x-n}$$

iii) Evaluate $\int_0^3 \frac{dx}{1+x}$ with 7 simple points by using simpson's $\frac{3}{8}^{th}$ rule. Also calculate value of ln2 using the above approximation.

Q4) a) Assume that f **[6]**

i) How process responds if it is received "death of child" signal?

ii) Write a note on expansion swap.

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

i) Write a note on context layers of a sleeping process.

ii) Write a note on shell

iii) Explain the various options of rpm command.

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

Total No. of Questions : 5]

SEAT No. :

P606

[Total No. of Pages : 2

[4241] - 302

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-302 : Software Engineering

(2008 Pattern) (Semester-III)

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

Instructions to the candidates:

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

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

a) Define system.

b) What is a software process?

c) What are critical systems?

d) List two advantages of incremental approach to software development.

e) Define i) object and ii) Class

f) Define 'Thin client' and 'Fat client'.

g) Give any two advantages of using a distributed approach to system development.

h) What is the difference between verification and validation?

i) Define : Test-case.

j) Define : Prototyping.

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

a) What is feasibility study? Explain different types of feasibility study.

b) Explain the stages involved in static analysis of V & V process.

c) Explain socio-technical systems.

d) Explain the Behavioral model.

e) Explain briefly the four main phases of requirement engineering process.

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

a) Explain system reliability.

b) Write a note on the tools that are included in Rapid Application Development (RAD) environment.

c) Explain waterfall model.

d) Explain the User Interface(UI) design process.

e) Explain the stages of object oriented design.

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

a) Draw a use-case and a state transition diagram for the control of a telephone answering machine. An incoming call is detected on the first ring and the machine answers the call with a pre-recorded announcement. When the announcement is complete, the caller's message is recorded. When the caller hangs up, the machine too hangs up and shuts off.

b) Consider a system for processing results of the students. The student fills in the examination form giving details about subject and centre etc., which is an input to the system. Student pay examination fees and is given a fee receipt and the admit card. Examination is conducted at various centres. Centres provide the absentee report. The evaluation department provides marks of the students in each subject. The marksheet and the merit list are the outputs of the system. Draw:

i) Context level diagram.

ii) Data flow diagram(1^{st} level DFD).

c) Explain in detail the "clean room software development".

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

a) Explain the attributes of a good software.

b) Write a note on various 'fact finding techniques".

c) Write a note on system testing.

d) What is the goal of test case design process? Give the various approaches taken for test case designing.

e) Explain functional and non-functional requirements in software requirements.

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Total No. of Questions : 5]

SEAT No. :

P607

[Total No. of Pages : 2

[4241] - 303
M.Sc. Tech.
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM-303 : Object Oriented Programming in Java
(2008 Pattern) (Semester-III)

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

Instructions to the candidates:

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

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

a) Define : i) Class ii) Object

b) What is the difference between 'throw' and 'throws' in exception handling?

c) What is polymorphism and how is it achieved in Java?

d) What are wrapper classes and why do we need them?

e) What is Java Virtual Machine(JVM)?

f) What is the difference between a scrollbar and a serollpane?

g) What is the difference between'>>' and '>>>' operators?

h) What is serialization? How is it achieved?

i) How do applets differ from application program?

j) When do we declare a class and a method as 'final'?

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

a) Differentiate between interfaces and the abstract classes.

b) What is inheritance? Explain different types of inheritance in Java.

c) Write a note on character and Byte stream.

d) Explain any four features of Java.

e) Explain types of database drivers in Java. Discuss advantages and disadvantages of each.

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

a) Write a program to accept files as command line arguments. Display the name and size of all the files with extension as.html from c:\Java> directory. Appropriate error messages should be printed.

b) Write a JDBC program which will perform the following operations on

Employee (eno, name, salary) database

i) Insert ii) Update

iii) Delete iv) Display.

Create a GUI for performing the above operations.

c) Write a Java program to implement following options on linked list using collections.

1) Intersection

2) Concatenation

3) Display

(Hint : Two lists are needed for the operations)

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

a) Create an abstract class shape. Derive three classes sphere, cone and cylinder from it. Calculate area and volume of all (use method overriding)

b) Create a GUI application in which the font of the text in the label, is changed as per the selected font name in a combo box.

c) What is an event? Explain the Delegation Event model in detail.

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

a) Discuss the various levels of access protection available for packages in Java.

b) Explain checked and unchecked exceptions in Java.

c) Write note on garbage collection in Java.

d) Write note on :

i) Flowlayout ii) Borderlayout

e) Write a note on Java API packages.

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Total No. of Questions : 5]

P609

SEAT No. :

[Total No. of Pages : 4

[4241] - 305

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATION

MIM-305 : Theoretical Computer Science

(2008 Pattern) (Semester-III)

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

Instructions to the candidates:

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

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

a) Give suffix & prefix of string X = abcd.

b) Define useful symbol.

c) Give any four identities of regular expression

d) What is a two-way tape turing machine?

e) Define the term symbol and language.

f) Construct left most derivation for "ababa"

for a = { $S \rightarrow$ AS/a. $A \rightarrow$ SA/b}.

g) What is the difference between recursive language & recursively enumerable language?

h) "Every PDA accepts only CFL's". Justify.

i) Construct DFA for (0+1)* 1.

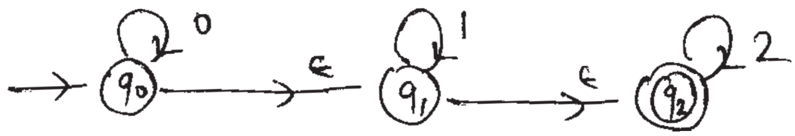
j) Write regular expression for a language over {0, 1} starting with 1 & third digit from right end is 1.

P.T.O.

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

i) Define Mealy Machine. Design Mealy Machine for 2's complement of a binary number. Convert it to moore machine

ii) Convert following NFA to DFA



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

i) Construct DFA for language $L = L_1 \cap L_2$ over {a, b} where

L_1 = All string starting with b

L_2 = All strings not having "ba" as a substring.

ii) Show that L = $\{a^p / p \text{ is prime}\}$ is not regular.

iii) Construct FA for following regular expression

ab (a+b)* + ba (a+b)*

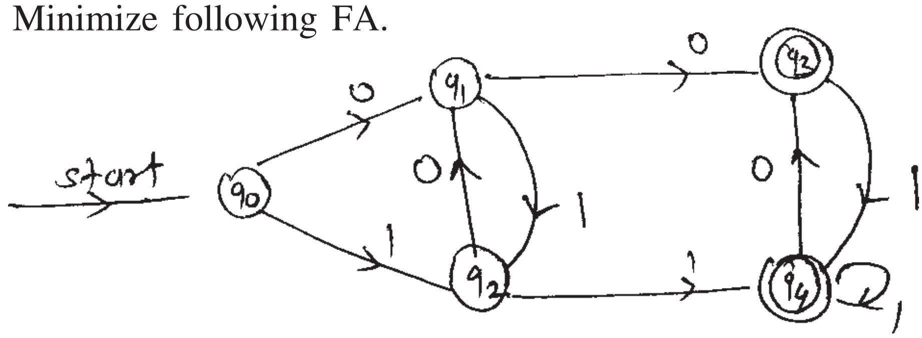
Q3) a) Attempt any one of the following **[6]**

i) Show that context free languages are not closed under complementation. i.e. complement of CFL may or may not be context free.

ii) Construct regular grammar for a language over {a, b, c} starting with a and having odd number of b's

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

i) Minimize following FA.



ii) Show that $L = \{a^i b^i c^i / i \geq 1\}$ is not CFL

iii) Construct CFG for the language

$L = \{ WCW^R / W \in (a+b)^* \}$

if $w = ab$, $W^R = ba$.

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

i) Define useless symbol. Construct CFG. with out useless symbol for

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

ii) Remove $\in$-productions from following grammar & convert it to CNF

$\{S \rightarrow ABA, A \rightarrow aA/\in, B \rightarrow bB/\in\}$

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

i) Construct PDA for language

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

ii) Convert CFG $G = \{ S \rightarrow AB, A \rightarrow SB/a, B \rightarrow AB/b\}$ to GNF

iii) Construct Turing Machine for $L = \{a^n b^n / n \geq 1\}$

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

i) Construct turing Machine for language

$L = \{ a^n b^n a^n / n \geq 1\}$

ii) Construct CFG equivalent of PDA $M=(\{q_1, q_2\}, \{0, 1\}, \{R, B\}, \delta, q, R, \phi)$

Where

$\delta(q_1, 0, R) = (q_1, BR)$

$\delta(q_1, 0, B) = (q_1, BB)$

$\delta(q_1, 1, B) = (q_2, \in)$

$\delta(q_2, \in, B) = (q_2, \in)$

$\delta(q_2, \in, R) = (q_2, \in)$

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

i) Explain chomsky Hierarchy.

ii) Construct PDA for CFG

$S \rightarrow OBB$, $B \rightarrow OS/1S/O$,

Test whether 010000 is in N(A).

iii) Construct PDA to accept all strings having equal no. of a's & b's.

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Total No. of Questions : 5]

SEAT No. :

P611

[Total No. of Pages : 2

[4241] - 402

M.Sc. Tech.

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-402 : Computer Networks

(2008 Pattern) (Semester-IV)

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

Instructions to the candidates:

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

SECTION - I

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

a) What is the purpose of presentation layer?

b) Explain the concept of DC component.

c) Discuss the main functions of network layer.

d) Explain the concept of protocol stack used in TCP/IP protocol.

e) What is piggy backing? Give the drawbacks of piggybacking techniques.

f) Show the NRZ-I and NRZ-Lencoding for the bit pattern 11000101.

g) Write a note on remote bridges.

h) Comment : TCP is a reliable protocol.

i) Explain the basic model of FTP.

j) Give the classes of following IP addresses
128.16.2.8
192.168.2.8

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

i) Write a note on static versus dynamic routing table.

ii) Explain one-bit sliding window protocol.

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

i) Write a note on FDMA.

ii) Explain the sender and receiver side of stop-and wait protocol.

iii) Write a note on CSMA/CD. Also draw its conceptual model.

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

i) Write a note on fiber optic cable.

ii) Explain BSS and ESS.

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

i) Write a note on PCM

ii) Differentiate between ISO-OSI and TCP/IP reference model.

iii) Explain with suitable example different types of errors.

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

i) Explain the communication over control and data connection in FTP.

ii) Write a note on dynamic address configuration.

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

i) Write a note on character count framing method of DLL. Also give its drawback.

ii) Discuss about transport service primitives

iii) Write a note on gigabit ethernet.

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

i) Explain with suitable example RZ encoding technique

ii) Write a note on remote login used in TELNET.

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

i) Write a note on dynamic channel allocation in LANS and MANS.

ii) Explain routing table for classful addressing.

iii) Explain remote procedure call.

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Total No. of Questions : 5]

SEAT No. :

P612

[Total No. of Pages : 2

[4241] - 403
M.Sc. Tech. - II
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATION
MIM-403 : Web Technology
(2008 Pattern) (Semester-IV)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***

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

a) What is server root and document root?

b) What does it mean for a tag or attribute of HTML to be deprecated? Which level of XHTML 1.0 allows the inclusion of HTML 4.0's deprecated tags and attributes?

c) What is use of primitive data types? List primitive types of Javascript.

d) What is XML namespace? What is its format?

e) Give any four relational operators used for strings in perl with their meaning.

f) How queue can be implemented in an array in perl?

g) What is CGI? In which format CGI program can produce results.

h) "PHP is dynamically typed". Justify whether True of False

i) What is purpose of init() and destroy() methods of Http servlet class?

j) Give any two advantages of servlets over CGI programs.

Q2) Solve <u>any four</u> of the following. **[4 × 4 = 16]**

a) Explain two different ways of creating array in PHP with suitable examples.

b) Explain concept of query string.

c) What are actual and formal parameters? Explain with suitable example how Javascript uses the pass-by-valve parameter passing method.

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d) Explain basic five table tags with suitable example.

e) List various features of perl that make it ideal for CGI programming.

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

a) Write short note on MIME.

b) Explain XSLT processing with suitable diagram.

c) Differentiate between Java and Javascript.

d) Write a perl program for accepting a filename as command line argument and convert the contents of the file in uppercase.

e) Explain following PHP functions with suitable example

i) Strpos-

ii) Chop-

iii) Strtolower-

iv) substr-

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

a) Write short note on document object model (DOM)

b) What is XML schema? What are its advantages over DTD.

c) What is cookie? How the CGI. pm module support cookies in perl?

d) Write a simple servlet to illustrate a GET request.

e) Explain any four character entities from HTML

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

a) Explain request phase of HTTP protocol.

b) Explain different popup boxes supported by Javascript with suitable examples.

c) Create XML document for storing employee details as Id, Name, address (city, pin), dept.

d) Explain concept of references in perl with suitable example

e) Explain concept of ordered and unordered lists with suitable example.

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Total No. of Questions : 4]

SEAT No. :

P613

[Total No. of Pages : 2

[4241] - 404

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-404 : Design and Analysis of Algorithms

(2008 Pattern) (Semester-IV)

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

Instructions to the candidates:

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

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

a) Show that $5n^2+n$ is $O(n^2)$.

b) Define back edge and tree edge.

c) Define : transitive closure of a graph.

d) Justify whether the following array can be sorted using counting sort in linear time.

A = {1, 8, 44, 2, 5}

e) Explain the process of relaxing an edge.

f) Explain : Time complexity

g) Define ‘θ‘ notation.

h) Give an example of a problem which is NP hard.

i) Justify : (23, 17, 14, 6, 10, 7, 12) is a heap.

j) What is longest common subsequence problem?

Q2) Attempt any two of the following: **[24]**

a) Explain quick sort algorithm and discuss its time complexity in best, average and worst case.

b) Explain activity selection problem and give a greedy algorithm for the same.

c) Give Floyd-Warshall algorithm and state its time complexity.

Q3) Attempt <u>any two</u> of the following. **[24]**

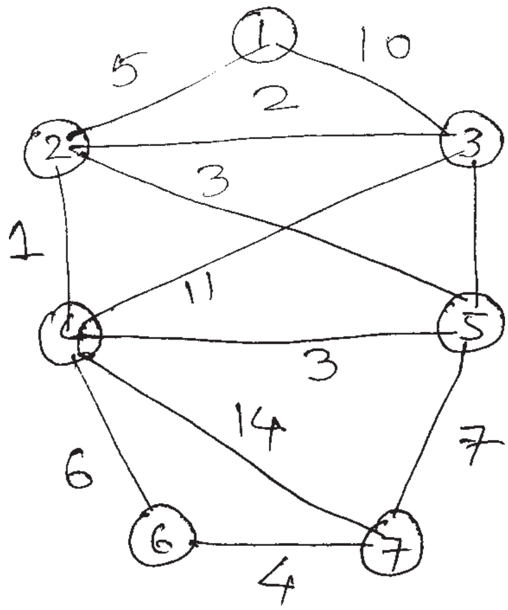
a) Explain Bellman Ford algorithm for solving single source shortest path problem.

b) Prove that vertex cover problem is NP complete.

c) What is dynamic programming? Discuss in detail optimal polygon triangularization.

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

a) Illustrate prim's and kruskal's algorithms on following graph.



b) Explain Huffman code. Find optimal Huffman code for the following set of frequencies.

A : 0.08, B : 0.10, C : 0.12, D : 0.15, E : 0.20, F : 0.35.

c) Obtain the reduced cost matrix for the travelling salesman problem given by cost matrix

$$\begin{bmatrix} \infty & 11 & 10 & 9 & 6 \\ 8 & \infty & 7 & 3 & 4 \\ 8 & 4 & \infty & 4 & 8 \\ 11 & 10 & 5 & \infty & 5 \\ 6 & 9 & 5 & 5 & \infty \end{bmatrix}$$

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Total No. of Questions : 5]

SEAT No. :

P617

[Total No. of Pages : 2

[4241] - 504
M.Sc. Tech.
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM-504 : Advanced Operating Systems
(2008 Pattern) (Semester-V)

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

Instructions to the candidates:

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

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

a) Discuss file system layout.

b) Explain the two parts of buffer.

c) State the role of process table and u area of kernel.

d) How kernel handles the signal?

e) Write in short about the concept of map.

f) Explain with syntax ioctl() system call.

g) State and explain the syntax of ptrace() system call.

h) Explain the two options of chkconfig command.

i) What is the use of real user ID and effective user ID?

j) Explain any two logical sections of a process on the UNIX system.

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

i) Explain the sequence of operations for fork performed by kernel.

ii) Write a note on various components of register context.

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

i) Explain the state diagram for page aging.

ii) Which are the important fields of u-area?

iii) State the five scenarios to allocate a buffer for a disk block.

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

i) Explain the possible cases, considered by kernel while freeing the resources.

ii) Write a note on functions of a line discipline.

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

i) What is the use of kill system call? Also explain the correspondance between value of pid and sets of processes.

ii) How to handle terminal interrupts? Explain with suitable diagram.

iii) What do you mean by service? Explain start, stop and restart service commands.

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

i) How process responds if it is received "death of child" signal?

ii) Write a note on expansion swap.

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

i) Write a note on context layers of a sleeping process.

ii) Write a note on shell

iii) Explain the various options of rpm command.

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

i) Explain the relationship between inode table and region table for shared text.

ii) Write a note on socket model.

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

i) Write a note on duplicating a region.

ii) How process space is mapped on to the swap device?

iii) Explain the structure of buffer header.

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Total No. of Questions : 5]

SEAT No. :

P596

[Total No. of Pages : 3

[4241] - 102
M.Sc. Tech.
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 102 : Algebra - I
(2008 Pattern) (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) Prove that, if G is abelian group, then for all a, $b \in$ G and all integers n,

$(a.b)^n = a^n.b^n$

b) In S_3, give an example of two elements x. and y such that $(x.y)^2 \neq x^2.y^2$

c) Is the following statement true. Justify your answer.
'Every abelian group is cyclic'.

d) Find index of H in G where

i) H = (18Z, +), G = (Z, +)

ii) H = (18Z, +), G = (3Z, +)

e) Find Kernels of the following homomorphisms

i) $\phi : G \longrightarrow G$, defined by

$\phi(g) = e, , \forall\ g \in G$

where e : identity in G.

ii) $\phi\ (R^2, +) \longrightarrow (R^2, +)$ defined by

$\phi(a, b) = (a, b),\ \forall\ (a, b) \in R^2$.

f) Give an example of a ring which is an integral domain but not a field. Justify your answer.

g) Show that a field has only trivial ideals.

h) Give an example of a ring and its subring such that

i) Ring is non - commutative but subring is commutative.

ii) A ring with unity and subring without unity.

i) Is $X^3 - g$ irreducible over the ring Z_7?

j) Find characteristics of the following rings :

i) $(Z \times Z, + , .)$

ii) $(Z_2 \times Z_3, + , .)$

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

i) State and prove Lagrange's theorem.

ii) Prove that 'HK is a subgroup of G if and only if HK = KH', where H and K are subgroups of G.

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

i) If H is subgroup of G, and $a \in G$;
let $aHa^{-1} = \{aha^{-1} / h \in H\}$.
Show that aHa^{-1} is a subgroup of G.

ii) Suppose that N and M are two normal subgroups of G and that $N \cap M = \{e\}$, show that for any $n \in N$ and $m \in M$, $nm = mn$.

iii) For a, b in a group G, we say 'b' is conjugate of 'a' in G if there exists an element 'c' $\in$ G such that $b = c^{-1} ac$.
Show that this conjugacy relation is an equivalence relation on G.

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

i) State and prove first fundamental theorem of homomorphism.

ii) If ϕ is a homomorphism of G into $\overline{G}$ with Kernel K, then prove that K is normal subgroup of G.

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

i) Express $\sigma = (1, 2, 3)\ (4, 5)\ (1, 6, 7, 8, 9)\ (1, 5)$ as a product of disjoint cycles and find σ^{-1}.

ii) Let G be a group and Z (G) be a center of G. Prove that if $\frac{G}{Z(G)}$ is cyclic then G is abelian.

iii) Show that a group of order 56 cannot be simple.

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

i) Prove that every finite integral domain is a field.

ii) Let R be a commutative ring with '1' then prove that M is maximal ideal of R if and only if $\frac{R}{M}$ is a field.

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

i) Show that, intersection of two ideals is again an ideal. What can you say about their union?

ii) Prove that the homomorphism ϕ of a ring R onto the ring R' is an isomorphism if and only if Kernel of ϕ is $\{0\}$.

iii) For any ideals I and J of a ring R, the sum I + J and the product IJ are ideals in R.

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

i) Prove that if R is an integral domain then the polynomial ring R [X] is also an integral domain.

ii) State and prove division algorithm for polynomial ring F [X], where F is a field.

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

i) Prove that Z_{11} [X] / $\langle X^2 + X + 4 \rangle$ is a field having |2| elements.

ii) Determine whether the following functions are ring homomorphisms or not.

I) Let $J(\sqrt{2})$ be all real numbers of the form $m + n\sqrt{2}$, m, n are integers.

and $\phi : J(\sqrt{2}) \longrightarrow J(\sqrt{2})$ defined by

$$\phi(m + n\sqrt{2}) = m - n\sqrt{2}.$$

II) $\tilde{\phi} : Z \times Z \to Z \times Z$ defined by $\tilde{\phi}\ (a, b) = (2 + a, b)$.

c) If p is a prime, then $f(X) = 1 + x + x^2 + ... + x^{p-1} \in Q$ [X] is irreducible.

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Total No. of Questions : 5]

SEAT No. :

P599

[Total No. of Pages : 2

[4241] - 105

M.Sc. Tech. - I

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 105 : Elements of Information Technology

(2008 Pattern) (Semester - I)

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

Instructions to the candidates:

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

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

a) Define software.

b) What is binary system for data representation?

c) What is logical file?

d) What is World Wide Web (WWW)?

e) Briefly explain ISAM.

f) Explain the difference between RAM and ROM.

g) What is distributed system?

h) Give the octal representation of following decimal numbers.

   i) 13

   ii) 22.

i) Explain the term EBCDIC code.

j) List out different input devices.

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

a) Explain secondary memory and its devices?

b) Define Operating System. Explain Batch OS in detail.

c) Explain the basic structure of computer.

d) With the suitable diagram explain working of star topology.

e) Define and differentiate dense index and sparse index.

P.T.O.

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

a) What are the goals of networking?

b) Explain tree structured indexing?

c) Explain different types of file organization?

d) State and explain any two serial input devices.

e) Explain how a record is deleted from dense indexed file.

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

a) Write a short note on ASC II code.

b) Explain different applications of network.

c) Explain how the software is classified.

d) With neat diagram explain the operation of VDU monitor.

e) What are the different types of computer?

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

a) Give comparison between magnetic and optical storage devices. Explain one device for each storage type.

b) What are different types of printer? Explain any two in detail.

c) Explain the concept of Information technology. What are the Goals of it.

Total No. of Questions : 5]

SEAT No. :

P603

[Total No. of Pages : 3

[4241] - 204

M.Sc. Tech. - I

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204 : Database Fundamentals

(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

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

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

a) State what is strong & weak entity set.

b) Write any two advantages of DBMS file system.

c) State types of DBMS languages provided by system.

d) What is a Candidate key?

e) Explain difference between an attribute and a value set.

f) What is degree of Relationship? Explain with example.

g) Explain Entity Integrity Constraint.

h) "Unique constraint and Primary Key has same meaning". State true or false. Justify.

i) Define foreign key. What is this concept used for?

j) Explain Group by, Having clause used in SQL.

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

a) Explain different relational algebra operations in detail.

b) Write short note on : Normalization and its forms.

c) Explain different types of database system user.

d) Discuss the naming conventions used for E-R schema.

e) Write a short note on data independence.

P.T.O.

Q3) a) Solve <u>any two</u>: **[8]**

i) Differentiate between Specialization and Generalization with example.

ii) Explain different types of attributes with suitable example.

iii) Design an E-R for the following Case Study:

Musical company wishes to computerize their information with respect to their Musician & the albums. Each Musician has SSN, name, address the instrument used in song recording has a name & a musical key. Each album recorded has a title & an author. Each Musician may play several instruments & a given instrument may be played by several musicians. Each album has several songs. Each song may be performed by one or more musicians and a musician may perform number of songs. Each album has exactly one musician who also acts as its producer. A musician may produce several albums.

b) Solve <u>any two</u>: **[8]**

i) What is DBA? Explain different responsibilities of DBA.

ii) What are insertion & deletion anomalies? Explain with example.

iii) What is Mapping Cardinality? Explain its types with example.

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

a) Explain aggregation with proper example.

b) Write short note on "Desirable Properties of Decomposition".

c) What is Trigger? Explain different events when trigger can be activated.

d) Consider the following relational database

Doctor (doc-no, doc-name, doc-city)

Hospital (hosp-no, hosp-name, hosp-city)

doc-hosp (doc-no, hosp-no)

Write relational algebra expressions for the following queries.

i) List the names of the doctors who live in 'Pune'.

ii) List all the hospitals visited by "Mr. Kale".

e) Write a short note on : "Components of DBMS".

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

a) Write a short note on functional dependency.

b) Define terms:

   i) Schema.

   ii) Entity.

   iii) Primary key.

   iv) Database.

c) Explain any four aggregate functions used in sql queries.

d) What is Cursor? Explain its types.

e) Consider the following relation

   Sailors (Sid, S name, rate, age)

   Boats (bid, b name, colour)

   Sailors and Boats are related with many - to - many relationship.

   Solve following queries.

   i) Find the names of Sailors who have reserved boat no. 105.

   ii) Find colours of boats reserved by "Mr. Sethi".

Total No. of Questions : 5]

SEAT No. :

P605

[Total No. of Pages : 4

[4241] - 301
M.Sc. Tech.
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 301 : Numerical Analysis
(Sem. - III) (2008 Pattern)

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

Instructions to the candidates:

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

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

a) Define a ill-conditioned system.

b) Evaluate the Jacobian matrix J (x, y, z) for the functions.

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

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

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

c) What is the condition under which the Jacobian method has a unique solution?

d) State the Runge-kutta formula of order N = 2 to solve an initial value problem.

e) Explain the concept of adaptive quadrature.

f) Does $g(x) = \cos x$ has a unique fixed point in [0, 1]? Justify your answer.

g) If $x = 3.141592$ and $\hat{x} = 3.14$, which is an approximation to x. What is the relative error in the approximation?

h) Let $\{x_n\}$ and $\{y_n\}$ be two sequences Let $x_n = \frac{n^2 - 1}{n^3}$, $n \geq 1$

What is the sequence $\{y_n\}$ such that $x_n = O(y_n)$?

i) If μ and δ are difference operators. Show that $\mu^2 = 1 + \frac{\delta^2}{4}$

P.T.O.

j) Solve the differential equation to find the general solution $\frac{dy}{dt} = -k(y - A)$ with $y(0) = y_0$.

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

i) Assume that $g \in C[a, b]$, g' is defined over (a, b) and a positive constant K exists with $|g'(x)| \le K < 1$, $\forall x \in (a,b)$. Then show that g has unique fixed point P in $[a, b]$.

ii) Assume that $f \in C[a, b]$ and that there exists a number $r \in [a, b]$ such that $f(r) = 0$. If $f(a)$ and $f(b)$ have opposite signs, and $\{C_n\}_{n=0}^{\infty}$ represents the sequence of midpoints generated by the bisection process then $|r - C_n| \le \frac{b-a}{2^{n+1}}$ for $n = 0, 1, ...$

Prove that the sequence $\{C_n\}_{n=0}^{\infty}$ converges to the zero, $x = r$; that is $\lim_{n\to\infty} C_n = r$.

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

i) Use Newton Raphson's method to find the real root of equation $3x = \cos x + 1$ using initial approximation $x_0 = 0.6$ upto first two iterations.

ii) Use Regula falsi method to determine the root of the equation $\cos x - xe^x = 0$ in [0, 1] upto first 3 - iterations.

iii) Suppose that the bisection method is used to evaluate the zero of $f(x)$ in the interval [2, 7]. How many iterations are required to guarantee the approximation of C_N has an accuracy of 5×10^{-9}?

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

i) Assume that $f \in C^2[a, b]$ x_0, x_1 are nodes in $[a, b]$ and $L_1(x)$ is the Lagrangian polynomial approximation to $f(x)$ on $[a, b]$ then show that the error term is : $E_1(x) = \frac{(x-x_0)(x-x_1)}{2!} . f^{(2)}(C)$

ii) State and prove composite trapezoidal rule.

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

i) Find the divided difference interpolating polynomial of degree 3 or less which passes through the points.

x	0	2	3	4
y	2	6	20	50

ii) If Δ represents the difference operator then show that

$$\Delta^n u_{x-n} = u_x - nu_{x-1} + \frac{n(n-1)}{2} u_{x-2} + ... + (-1)^n u_{x-n}$$

iii) Evaluate $\int_0^3 \frac{dx}{1+x}$ with 7 sample points by using Simpson's $\frac{3}{8}^{th}$ rule. Also calculate value of ln^2 using the above approximation.

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

i) Assume that $f \in C^4\,[a, b]$ and x_0, x_1, x_2 are nodes in the interval $[a, b]$ then show that

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

ii) Define a continuous function f on $[a, b]$ and x_0, x_1, x_2 are points in $[a, b]$ then show that Lagrangian polynomial of order 2 $L_2(x)$ is given by

$$L_2(x) = \frac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)} f_0 + \frac{(x-x_0)(x-x_2)}{(x_1-x_0)(x_1-x_2)} . f_1 + \frac{(x-x_0)(x-x_1)}{(x_2-x_0)(x_2-x_1)} . f_2$$

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

i) Use Taylor series method of order N = 4 to solve $y' = \frac{(t-y)}{2}$ on [0, 3] with initial condition $y(0) = 1$. Evaluate the value of y at 0.25 considering $h = \frac{1}{4}$.

ii) Solve the equation $\frac{dy}{dx}=1+xy$ subject to $y(0) = 1$; using Euler's method to find $y(0.3)$ considering $h = 0.1$.

iii) Use Picard's Method to approximate y when $x = 0.1$ for

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

When $y(0) = 1$ using the first three approximations of y.

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

i) Find the first two approximations to the system of Non-linear equations given by Newtons method.

$$x^2 - y^2 = 3$$
$$x^2 + y^2 = 13$$

Use initial approximation $(x_0, y_0) = \left(\sqrt{6.5}, \sqrt{6.5}\right)$.

ii) Find the first three approximations to the system of linear equations using Gauss - Seidel iterative method.

$$-2x + y + 5z = 15$$
$$4x - 8y + z = -21$$
$$4x - y + z = 7$$

Consider initial approximation $P_0 = (1, 2, 2)$.

iii) Reduce the matrix $A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}$ to the tridiagonal form.

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Total No. of Questions : 5]

SEAT No. :

P608

[Total No. of Pages : 3

[4241] - 304

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 304 : Operating Systems

(2008 Pattern) (Sem. - III)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***

Q1) Attempt Any Eight of the following: **[8 x 2 = 16]**

a) List 2 common modes of interprocess communication.

b) What readnext and writenext operations signify.

c) State types of DBMS languages provided by system.

d) What is A CANDIDATE key?

e) Explain difference between an attribute and a value set.

f) What is degree of Relationship? Explain with example.

g) Explain Entity Integrity Constraint.

h) "Unique constraint and Primary Key has same meaning". State true or false. Justify.

i) Define foreign key. What is this concept used for?

j) Explain Group by, Having clause used in SQL.

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

a) Explain different relational algebra operations in detail.

b) Write short note on : Normalization and its forms.

c) Explain different types of database system user.

P.T.O.

d) Discuss the naming conventions used for E-R schema.+

e) Write a short note on data independence.

Q3) a) Solve <u>any two</u>: **[8]**

i) Differentiate between Specialization and Generalization with example.

ii) Explain different types of attributes with suitable example.

iii) Design an E-R for the following Case Study:

Musical company wishes to computerize their information with respect to their Musician & the albums. Each Musician has SSN, name, address the instrument used in song recording has a name & a musical key. Each Musician may play several instruments & a given instrument may be played by several musicians. Each album has several songs. Each song may be performed by one or more musicians and a musician may perform number of songs. Each album has exactly one musician who also acts as its producer. A musician may produce several albums.

b) Solve <u>any two</u>: **[8]**

i) What is DBA? Explain different responsibilities of DBA.

ii) What are insertion & deletion anomalies? Explain with example.

iii) What is Mapping Cardinality? Explain its types with example.

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

a) Explain aggregation with proper example.

b) Write short note on "Desirable Properties of Decomposition".

c) What is Trigger? Explain different events when trigger can be activated.

d) Consider the following relational database

Doctor (doc-no, doc-name, doc-city)

Hospital (hosp-no, hosp-name, hosp-city)

doc-hosp (doc-no, hosp-no)

Write relational algebra expressions for the following queries.

i) List the names of the doctors who live in 'Pune'.

ii) List all the hospitals visited by "Mr. Kale".

e) Write a short note on : "Components of DBMS".

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

a) Write a short note on functional dependency.

b) Define terms:

   i) Schema.

   ii) Entity.

   iii) Primary key.

   iv) Database.

c) Explain any four aggregate functions used in sql queries.

d) What is Cursor? Explain its types.

e) Consider the following relation

   Sailors (Sid, S name, rate, age)

   Boats (bid, b name, colour)

   Sailors and Boats are related with many - to - many relationship.

   Solve following queries.

   i) Find the names of Sailors who have reserved boat no. 105.

   ii) Find colours of boats reserved by "Mr. Sethi".

Total No. of Questions : 5]

SEAT No. :

P610

[Total No. of Pages : 3

[4241] - 401

M.Sc. Tech.

MATHEMATICS

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 401 : Topology

(Semester - IV) (2008 Pattern)

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

Instructions to the candidates:

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

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

a) Show that arbitrary intersection of open sets need not be open.

b) Show that (0,1) to [0,1] with usual topology are not homeomorphic.

c) Give an example of a connected topological space which is not path-wise connected.

d) State Tychonoff's theorem.

e) Let X, Y and Z be topological spaces. If $f:X \to Y$ and $g:Y \to Z$ are continuous functions then show that fog : $X \to Z$ is a continuous function.

f) Show that Q, the set of rational numbers is not a connected subspace of R.

g) Define Lindelof space. Give an example of a Lindelof space.

h) Give an example of a topological space X and a subset A of X such that A is closed and bounded but A is not compact.

i) State Urysohn lemma.

j) Let X be a Hausdorff space and $x \in X$. Show that $\{x\}$ is a closed set in X.

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

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

P.T.O.

ii) Let X be a topological space and Y be a subspace of X. If A is a subset of Y and $\overline{A}$ denotes the closure of A in X then show that the closure of A in Y equals $\overline{A} \cap Y$.

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

i) Let $f: R \to R$ defined by $f(x) = \frac{x}{1-x^2}$. Show that f is a homeomorphism.

ii) In R^n, define $d(x, y) = |x_1 - y_1| + ... + |x_n - y_n|$. Show that d is a metric. Further show that d induces the usual topology on R^n.

iii) Let $f: [0,1] \to [0,1]$ be a continuous function. Show that there is a point $x \in [0,1]$ such that $f(x) = x$. What happens if instead of [0,1] we have (0,1)?

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

i) Show that every compact subset of a Hausdorff space is closed.

ii) Show that every metrizable space is normal.

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

i) Let $A = \{x \times y | xy = 1\}$. Show that A is a closed subset of R^2. Is it a compact set in R^2?

ii) Prove that a subspace of a Hausdorff space is Hausdorff. Also show that a product of Hausdorff spaces is Hausdorff.

iii) Show that if X is regular, every pair of points of X have neighbour hoods whose closures are disjoint.

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

i) State and prove the intermediate value theorem.

ii) State and prove the tube lemma.

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

i) Let A be a connected subset of X and $A \subset B \subset \overline{A}$. Show that B is a connected set.

ii) Let Y be an ordered set in the order topology. Let $f, g: X \to Y$ be continuous. Let $h: X \to Y$ be the function $h(x) = \min\{f(x), g(x)\}$. Show that h is a continuous function.

iii) Prove that the image of a compact space under a continuous map is compact.

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

i) Prove that a subspace of a completely regular space is completely regular.

ii) Prove that any regular space with a countable basis is normal.

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

i) Characterize all the connected components of R with usual topology.

ii) Prove that one point compactification of R is S^1.

iii) Show that the set of rationals Q is not locally compact.

Total No. of Questions : 5]

SEAT No. :

P614

[Total No. of Pages : 4

[4241] - 501

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 501 : Operations Research & Optimizing Techniques

(2008 Pattern) (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.*
3) *Use of single memory, non-programmable scientific calculator is allowed.*
4) *Graph papers will be supplied on demand.*

Q1) Attempt each of the following: **[2 Marks each]**

a) Define basic solution of a system of m simultaneous linear equations in n unknowns ($m < n$). Find a non-degenerate basic solution of $x + 2y + z = 4$ and $2x + y + 5z = 5$.

b) Rewrite in standard form the following LPP:

Min $z = 2x_1 + x_2 + 4x_3$ subject to the constraints

$-2x_1 + 4x_2 \leq 4, \; x_1 + 2x_2 + x_3 \geq 5, \; 2x_1 + 3x_3 \leq 2,$

$x_1, x_2 \geq 0$ and x_3 unrestricted.

c) Obtain the dual of the following LPP:

Max $f(x) = 2x_1 + 5x_2 + 6x_3$ subject to the constraints:

$5x_1 + 6x_2 - x_3 \leq 3, \quad -2x_1 + x_2 + 4x_3 \leq 4$

$x_1 - 5x_2 + 3x_3 \leq 1, \quad -3x_1 - 3x_2 + 7x_3 \leq 6, x_1, x_2, x_3 \geq 0.$

d) Following are the activities which are to be performed for a building site preparation. Determine the precedence relationship and draw the network.

i) Clear the site.
ii) Survey and layout.
iii) Rough grade.
iv) Excavate for sewer.
v) Excavate for electrical manholes.
vi) Install sewer and backfill.

P.T.O.

vii) Install electrical manholes.

viii) Construct the boundary wall.

e) Explain the procedure to detect saddle point. Detect the saddle point (if it exists) and game value for the following:

$$A \overset{B}{\begin{pmatrix} 1 & 13 & 11 \\ -9 & 5 & -11 \\ 0 & -3 & 13 \end{pmatrix}}$$

f) Solve the following assignment problem:

Contractor

Assemblies	15	13	14	17
	11	12	15	13
	13	12	10	11
	15	17	14	16

g) Explain the primal - dual relationships.

h) Write a short note on complementary slackness.

Q2) Attempt any four of the following: **[4 Marks each]**

a) Solve the following game by using the principle of dominance:

Player B

		I	II	III	IV	V	VI
Player A	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
	3	4	3	7	-5	1	2
	4	4	3	4	-1	2	2
	5	4	3	3	-2	2	2

b) Write a note on degeneracy. Discuss a method to resolve degeneracy in LPP.

c) Solve by graphical method:

Max $z = 40x_1 + 100x_2$ subject to the constraints

$12x_1 + 6x_2 \leq 3000, \quad 4x_1 + 10x_2 \leq 2000, \quad 2x_1 + 3x_2 \leq 900, \; x_1, x_2 \geq 0.$

d) Prove that the dual of the dual is primal.

e) Obtain an initial basic feasible solution to the following transportation problem, using least cost method.

	D_1	D_2	D_3	D_4	Supply
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	

Q3) Attempt any <u>four</u> of the following: **[4 Marks each]**

a) Describe Big-M Method.

b) Explain North - West Corner Method.

c) Solve the following 2 x 3 game graphically.

Player B

$$\text{Player A}\begin{pmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{pmatrix}$$

d) Four new machines M_1, M_2, M_3 and M_4 are to be installed in a machine shop. There are five vacant places A, B, C, D and E available. Because of limited space, machine M_2 can not be placed at C and M_3 can not be placed at A, C_{ij}, the assignment cost of machine *i* to place *j* in rupees is shown below. Find the optimum assignment schedule.

	A	B	C	D	E
M_1	4	6	10	5	6
M_2	7	4	-	5	4
M_3	-	6	9	6	2
M_4	9	3	7	2	3

e) Explain MODI method.

Q4) Attempt any <u>two</u> of the following: **[8 Marks each]**

a) i) Describe a two-person zero-sum game and illustrate with an example.

ii) Describe Hungarian assignment method.

b) Use simplex method to prove that the following LPP has infinite number of non-basic feasible optimal solutions:

Maximize $Z = 4x_1 + 10x_2$

Subject to $2x_1 + x_2 \le 10,$

$2x_1 + 5x_2 \le 20,$

$2x_1 + 3x_2 \le 18,$

$x_1, x_2 \ge 0.$

c) A product is produced by four factories A,B,C and D. The unit production costs in them are Rs. 2, Rs. 3, Re. 1 and Rs. 5 respectively. Their production capacities are, A-50 units, B-70 units, C-30 units and D-50 units. These factories supply the product to four stores, demands of which are 25, 35, 105 and 20 units respectively. Unit transport cost in rupees form each factory to each store is given in the table below.

		Stores 1	2	3	4
Factories	A	2	4	6	11
	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum.

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

a) A company has one surplus truck in each of the cities A,B,C,D and E and one deficit truck in each of the cities 1,2,3,4,5 and 6. The distance between the cities in kilometers is shown in the matrix below. Find the assignment of trucks from cities in surplus to cities in deficit so that the total distance covered by vehicles is minimum.

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

b) Describe the iterate procedure of determining the critical path and illustrate with an example.

c) Describe main steps of dual simplex algorithm and hence solve the following LPP by using dual simplex method.

Maximize $Z = -3x_1 - x_2$

Subject to $x_1 + x_2 \geq 1,$

$2x_1 + 3x_2 \geq 2,$

$x_1, x_2 \geq 0.$

Total No. of Questions : 5]

SEAT No. :

P615

[Total No. of Pages : 4

[4241]-502

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM-502: Numerical and Statistical Methods

(2008 Pattern) (Semester - V)

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

Instructions to the candidates :

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

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

a) Define the following terms :

i) Sample space.

ii) Event.

b) Two fair dice are rolled. Find the probability that the total on the two dice is not equal to 5.

c) If $P(A) = 0.7$, $P(B') = 0.4$ and $P(A \cap B) = 0.5$, find $P(A \cup B)$.

d) If A is an event defined on a sample space Ω, show that A and Ω are independent.

e) Determine K such that the following function represents p.m.f. of a discrete random variable X.

$$p(x) = kx;\ x = 1, 2, \ldots 10$$
$$= 0;\ \text{otherwise.}$$

f) State the additive property of Binomial distribution.

g) Let a discrete random variable X has Poisson distribution with parameter 2. Find $P(X>2)$.

h) Let a continuous random variable Z has standard normal distribution. If $P(0<z<c) = 0.3944$, find the value of c.

i) State any two properties of Karl Pearson's co-efficient of correlation r.

j) Define multiple correlation co-efficient $R_{2.13}$.

P.T.O.

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

a) Explain the following terms with an illustration :

i) Mutually exclusive events.

ii) Complement of an event.

b) Four hundred people attending a party are each given a number, 1 to 400. Find the probability that the number called,

i) has the same three digits.

ii) ends with 9.

iii) is less than 101.

iv) is divisible by 5.

c) Suppose a discrete random variable X assumes values 1, 2 and 4. If $P(X = 1) = 0.3$ and $E(X) = 2.5$, find $P(X = 2)$ and $P(X = 4)$.

d) Define distribution function of a continuous random variable X. Also state its important properties.

e) A machine has 14 identical components that function independently. It will stop working if three or more components fail. If the probability that a component fails is equal to 0.1, find the probability that the machine will be working.

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

a) On a day in December, the probability that it will snow in Boston is 0.4 and the probability that it will snow in Moscow is 0.7. Assuming independance, find the probability that it will snow,

i) in both the cities.

ii) only in Moscow.

b) Let X be a discrete random variable. Define,

i) Probability distribution of X.

ii) Mean of X.

iii) Variance of X.

c) Define the probability distribution of a Poisson random variable X. State its Mean and Variance. Also state any real life situation where Poisson distribution is applicable.

d) Let a continuous random variable X has exponential distribution with mean 4.

Obtain the distribution function of X.

Hence or otherwise find $P(X<2)$.

e) Given,

$$n = 10,\ \sum_{i=1}^{10} xi = 638,\ \sum_{i=1}^{10} yi = 690,\ \sum_{i=1}^{10} xi^2 = 43572,$$

$$\sum_{i=1}^{10} yi^2 = 49014 \text{ and } \sum_{i=1}^{10} xiyi = 44634.$$

Find the regression equation of Y on X.

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

a) The weight of food packed in certain containers is a normally distributed random variable with a mean weight of 500 pounds and a standard deviation of 5 pounds. Suppose a container is picked at random, find the probability that it contains,

i) More than 510 pounds.

ii) Less than 498 pounds.

b) For a bivariate data (x_i, y_i) $i = 1,2 \ldots. n$, explain the method of fitting the regression equation of Y and X.

c) For a trivariate data (X_1, X_2, X_3) the following information is given :

$\sigma_1 = 2.81$ $\sigma_2 = 12$ $\sigma_3 = 1.5$

$\gamma_{12} = 0.75$ $\gamma_{23} = 0.54$ $\gamma_{13} = 0.43$

Calculate the partial regression co-efficients $b_{12.3}$ and $b_{21.3}$. Hence or otherwise calculate $\gamma_{12.3}$

d) Explain the test procedure for testing H_0: $\mu = \mu_0$ against H_1: $\mu<\mu_0$ for sample of size n, (n<30) taken from a normal population at α% level of significance.

e) A machine is known to produce 30% defective tubes. After repairing the machine, it was found that it produced 22 defective tubes in the first run of 100. Is the true proportion of defective tubes reduced after the repairs? Use 1% level of significance.

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

a) For a bivariate data (X, Y) , the regression equations are given by, 8X –10Y + 66 = 0 and 40X – 18Y = 214. Find,

i) the means of X and Y.

ii) correlation co-efficient between X and Y.

b) Let X and Y be two independently normally distributed random variables with parameters (5, 16) and (10, 25) respectively. State the distribution of,

i) $X + Y$

ii) $X - Y$

iii) $2X - 10$

iv) $-Y/5$.

c) Explain the following terms :

i) null hypothesis

ii) level of significance

iii) critical region

iv) two sided test

d) A store asked 500 of its customers whether they were satisfied with the service or not. The response was classified according to the sex of the customer and is given in the following table :

	Male	Female
Satisfied	140	231
Not satisfied	39	90

At 5% l.o.s. test the hypothesis whether the satisfaction of the customer depends upon sex.

e) Complete the following ANOVA table and write your conclusion at 5% l.o.s.

Source of variation	*df*	SS	MSS	F ratio
Between	6	210.7	☐	☐
Within	18	187.2	☐	
Total	24	397.9		

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Total No. of Questions : 5]

SEAT No. :

P616

[Total No. of Pages : 2

[4241] - 503

M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 503 : Digital Image Processing

(2008 Pattern) (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.***
3) ***Use of log table / calculator is allowed.***

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

a) State the purpose of Digital Image Processing.

b) What is 'Image Restoration'?

c) What do you understand by Gamma correction?

d) What information can be obtained from the histogram?

e) Explain the term - Random Noise.

f) Define the term - Texture.

g) Explain the histogram based method of segmentation.

h) Justify - All image processing techniques require input data in digital format.

i) Comment - Lossy type of image compression method is not invertible.

j) Justify - Quality of picture depends on the number of gray levels.

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

a) Explain in detail the elements of digital image processing.

b) Write a short note on 'Image acquisition method'.

c) Discuss in detail the spatial and intensity level resolution.

d) Differentiate between Image Processing and Image analysis.

e) Discuss the sampling and quantization of digital image.

P.T.O.

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

a) What is segmentation? Give its applications.

b) Differentiate between Image Enhancement and Image Restoration.

c) Explain in detail the enhancement techniques in spatial domain used for images.

d) What is threshold? Explain how to obtain the threshold for segmentation.

e) Explain with suitable example the difference between Correlation and Convolution.

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

a) Explain Zooming of an image. Does it increase the information content of an image?

b) Describe the general compression system model.

c) What is biometrics? Explain the role of image processing in fingerprint identification.

d) Discuss the method of Brightness and Contrast Control.

e) Discuss the applications of digital image processing in biology and agriculture.

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

a) Explain the discrete fourier transform and give its applications in image processing.

b) Explain basic principles of detecting following in the image.

  i) Point.

  ii) Line.

  iii) Edge.

c) State different types of biomedical imaging techniques. Discuss their role in medical diagnosis.