P 834   **[4041] - 101**

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 101 : Real Analysis

(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.

   a) Give an example of a metric space x in which d (A,B) = 0, although A $\cap$ B $= \phi$, where A & B are subsets of X.

   b) Prove that $\overline{A \cap B} \subseteq \overline{A} \cap \overline{B}$ and give an example where equility fails.

   c) Show that $\displaystyle\lim_{n \to \infty} \frac{3 + 2\sqrt{n}}{\sqrt{n}} = 2$

   d) Show that the sequence $\{S_n\}$, where $S_n = 1 + \frac{1}{2} + \frac{1}{3} + - - - + \frac{1}{n}$ cannot converge.

   e) Let $f_1 \in R(\alpha)$, $f_2 \in R(\alpha)$ on [a, b] and $f_1(x) \le f_2(x)$ on [a, b]. Prove that

   $$\int_a^b f_1 \, d\alpha \le \int_a^b f_2 \, d\alpha$$

   f) Show that $\displaystyle\sum_{n=1}^{\infty} \frac{a_n}{n}$ converges uniformely in [0,1], if $\displaystyle\sum_{n=1}^{\infty} a_n$ converges.

   g) Let f: [-1, 1] $\to$ [-1, 1] be continuous. Show that there exists c $\in$ [-1, 1] such that f(c) = c.

   h) Show that the function f defined as $f(x) = \frac{1}{2^n}$, when $\frac{1}{2^{n+1}}, < x < \frac{1}{2^n}$, n = 0, 1, 2, --- f(0) = 0, is integrable on [0, 1].

   i) Is arbitrary intersection of open set, open?

   j) Discuss the connected ness of following:
      i) Q - the set of all rational numbers.
      ii) X = $\{x \in R / -1 \le x < 0 \text{ or } 0 < x \le 1\}$ with usual metric induced from R -the set of real numbers.

Q2) a) Attempt any one of the following:

    i)   Let X is a metric space and Y $\subseteq$ X. Prove that a subset E of Y is open relative to Y if and only if E = G$\cap$Y for some open subset G of X.

    ii)   Let $\{S_n\}$ be Monotonic sequence prove that $\{S_n\}$ converges if and only if it is bounded.

  b) Attempt any two of the following :

    i)   Prove that every infinite subset of a compact set K has limit point in K.

    ii)   Prove that a mapping f from 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.

    iii)   Show that $\lim\limits_{x \to 0} \dfrac{1}{4}\sin\dfrac{1}{4}$ does not exists.

Q3) a) Attempt any one of the following.

    i)   Prove that the continuous image of a compact metric space is compact.

    ii)   Let f be a continuous real valued function on the interval [a, b]. If $f(a) < f(b)$ and if c is a number such that $f(a) < c < f(b)$, then show that there exists a point $n \in$ (a, b) such that $f(x) = C$.

  b) Attempt any two of the following.

    i)   Suppose f is a continuous mapping of [a, b] into R^k and f is differentiable in (a, b). Prove that there exists n$\in$ (a, b) such that $|f(b) - f(a)| \le (b-a)|f^1(x)|$.

    ii)   Prove that $\int\limits_{\underline{a}}^{b} f \, d\alpha \le \int\limits_{a}^{\overline{b}} f \, d\alpha$

    iii)   Verify mean value Theorem. $f(x) = \dfrac{1}{x^2}$ and $g(x) = \dfrac{1}{x}$ in $[a,b], a > 0$.

Q4) a) Attempt any one of the following.

    i)   State and prove the Taylor's Th^m.

    ii)   Prove that a continuous mapping from a compact metric space X to any other metric spaceY is uniformly continuous on X.

b) Attempt any two of the following.

i) Let $f \in R[a,b]$. for $a \le x \le b$, put

$$F(x) = \int_a^x f(t)\,dt.$$ prove that F is continuous on [a, b].

ii) Let $\{f_n\}$ be a sequence of continuous functions on set E and $f_n \to f$ uniformely on E. Prove that f is continuous on E.

iii) Show that the sequence $\{f_n\}$, where $f_n(x) = \dfrac{nx}{1+n^2x^2}$ is not uniformely convergent on any interval containing. 0.

Q5) a) Attempt any one of the following:

i) Prove that $f \in R(\alpha)$ on [a, b] if and only if for every $\in > 0$ there exists a partion P such that $U(p, f, \alpha) - L(p, f, \alpha)\alpha \in$.

ii) State and prove the fundamental theorem of calculus.

b) Attempt any two of the following:

i) Let l^p be the set of all real sequences for which $\displaystyle\sum_{i=1}^{\infty} |x_i|^p < \infty$.

Define the metric d in l^p by $d(x,y) = \left(\displaystyle\sum_{i=1}^{\infty} |x_i - y_i|^p \right)^{1/p}$ for $x, y \in l^p$.

Prove that (l^p, d) is a complete metric space.

ii) Show that the function f defined by

$$f(x) = \begin{cases} 0, & x\,is\,rational \\ 1, & x\,is\,irrational \end{cases}$$

is not integrable on any interval.

iii) Let Y be a connected set in a metric space (x,d) and Z be a set such that $Y \subseteq Z \subseteq \overline{Y}$. Prove that Z is connected.

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P 835   **[4041] - 102**

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 102 : Algebra - I

(New) (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) Answer in short any <u>eight</u> of the following: **[16]**

   a) Determine whether the following statement is true or false; Justify your answer.

     $(G, *) = (Z_2 \times Z_2, +)$ is a cyclic group.

   b) Let σ = (1, 2, 3, 4, 5) (1, 2, 3) (4, 5) in S_5. Determine whether σ^{-1} is an even permutation or odd permutation.

   c) Determine whether the following statement is true or false. Let G be a group and a, b $\in$ G. 0 (a) = 2, 0(b) = 3, then 0 (ab) = 6.

   d) Let $(G, *) = (R^2, +)$ be a group and $(H, *) = \{(a, a) \,|\, a \in R\}$ be a subgroup of G. Find all co-sets of H in G and explain graphically.

   e) Find conjugacy classes of R_{180} and R_{270} in $(D_4, 0)$ where,

     $(D_4, 0)$ is a dihedral group of order 8 under composition and R_{180}, R_{270} indicate rotation of a square by 180º, 270º respectively.

   f) Give an example of a ring 'R' such that R is non-commutative but its subring 'S' is commutative.

   g) Prove that every field is an integral domain.

   h) Prove that $X^2 + 1$ is irreducible over Z_7.

   i) Find characteristics of each of the following rings:

     a) 2 Z   b) $Z_6 \times Z_{15}$

   j) Determine whether the following statement is true or false, Justify your answer.

     'Every subring is an ideal of the ring.'

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

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

      ii)   Let G be a group and H, K be subgroups of G such that K is normal in G then prove that H∩K is normal subgroup of H.

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

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

      ii)   Find all left and right cosets of $(A_3, 0)$ in $(S_3, 0)$.

      iii) Let (G, .) be a group and a, b ∈ G. Then b is said to be conjugate of a if ∃ $x \in$ G. Such that $b = x\,a\,x^{-1}$. This relation is said to be conjugacy relation.
Show that being conjugate is an equivalence relation.

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

      i)   State and prove fundamental theorem of group homomorphism.

      ii)   Let (G, .) be a group and H be a subgroup of G, and let a, b ∈ G then prove that

      aH = bH or aH ∩ bH = ϕ

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

      i)   If ϕ : G →G^1 be a homomorphism and K : Ker ϕ then show that K is normal subgroup of G.

      ii)   Show that a group of order 42 cannot be a simple group.

      iii) Let (G, .) be a finite group and H be its subgroup. Then show that if [G : H] = 2 i. e. index of H in G is 2 then H is normal subgroup of G. Is the converse true? Justify your answer.

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

      i)   Let $\phi : R \to R'$ be a ring homomorphism prove that

      a)   Ker ϕ is an Ideal of R.

      b) ϕ (R) is subring of R'.

      ii)   Let R be a commutative ring with unity. If M is a maximal ideal of R then prove that $\dfrac{R}{M}$ is a field.

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

i) Let R be a ring and S_1, S_2 be subrings of R. Then show that $S_1 \cap S_2$ is also a subring of R. What can you say about union of two subrings of R? Justify your answer.

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

iii) Find all prime ideals of Z_{12}.

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

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

ii) State and prove Eisenstein's Criterion for irreducibility.

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

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

ii) Define content of the polynomial and find content for following polynomials:

   a) $8x^4 + 4x^3 + 12x + 16$

   b) $9x^3 + 6x + 3$

   c) $100x^4 + 50x^3 + 25x^2 + 13$.

iii) Prove that $Z_3[x] / < x^3 + 2x + 2 >$ is a field containing 27 elements.

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P836   **[4041]-103**

M.Sc. Tech. - I (Sem. - I)
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 103 : Discrete Mathematical Structures - I
(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.*
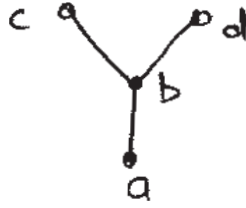
Q1) Attempt <u>any eight</u> of the following: **[16]**

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

b) How many numbers must be selected from the set {1, 2, 3, 4, 5, 6} to guarantee that at least one pair of these numbers add upto 7 ?

c) Draw Hasse diagram of $(D_{12}, 1)$, where D_{12} is the set of all divisors of 12.

d) On the set of natural numbers N, define a binary operation $*$ by
$a * b = \min \{a, b\}, \ \forall\, a, b \in N$.
Is $(N, *)$ a semigroup ?

e) Transcribe the following into logical notation. Let the universe of discourse be the real numbers: "for every value of x there is some value of y such that xy = 1".

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

g) State the dual of
$a \vee (b \wedge a) = \bar{a}$.

h) Define an atom of a Boolean Algebra
$(B, ^{-}, \vee, \wedge)$

i) Let $A = \{a, b, c\}$. Consider the semigroup $(A^*, \cdot)$ where $\cdot$ is the operation of catenation. If $\alpha = abac$, $\beta = cba$, $\gamma = babc$.
Compute $(\alpha \cdot \beta) \cdot \gamma$ and $\gamma \cdot (\alpha \cdot \alpha)$.

                                                            P.T.O.

j) Does the poset whose Hasse diagram is given below represent a lattice? Justify.

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

    i) Show that the hypothesis

       $\neg p \wedge q, r \rightarrow p, \neg r \rightarrow s$ and $s \rightarrow t$ leads to the conclusion t.

    ii) Show that $(p \wedge q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$ are not logically equivalent. **[10]**

  b) Attempt <u>any two</u> of the following:

    i) Prove that if the lattices L and M are distributive then L×M is distributive.

    ii) Find a counter example, if possible, to the following universally quantified statements, where the domain for all variables consists of all integers.

      α) $\forall x (x^2 \geq x)$ β) $\forall x (x>0 \vee x<0)$

      γ) $\forall x (x=1)$

    iii) Construct circuits that produce the following outputs

      α) $\bar{x} \, (\overline{y + \bar{z}})$ β) $(x + y + z) \cdot (\bar{x} \cdot \bar{y} \cdot \bar{z})$

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

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

    ii) Prove that if a poset $(L, \leq)$ is a lattice then every non-empty finite subset of L has sup and inf.

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

    i) Show that the hypothesis "If you send me an e-mail message, then I will finish writing the program." "If you do not send me an e-mail message, then I will go to sleep early". and "If I go to sleep early, then I will wake up feeling refreshed" lead to the conclusion "If I do not finish writing the program,then I will wake up feeling refreshed".

ii) How many permutations of the letters A B C D E F G contain

α) the string BCD β) the strings BA and GF

γ) the strings ABC and CDE

iii) Use k - Maps to simplify the sum - of - products expansion.

$$x\,y\,z + x\,\bar{y}\,z + x\,\bar{y}\,\bar{z} + \bar{x}\,y\,z + \bar{x}\,y\,\bar{z} + \bar{x}\,\bar{y}\,\bar{z}$$

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

i) Show that in Boolean algebra, the distributive Law $x\,(y + z) = x\,y + x\,z$ is valid.

ii) State and prove De Morgan's Laws in a Boolean algebra.

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

i) Find the sum - of - products expansions (disjunctive normal form) of the Boolean function $f(x, y, z) = x + y + z$.

ii) Prove that $p \rightarrow q, \neg\, p \rightarrow r, s \rightarrow \neg\, r, s$ leads to the conclusion q by using indirect method.

iii) Is the following tattice modular? Justify!
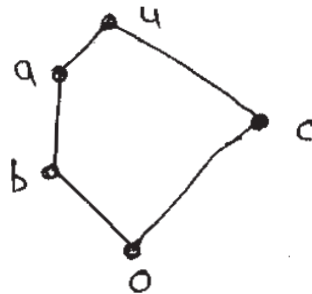
Q5) a) Attempt <u>any one</u> of the following: **[6]**

i) Prove that duod of a complemented lattice is complemented.

ii) Prove that any quotient lattice of a lattice L is a homomorphic image of L.

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

i) Define a congruence relation. Let A = {0, 1} and consider the free Semigroup $(A^{*}, \cdot)$ generated by A. Define the following relation on A. α R β if and only if α and β have the same number of 1's show that R is a congruence relation on $(A^{*}, \cdot)$.

ii) A total of 1232 students have taken a course in Spanish, 879 have taken a course in French, and 114 have taken a course in Russian. Further, 103 have taken courses in both Spanish and French, 23 have taken courses in both Spanish and Russian, and 14 have courses in both french and Russian. If 2092 students have taken at least one of Spanish, French and Russian, how many students have taken course in all three language?

iii) Explain the Quine - Mc Cluskey Method for simplifying sum - of - Products expansions.

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P 837   **[4041] - 104**

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 104 : C Programming

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

   a) State any four escape sequences.

   b) Explain any two modes in which file can be opened?

   c) Give any two advantages of using functions.

   d) Write the output of:

   ```
   # include < stdio. h >
   Void main( )
   {
       int a = 10;
       long int b = 20;
       a = size of (+ + b);
       printf ("%d %d", a, b);
   }
   ```

   e) How to access data member from structure? Explain.

   f) Give any two rules to declare a variable.

   g) What is a pointer? Write any two uses of pointer.

   h) Write the output of:

   ```
   # include < stdio. h >
   main ( )
   {
       static int a [ ] = {10, 20, 30};
       static int *mess[ ] =  {a, a + 1, a + 2};
       printf ("%d %d,%d", size of (a), size of (mess), size of (mess [1]));
   }
   ```

i)   What do you mean by a bitwise operator in C?

j)   Write the output of:

```
# include < stdio. h >

main ( )

{
    int x = 1;

    while (x = = 1)

    {
        x = + + x + 1;

        printf ("\ n %d", x);

    }

}
```

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

a)   Write a C program to find the multiplication of two matrices.

b)   Write a program to accept the string and count the occurrences of character in string using pointer and function.

c)   Write a program to accept two filenames as command line arguments and copy the contents of first file to the second file.

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

a)   Write a C program to calculate the factorial of a number using recursion.

b)   What is the difference between call by value and call by references? Explain with example.

c)   Write a note on while loop.

d)   Explain increment and decrement operator in C.

e)   Explain the concept of pointer to function with example.

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

a)   What is a recursion?

b)   Give the syntax of for loop.

c)   "C does not perform for the bound checking of an array". Justify?

d) Write the output of:

```
main ( )
{
    static int n [ ] = {10, 20, 30, 40, 50};
    static int *p [ ] = {n, n+1, n+2, n+3, n+4};
    static int ** ptr = p;
    **ptr ++;
    printf ("%d %d %d", ptr–p, *ptr – n, ** ptr);
    ++ ** ptr;
    printf ("%d %d %d", ptr–p * ptr – n, **ptr);
}
```

e) What do you mean by block scope and file scope of variable.

f) Write the syntax of fwrite ( ) and fread ( ).

g) Explain the conditional operator in C.

h) What are preprocessor directives.

i) Write the output of:

```
main ( )
{
    static char *S [ ] = {"Red", "Blue", "Yellow"};
    printf ("%d", size of (s) );
    printf ("\n %d", size of (s[1]));
    printf ("\n %d", size of (*s[1]));
}
```

j) What is DMA?

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

a) What is a file? State any four operations on file by giving proper example.

b) Explain break and continue statements.

c) Write a C program to generate n terms of Fibonacci sequence 1, 1, 2, 3, 5, 8, 13, ...

d) Write a note on two - dimensional array in C.

e) Explain the functions malloc ( ) and realloc ( ).

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P838   **[4041]-105**

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 105 : Elements of Information Technology
(2008 Pattern)

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

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

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

a) Explain any 2 characteristics of a computer.

b) State any 2 serial port input devices.

c) Give the binary representation of following decimal numbers.
   i)   10   ii)   15

d) What is cache memory?

e) Define operating system.

f) What is time sharing. System.

g) State and explain briefly any 2 types of file organization.

h) Define
   i)   Dense index.
   ii)   Unclustered index.

i) Define Rom. State different types of Rom.

j) What are features of multiprogramming operating system.

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

a) Give the types of printers. With necessary diagram, discuss working of Dot Matrix printer.

b) Discuss with necessary diagram, the basic structure of a computer.

c) Explain different services provided by operating system.

d) Discuss with suitable diagram working of bus topology.

e) Explain tree structured indexing.

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

   a) Write a note on ASCII code.

   b) What is memory? Explain primary memory and its different types.

   c) Write a note on 4th generation of computers.

   d) Explain different applications of networks.

   e) What is heap file organization? Compare it with sequential file organization.

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

   a) Explain how an element is inserted in sparse index. Give suitable example.

   b) Discuss physical and logical files. What are special characters in files?

   c) Write a note on distributed system.

   d) State and explain different networking protocols.

   e) With suitable diagram explain the working of video Display unit.

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

   a) Explain the concept of Information Technology. Discuss any four of its applications.

   b) State and explain different components of networks.

   c) Explain the concept of software. In detail discuss the classification of software.

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P 839   **[4041] - 201**

M.Sc. Tech. - I (Sem. - II)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 201 : Real and Complex Analysis

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

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

   b) If m* A = 0 then prove that A is measurable.

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

   d) If *f* and *g* are integrable over E and if A and B are disjoint measurable sets contained in E, then prove that $\int\limits_{A\cup B} f = \int\limits_{A} f + \int\limits_{B} f$.

   e) Prove that continuous functions are measurable on a closed and bounded interval.

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

   g) Determine whether the function $f(z) = xy + iy$ is analytic every where?

   h) Derive polar form of the Cauchy-Riemann equations.

   i) Find radius of convergence of the complex series $\sum\limits_{n\geq 0} \dfrac{z^{2n}}{2^n}$.

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

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

   i)   'The outer measure of an interval is its length'. Prove the above statement.

   ii) Let $\{A_n\}$ be a countable collection of sets of real numbers. Then

   $m*\left[\bigcup\limits_{n=1}^{\infty} A_n\right] \leq \sum\limits_{n=1}^{\infty} m*A_n.$

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

   i)   Let X_E indicates characteristic function of a set E. Then show that

      a) $X_{A \cap B} = X_A . X_B$

      b) $X_{A \cup B} = X_A + X_B - X_A . X_B$

      c) $X_{\bar{A}} = 1 - X_A$; where $\bar{A}$ = Complement of A.

   ii)   Let f be a measurable function and $f = g$ a.e, prove that g is measurable.

   iii) If f and g are non - negative measurable functions then prove that

$$\int_E (f + g) = \int_E f + \int_E g.$$ where $E \subseteq R$.

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

   i)   State and prove Bounded convergence theorem.

   ii)   Let f be a bounded function defined on $[a, b]$. If f is Riemann integrable on $[a, b]$ then prove that it is measurable and

$$R\int_a^b f(X) dX = \int_a^b f(X) dX.$$

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

   i)   Suppose f is analytic in a Domain D. Prove that if $f^1(z) \equiv 0$ in D then f is constant function.

   ii)   Show that $u(x, y) = \dfrac{1}{2} \log(x^2 + y^2)$ is a harmonic function. Obtain its harmonic conjugate.

   iii) Let f be differentiable at $Z_0 \in C$. Show that f is continuous at Z_0. Is the converse true? Justify.

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

   i)   Let $f(z) = \sum\limits_{n=0}^{\infty} a_n z^n$ have the radius of convergence R > 0. Prove that the series $\sum\limits_{n=0}^{\infty} n a_n z^{n-1}$ has radius of convergence R.

   ii)   State and prove Cauchy's Residue Theorem.

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

    i)   Obtain Laurent series for the function

$$f(z) = \frac{z^2-1}{(z+3)(z+4)} \text{ valid for } 3<|z|<4$$

    ii)   Show that cross ratio is invarient under Möbius transformation.

    iii) Let f be analytic in a simply connected domain D and γ be a closed contour in D and $a \in D - \{\gamma\}$ Prove that

$$f(a)\eta(\gamma; a) = \frac{1}{2\pi i} \int_\gamma \frac{f(z)}{z-a} dz \text{ where } \eta (\gamma;a) \text{ is winding number of } a$$

with respect to γ .

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

    i)   Show that the composition of two Möbius transformations is again a Möbius transformation.

    ii)   State and prove Liouville's theorem.

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

    i)   Using Cauchy's residue theorem compute

$$\int_0^{2\pi} \frac{d\theta}{5+3\cos\theta}.$$

    ii)   Prove that for every closed contour γ in C and $a \in C - \{\gamma\}, \eta(\gamma;a)$ is an integer.

    iii) Prove that every zero of a nonzero analytic function f is isolated.

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P840   **[4041]-202**

M.Sc. Tech. (Sem. - II)
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 202 : Algebra - II
(2008 Pattern)

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

Instructions to the candidates:
1) *All questions are compulsary.*
2) *Figures to the right indicade full marks.*

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

     a) Prove that if two vectors are linearly dependent, one of them is a scalar multiple of the other.

     b) Let V be the vector space of all nxn matrices over R, the set of real numbers and W be the set of all matrices in V such that

$$W = \left\{ [a_{ij}] \,\middle|\, a_{ij} = -a_{ji} \text{ for all } i, j \right\}$$

        Show that W is a subspace of V

     c) Let S = {(1, 0, –1), (1, –1, 0), (2, 1, 3)}. Is S a basis of R^3? Justify

     d) Let R [x] denote the set of all polynomials having real coefficients. Show that $T: R[x] \to R[x]$ defined by

$$T\left(\sum_{i=0}^{n} a_i x^i \right) = \sum_{i=0}^{n} iai\, x^{i-1}$$

        is a linear transformation

     e) Let S= {u_1,..., u_n}be an orthonormal set in a vector space V. Show that S is a linearly independent set.

     f) Show that if [E :F] = 2 then E/F is a normal extension.

     g) Show that Q[i] / Q is a Galois extension.

     h) Let F = $Z/2Z$. Give an example of an irreducible polynomial of degree 3 over F.

i) Give an example of an in separable extension.

j) Show that $Q(\sqrt{2},i)=Q(\sqrt{2}+i)$

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

    i) Let V be a vector space which is spanned by a finite set of vector $\beta_1,..,\beta_m$. Then show that any independent set of vectors in V is finite and contains no more than m elements.

    ii) Let T be a linear operator on the finite dimensional vector space V Let $C_1,....,C_k$ be the distinct characteristic values of T and let Wi be the space of characteristic vectors associated with the characteristic value C_i. If $W=W_1 +...+ W_k$ then show that dim W = dim $W_1 +... + $ dim W_k.

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

    i) Let $T : R^3 \rightarrow R^3$ defined by
$T(x, y, z) = (x - y + 2z, 2x + y, - x - 2y + 2z)$.
Show that T is a linear transformation. Find rank and nullity of T.

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

$$\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$$

Prove that T is diagonalizable.

    iii) Let V be the set of all nxn matrices over R.
If U denotes the set of all upper triangular matrices and L denotes the set of all lower triangular matrices then find dim (U), dim (L) and dim (U∩L)?

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

    i) Let V be an inner product space and α, β be vectors in V Show that

$$|(\alpha|\beta)|\le \|\alpha\|\|\beta\|$$
$$\text{and} \|\alpha+\beta\|\le \|\alpha\|+\|\beta\|$$

ii) Let V be an inner product space and $\beta_1, ..., \beta_n$ be any independent vectors in V. Prove that one can construct orthogonal vectors $\alpha_1, ..., \alpha_n$ in V such that for each $k = 1, 2, .., n$ the set $\{\alpha_1, ..., \alpha_k,\}$ is a basis for the subspace spanned by $\beta_1, ..., \beta_k$

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

i) Let A and B be nxn matrices over the field F. Prove that it (I-AB) is invertible then (I-BA) is invertible.

ii) Show that every abelian group is a Z -module Give an example of a tree module of rank n.

iii) Let V be a finite dimensional vector space over the field F, and let W be a subspace of V. Prove that
dim W + dim W$^{\circ}$ = dim V.

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

i) Let K be an extension of field F and $a \in K$. Show that a is algebraic over F if and only if F (a) is a finite extension of F.

ii) If F is a field of characteristic O and if a, b, are algebraic over F then prove that there exists an element $c \in F(a, b)$ such that $F(a,b) = F(C)$.

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

i) If P is a prime number, then show that the splitting field of the polynomial $x^p - 1$ over the field of rational numbers is of degree p–1.

ii) Let F be a finite field of characteristic P. Show that F has P^n elements for some positive integer n.

iii) Let P(x) be an irreducible polynomial of degree 2011 over a field F. If P(α) = 0 then prove that F (α) = F (α^2).

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

i) Let K/F be a Galois extension with Galois group G. Let H be a subgroup of G. If E = $\{x \mid \sigma(x) = x$ for every $\sigma \in H\}$ then show that k/E is a Galois extension with Galois group H.

ii) Let $f(x) \in F(x)$ be an irreducible polynomial. If characteristic of F is zero then show that $f(x)$ has no multiple roots. If characteristic of F is $p \neq o$, then show that f (x) has a multiple root if and only if it is of the form $f(x) = g(x^p)$.

b) Attempt _any two_ of the following: **[10]**

  i) Let $K = Q(i, w)$. Show that K/Q is a Galois extension Find $[K; Q]$.

  ii) "If K/E and E/F are normal extensions then K/F is a normal extension" Is this statement true or false? Justify your answer.

  iii) Find the Galois group of $x^3 - 7$ over the field of rationds.

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

P841   **[4041]-203**

M.Sc. Tech. - I (Sem. - II)

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 203 : Discrete Mathematical Structures - II

(2008 Pattern)

Time : 3 Hours]   [*Max. Marks : 80*
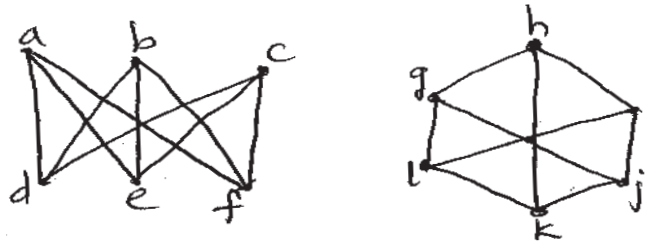
Instructions to the candidates:

   1)   *All questions are compulsory.*

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

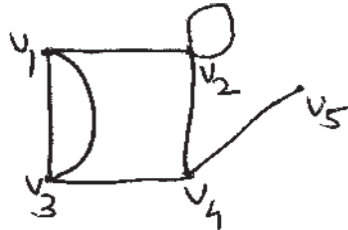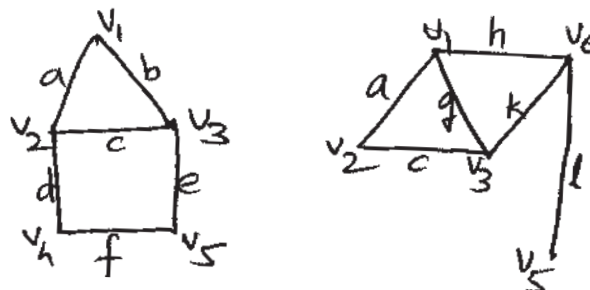*Q1)*   Attempt <u>any eight</u> of the following: **[16]**

   a)   Show that the following graphs are isomorphic

   b)   Verify the Hand Shaking lemma in the following graph.

   c)   Define the union of two graphs. Determine the ring sum of the following graphs.

   d)   Draw all non isomorphic trees on 7 vertices such that one vertex is of degree at least 4.

P.T.O.

e) Find the rank and nullity of the complete graph K_4.

f) Find the graph represented by the following adjacency matrix.

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

g) Define : Asymmetric digraph and complete symmetric digraph.

h) Show that in any simple, connected planar graph with f regions, n vertices and e edges $(e > z)$ the inequality $e \leq 3n - 6$ holds.

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

j) Find the incidence matrix of the following graph.
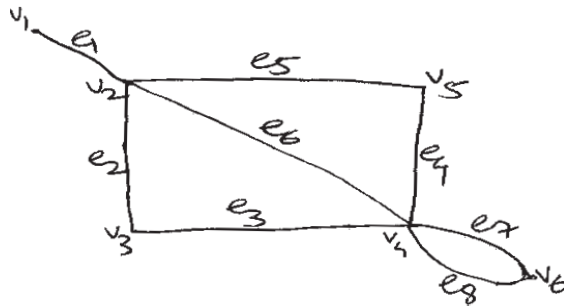
Q2) a) Attempt <u>any one</u> of the following: **[6]**

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

ii) Prove that a simple graph with n vertices and k components can have at most $(n - k)(n - k + 1)/2$ edges.

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

i) Prove that if a graph G is an Euler graph then all vertices of G are of even degree.

ii) Prove that a tree with n vertices has $n-1$ edges.

iii) Define a binary tree.
Show that the number of vertices n in a binary tree is always odd.
Find the number of pendant vertices in a binary tree T.

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

    i) Use the Kruskal's algorithm to find a shortest spanning tree in the following weighted graph.
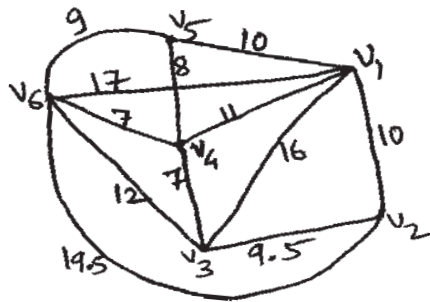
    ii) Prove that a connected planar graph with n vertices and e edges has *e-n*+2 regions.

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

    i) Let X be the adjacency matrix of a simple graph G. Show that the ijth entry in X^r is the number of different edge sequences of r edges between vertices v_i and v_j.

    ii) Describe the Depth-first search algorithm.

    iii) Use Fleury's algorithm to construct an Euler circuit for the following graph.
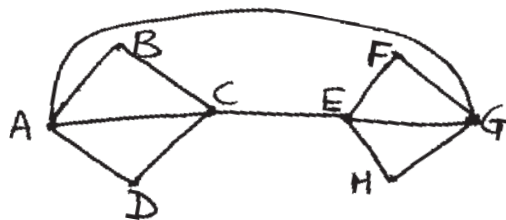
Q4) a) Attempt <u>any one</u> of the following: **[6]**

    i) Use the Ford and Fulkerson algorithm to find a maximal flow and a cut with capacity equal to this flow for the following network.
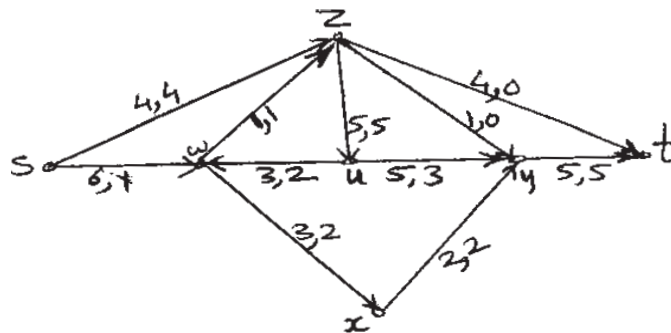
ii) Let f be a flow on a network $N = (V, A)$ and let f have value d. Prove that if $A(X, \overline{X})$ is a cut in N then

$$d = f(X, \overline{X}) - f(\overline{X}, X) \text{ and } d \leq c(X, \overline{X})$$

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

   i) Let $G = C_n$, the cycle of length n.

   Show that $X(C_n) = \begin{cases} 2, \text{if } n \text{ is even} \\ 3, \text{If } n \text{ is odd.} \end{cases}$

   Prove that $X(G) = 1$ if and only if G is an empty graph.

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

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

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

   i) Describe the simple sequential colouring Algorithm.

   ii) Find a colouring of the following bipartite graph using the Largest-First sequential Algorithm (Welsh and Powell)
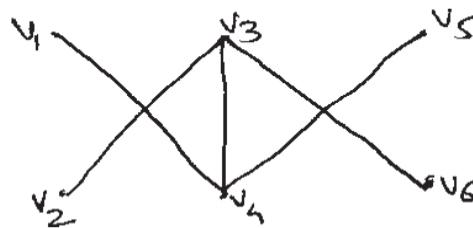
b) Attempt <u>any two</u> of the following: **[10]**

   i) Let $K_{n,n}$ have bipartition $V = X \cup Y$, where
   $X = \{x_1, \dots, x_n\}$ and $Y = \{y_1, \dots, y_n\}$ and denote the colours of the edge colouring by $1, 2, \dots, n$. We define the n×n matrix $A = (a_{ij})$ by $a_{ij} = k$, where $x_i y_k$ is the edge coloured j. Show that A is a Latin square.

   ii) Describe the Warshall-Floyd algorithm for finding shortest path between all pairs of vertices.

   iii) Describe the Smallest-Least Sequential Algorithm.

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P842   **[4041]-204**

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 204 : Database Fundamentals

(2008 Pattern)

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

Instructions to the candidates:

1) All questions are compulsary.

2) Figures to the right indicade full marks.

Q1) a) Attempt the following: **[10]**

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

i) Draw E-R dig. For given case study.

ii) Convert E-R diagram into relational database by specifying relational schema.

iii) Identify primary key for each entity set.

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

i) Explain the term 'relation' in relational data model. Explain different types of relationships with example.

ii) Write a note on hierarchical data model.

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

a) Explain advantages of DBMS.

b) What is meant by Data Model? Explain any one type.

c) Explain integrity constraints.

d) Consider following database:

Customer (cust ₋ ID, cust ₋ name)

Account (AC ₋ no, cust ₋ID, AC ₋ Type)

Write PL/SQL block for the following:

Accept name of customer and display his all details.

e) Define :
   i)   DDL
   ii) DML

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

   a) Write a note on normalization.

   b) What is Cartesian product? Explain with example.

   c) What is group by clause ? Explain with example.

   d) Consider following relational schema:
       Wholesaler (wno, wname, address, city)
       product (pno, pname)
       w- product (wno, pno)
       solve the following queries in SQL:
       i)   Delete record of wholesalers having product 'cabel'.
       ii)   Count number of wholesalares from city 'Pune'.
       iii) Update the address of wholesaler having who greater than 30.
       iv)   List all products.

   e) Write note on structure of DBMS.

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

   a) Explain following terms with suitable example
       i)   Entity
       ii)   Attributes

   b) Write a note on cursors.

   c) Explain tuple relational calculus.

   d) Consider following relational schema:
       Doctor (doc‿ no, name, specialization)
       Hospital (Hospno, name, address)
       Doctor and Hospital are related with many-many relationship. Create a
       relational data base in 3NF and solve following queries in SQL.
       i)   List name of Doctors with specialization 'cardiac'.
       ii)   List names of doctors visiting 'Birla Hospital'.
       iii) Delete all doctors working with 'care Hospital'.
       iv)   Insert a record in Doctor table.

e) Explain following commands with example.
   i) Update
   ii) Alter

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

   a) Define:
      i) Super key
      ii) DCL
      iii) Generalization
      iv) Data Independence

   b) Write a note on aggregation.

   c) Write a note on relational algebra explain selection, projection.

   d) Explain following aggregate functions with example.
      i) min ( )
      ii) max ( )
      iii) count ( )
      iv) sum ( )

   e) Write a not on joins in SQL.

■■■

P843   **[4041]-205**

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 205 : Data Structures Using C

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

    a) What is stack? Explain different operations performed on stack.

    b) Transform the following infix expression to postfix.
        A - B $*$ (C - D) + (M - N)

    c) List the applications of linked list.

    d) Define data type and data structure.

    e) Distinguish between queue and circular queue.

    f) What is ADT ? Give any two examples.

    g) What is the best case and waste case of quick sort.

    h) Define i) Isolated vertex ii) Pendant vertex.

    i) What are polish notations.

    j) Define priority queue.

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

    a) Write a 'C' program to create a doubly linked list and to delete an element from it.

    b) Write a 'C' program to soft the 'n' elements in descending order using bubble sort.

    c) Write a 'C' program to demonstrate the depth first search method of graph traversal.

P.T.O.

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

a) Give adjacency list representation of the following graph.
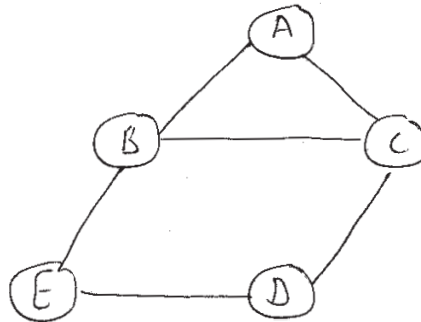
b) Define the following
   i)   Complete binary tree ii) Strictly binary tree.

c) Write an algorithm to evaluate the postfix expression.

d) What is doubly ended queue.

e) What is linked list? How is it represented?

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

a) Explain the quick sort method with the help of an example.

b) Define the following

   i)   Vertex ii) Edge iii) Indegree iv) Outdegree.

c) Differentiate between static and dynamic list.

d) Explain in short binary search tree.

e) What are different representations of graph? Explain adjacency matrix representation of graph.

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

a) Differentiate between linear and non linear data structures.

b) Explain different types of queues.

c) Write a program to check whether the given input expression is well parenthesized.

d) Give the Bfs and Dfs traversal for the following graph.
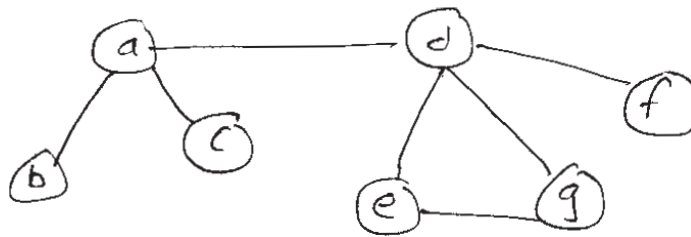
e) What are the advantages of an away over linked list?

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P1425

[4065] - 40

M.E. (Civil) (Structures)

NONLINEAR ANALYSIS OF STRUCTURE

(Elective - I) (2002 Course) (501509)

Time : 4 Hours]   *[Max. Marks :100*

Instructions to the candidates:

   1)   *Answer any two questions from each Section.*

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

   3)   *Assume suitable data, if required.*

   4)   *Use of non programmable calculator is permitted.*

   5)   *Use of stability coefficient table is permitted.*

SECTION - I

Q1) a)   Explain with neat sketch stress - strain relation in elastic, rigid - plastic, elasto - plastic state. **[7]**

     b)   Derive with usual notation the m - ϕ nonlinear equation for beam. **[8]**

     c)   Explain with suitable example the type of nonlinearities in a structure. **[10]**

Q2) a)   Using stress function approach and accounting for geometrical nonlinearity, write strain energies due to stretching and bending and kinetic energy of an orthotropic plate. **[13]**

     b)   Find relation for m - ϕ by approximate solution method, for a beam supported at its two ends and loaded centrally with point load. **[12]**

Q3) a)   Obtain collapse mechanism for a contilever beam of length l loaded with point load at its ends. **[12]**

     b)   Explain step - by step procedure for nonlinear analysis of structure and Newton - Raphson method for solution of equation. **[13]**

SECTION - II

Q4) a)   Derive the nonlinear stiffness matrix with usual notations for plane frame member. **[15]**

     b)   Develop the stiffness matrix in global x - y co-ordinates for member AB of plane frame as shown in fig 4.a **[10]**
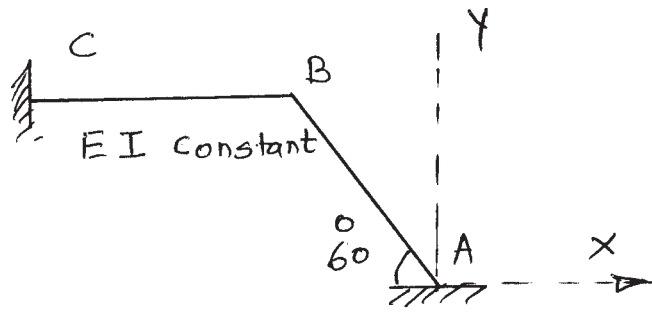
Fig 4.a

Q5) Develop stiffness matrix for non linear analysis of plane frame as shown in Fig 5.a. c/s. of member AB & BC = 1.5×10^6m, E = 200 GPa. **[25]**
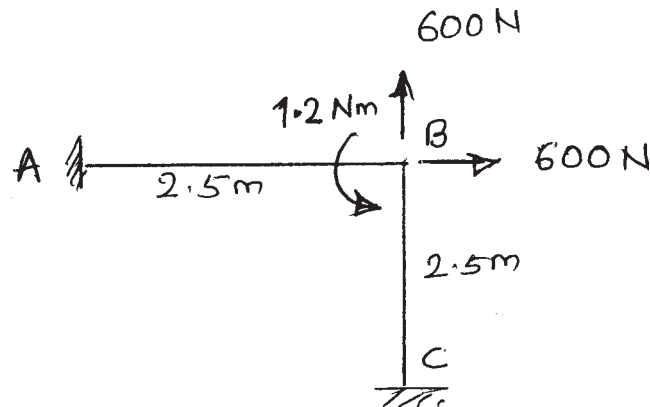
Fig 5.a

Q6) Analyse the prop contilever as shown in fig 6. for elastoplastic range. Assume E = 200 GPa, depth / width ratio of beam as 1. **[25]**
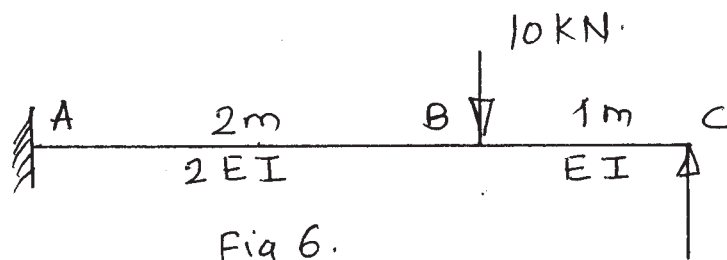
Fig 6.

[4041] - 301

P844

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 301 : Numerical Analysis
(New) (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) Answer <u>any eight</u> of the following:

    a)   What is an ill conditioned matrix?

    b)   Find the rank of a matrix given below.

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 3 & 2 & 1 \end{bmatrix}$$

    c)   Evaluate $\int_{0}^{\pi} t \sin t \, dt$ using the trapezoidal rule.

    d)   Find the root of the equation $2x = \cos x + 3$ by the iteration method correct upto two decimal places.

    e)   Show that $A = \begin{bmatrix} 0 & 2 & 3 \\ -2 & 0 & 5 \\ -3 & -5 & 0 \end{bmatrix}$ is skew symmetric matrix.

    f)   Can either Jacobi or Gauss - Seidel iteration be used to solve following linear system

$$5x + 3y = 6$$
$$4x - 2y = 8.$$

    g)   Find the linear interpolation using Lagrange polynomial that approximate $f(x) = x^3$ using the nodes $x_0 = -1$, $x_1 = 0$.

    h)   For any fixed θ, show that $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ is an orthogonal matrix.

P.T.O

i)   Let λ, v be an eigen pair of a matrix A. If α is any constant, show that $\lambda - \alpha$, v is an eigen pair of matrix $A - \alpha I$

j)   What is successive over relaxation method?

Q2) a)   Answer <u>any one</u> of the following:

   i)   Derive Newton's forward difference formula.

   ii)   Show that $\sum_{k=1}^{N} L_{N.K}(x) = 1$ for all x where $L_{N,K}(x)$ is k^{th} Lagrange coefficient polynomial.

b)   Answer <u>any two</u> of the following:

   i)   Using Newton's method for nonlinear system. Solve the following nonlinear system.

   $x^2 + y^2 = 4$

   $x^2 - y^2 = 1$

   with $(x_0, y_0) = (1.6, 1.2)$

   ii)   If $f(x) = 1/x^2$, find the divided differences [a, b] and [a, b, c].

   iii)   Using Newton's forward difference formula. Find the sum $S_n = 1^3 + 2^3 + ... + n^3$.

Q3) a)   Answer <u>any one</u> of the following:

   i)   Let (x_0, y_0), (x_2, y_2), ... (x_n, y_n) be the given $(n + 1)$ points where x_i's are equally spaced with distance h. Show that

   $$[x_0, x_1, ..., x_n] = \frac{1}{h^n n!} \Delta^n y_0$$

   ii)   Discuss the acceleration of convergence of iteration method by using Aitken's method.

b)   Answer <u>any two</u> of the following:

   i)   Use Gauss elimination with partial pivoting to solve the system

   $2x_1 + x_2 - x_3 = -1$

   $x_1 - 2x_2 + 3x_3 = 9$

   $3x_1 - x_2 + 5x_3 = 14.$

ii) Use fourth order Runge - Kutta method to solve

$$10\frac{dy}{dx} = x^2 + y^2, y(0) = 1.$$

to find y (0, 2) with $h = 0.1$

iii) Find the missing term in the following table using interpolation.

x	0	1	2	3	4
y	1	3	9	–	81

Q4) a) Answer <u>any one</u> of the following:

i) Let C be a computed inverse of a given matrix A. The residual matrix R is given by $R = I - CA$.

If $\|R\| < 1$, then show that A and C are honsingular and

$$\frac{\|R\|}{\|A\|\|C\|} \le \frac{\|A^{-1}-C\|}{\|C\|} \le \frac{\|R\|}{1-\|R\|}$$

ii) Derive Simpson's 1/3 rule for numerical integration.

b) Answer <u>any two</u> of the following:

i) Establish whether the following matrices are ill - conditioned or well - conditioned.

$$A = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9.1 \end{bmatrix} \quad B = \begin{bmatrix} 3 & -1 & 3 \\ 1 & 0 & 4 \\ 2 & 2 & 1 \end{bmatrix}$$

ii) Find $\frac{d}{dx}$ (J_0) at $x = 0.1$ from the following table

x	$J_0(x)$
0.0	1.0000
0.1	0.9975
0.2	0.9900
0.3	0.9776
0.4	0.9604

iii) Given $\frac{dy}{dx} = x^2 + y$ $\qquad y(0) = 1$

Determine y (0.02) and y (0.04) using Euler's modified method.

Q5) a) Answer <u>any one</u> of the following:

    i)   Derive the total error of the trapezoidal formula.

    ii)   Determine the largest eigenvalue and the corresponding eigenvector of the following matrix

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

b) Answer <u>any two</u> of the following:

    i)   Using Simpson's 3/8 rule, evaluate $I = \int_0^1 \frac{1}{1+x} dx$ with h=1/6

    ii)   Decompose the following matrix into the LU form.

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

    iii)   Reduce the following matrix to the tridiagonal form by Householder's method.

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

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[4041] - 302

P845

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 302 : Software Engineering (OOSE)
(2008 Pattern) (New Course)

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

   a) Give any 2 differences between software engineering and system engineering.

   b) List different process model.

   c) Define: Test case.

   d) What is unit testing?

   e) Define:
      i) Object   ii) Class

   f) What are functional and Non-functional requirements.

   g) Define: Client server architecture.

   h) List the 2 advantages of incremental approach to software development.

   i) State the different fact finding techniques in analysis phase.

   j) What are critical systems?

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

   a) Explain Socio-Technical systems.

   b) Explain four common design issues of a user interface.

   c) Explain the characteristics of a Inheritance Model.

   d) Explain the process activity of a spiral model.

   e) Explain the usage of fat and thin client model.

P.T.O.

Q3) Attempt <u>any four</u> of the following: **[16]**
    a)   Explain Agile Methods.
    b)   Explain the practices involved in Extreme Programming that fits to the principles of agile methods.
    c)   Explain the internal and external event of a system through state machine model.
    d)   Explain the factors in distributed object architecture.
    e)   What is User Interface Prototype?

Q4) Attempt <u>any two</u> of the following: **[16]**
    a)   Draw a state diagram for a simple microwave oven equipped with buttons to set the power and the timer and to start the system. The model includes the essential features of a system which includes the sequence of actions like:
        i)   Select the power level (either half-power or full-power)
        ii)   Input the cooking time.
        iii)   Press start and the food is cooked for the given time.
        For safety reasons the oven should not operate when the door is open and on completion of cooking, a buzzor is sounded. The oven has a very simple alphanumeric display that is used to display various alerts and warning messages.
    b)   Consider an inventory control system of several products. The system manages customers, stock, purchase and billing modules. Make your own assumptions of the above system and represent as
        i)   use case diagram
        ii)   context level diagram.
    c)   Explain in detail the "Clean room software development".

Q5) Attempt <u>any four</u> of the following: **[16]**
    a)   Explain verification and validation.
    b)   Write a short note on the tools that are included in RAD environment.
    c)   Explain Integration Testing in detail.
    d)   Explain the number of stages involved in object oriented design.
    e)   Draw a class diagram for a college Admission system which involves management, college, student, courses and subjects. Make your own assumptions for the above specification as needed.

[4041] - 302

P845

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 302 : Data Bases

(2008 Pattern) (Old Course)

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

Instructions to the candidates:

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

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

a) State full form of DML - state DML statements given by SQL.

b) Define entity in ER model. Give example.

c) Define candidate key.

d) State any 4 functions of DBA.

e) What is an outer join? State different types of outer joins.

f) List four advantages of DBMS over file processing.

g) State generated form of SQL query.

h) Define any two nested query operators.

i) What is cursor?

j) Define trigger. State parts of trigger.

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

i) Draw an ER diagram for college with following information.

- A course can have many subjects.
- A student can enroll for a single course.
- A lecturer can teach multiple subject.

ii) Consider following relations.

emp (<u>eno</u>, ename, dno)

dept (<u>dno</u>, dname)

proj (<u>pno</u>, pname, dno)

e-p (<u>eno</u>, <u>pno</u>, hours)

Write following queries in SQL.

P.T.O.

3

I) List names of employees who works on all projects.

II) List names of employees who are not working on any projects.

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

i) Consider following functional dependency defined on R(A, B, C, D, E), as F = {A →B, CD   E, BD   E, B   C)

Compute

I) Closure of F

II) $(AC)+$

ii) Explain weak entity set in ER model.

iii) Explain basic steps involved in processing a query.

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

i) Write following queries in Relational algebra using relations.
Project (proj - no, p - name, manager)
Employee (emp - no, emp - name)
Assigned (proj - no, emp- no)

I) List employee names with their manager.

II) List project names along with no. of employees working on it.

ii) Explain B+ tree index structure.

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

i) Explain concept of aggregation.

ii) Explain various techniques used for database security.

iii) Explain domain relational calculus.

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

i) What is normalization? Explain BCNF with an example.

ii) What is Functional dependency? Explain trivial & non trivial dependency with an example.

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

i) Explain any 4 SQL functions with an example.

ii) Write note on "Raise" statement in PL/Pg SQL.

iii) Explain different types of triggers in PL / SQL? Give usage.

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

    a)   Explain group by and order by statements with an example.

    b)   Give steps used to create & use CURSORS in PL/SQL statements.

    c)   Define

        i)   A cartesian product of Relation R & S.

        ii)   A projection on Relation R.

    d)   Explain various loop statements available in PL/SQL with an example.

    e)   Define

        i)   An identifying relationship

        ii)   Multivalued attribute.

        iii)   Total participation in relationship.

        iv)   Grouping & ungrouping.

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[4041] - 303

M.Sc. Tech. - II

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 303 : Object Oriented Programming in Java
(Sem. - III) (New Course) (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 <u>any eight</u> of the following: **[16]**
   a) What do you mean by instance and class variables?
   b) What is a constructor? What are its special properties?
   c) When do we declare a method and a class as 'final'?
   d) What is a vector? How is it different from array?
   e) What are wrapper classes and why do we need them?
   f) What is the major difference between a interface and a class?
   g) What is encapsulation and how is it achieved?
   h) How do applets differ from application program.
   i) What is a stream in java and how is it classified?
   j) What is the difference between JVM (java Virtual Machine) and JRE (Java Runtine Environment)?

Q2) Attempt <u>any four</u> of the following: **[16]**
   a) Explain any four major features in java.
   b) State the classification and importance of packages in java. Also discuss the various levels of access protection available for packages.
   c) Explain how memory management is handled in java.
   d) What is inheritance and describe its various forms with example.
   e) What is the use of control statements? Explain iteration statements with example.

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

   a)   Write a program, which will read a string and rewrite it in alphabetical order. For eg, the word STUDENT should be written as DENSTTU.

   b)   Read two two - dimensional arrays 'A' and 'B' sort them in ascending order. Merge them into a single sorted array 'C' that contains every item from A and B, in ascending order. Write a program for the above mentioned task of reading arrays, sorting them and merging them.

   c)   Write a program to create two files F1 and F2. Copy the contents of file F1 and F2 into a file F3. Display the contents of file F3. Use command line arguments to read the file names. Also apply exception handling wherever applicable.

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

   a)   Write a program using Frame (add, save, modify, delete, exit) for entering the student information.

   'add' button should add the information to the student. mdb file.

   'modify' button should modify the information.

   'Save' and 'Delete' should save and delete the student information resp.

   'Exit' button should exit from the application. Following information should be used for the student:

     i)   Stud_Rouno Number   // Text Field.

    ii)   Stud_Name   Text   // Text Field.

    iii) Stud_Addr   Text   // Text Field.

    iv) Stud_Gender ('M', 'F')   // Check boxgroup.

    v)   Stud_Class   {'M.Sc', 'M.Tech', 'MCA'} // choice.

   b)   Explain the event handling mechanism in java.

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

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

   a)   Explain abstract classes with an example and differentiate between a abstract class and interfaces.

   b)   What is an applet and explain the life cycle of a applet.

   c)   What is a Layout Manager? Explain Flow Layout and Border Layout with example.

   d)   Explain the exception handling mechanism in java.

   e)   Explain the four drivers used in java database connectivity (JDBC) and give the steps to establish this connectivity.

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[4041] - 304

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 304 : Operating Systems

(New Course) (2008 Pattern)

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

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *All questions carry equal marks.*

    3)   *Neat diagrams must be drawn wherever necessary.*

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

    a)   "In unsafe state, system is always in deadlock". Justify your answer.

    b)   Write down the elements of P, R and E set for the following resource allocation graph.
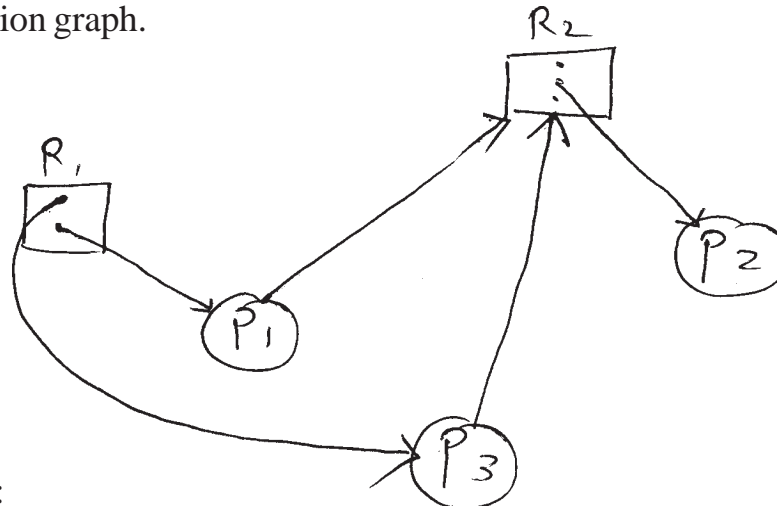
    c)   Define:

        i)   Degree of Multiprogramming.

        ii)   Thrashing.

    d)   List out the advantages of multiprocessor systems.

    e)   Write a short note on sequential access method.

    f)   Explain any two benefits of thread.

    g)   Explain race condition.

    h)   Write a short note on logical versus physical address space.

    i)   Define the following terms:

        i)   Nonmaskable interrupts.

        ii)   Maskable interrupt.

    j)   What is paging? State the contents of page table.

P.T.O

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

    i) Write a note on PCB.

    ii) What is wait for graph? How it is used to detect deadlock?

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

    i) Write a note on CPU - I/O burst cycle.

    ii) Which algorithm is used to avoid deadlock? Write an algorithm to find out whether system is in safe state or not.

    iii) Explain with suitable diagram the concept of overlapped swapping.

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

    a) Write a note on time shared systems.

    b) Explain linked allocation method for files.

    c) Consider the following page reference string:

    1, 2, 3, 4, 5, 3, 4, 1, 6, 1, 3, 5, 8, 9, 6.

    How many page faults would occur for the following page replacement algorithms : OPT and FIFO Assume frame size = 4.

    d) Define the following terms:

    i) Through put   ii) Response time

    iii) Turn around time   iv) Waiting time

    e) Write a note on binary semaphore. Also explain the wait and signal operations using binary semaphore.

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

    a) Write a note on indexed allocation method for file.

    b) List and explain any four services of operating system.

    c) Explain one - to - one and many - to - one thread models.

    d) What is critical section problem? Explain the solution to critical section problem.

    e) Explain status, control, data - in and data - out registers.

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

a) Consider the following snapshot of a system. A system has 5 processes and three resource types A, B and C. Resource type A has 10 instances, 'B' has 5 and 'C' has 7 instances.

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

Answer the following questions using Banker's algorithm.

i)   What are the contents of matrix need?

ii) Give the safe sequence, if the system is in safe state.

b) Explain two level and tree structured graph directories.

c) How operating system handles main memory management?

d) Write a note on clocks and timers used in application I/O interface.

e) Explain the following terms:

i)   Blocking send.

ii) Non blocking send.

iii) Blocking receive

iv) Non - blocking receive.

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[4041] - 305

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 305 : Theoretical Computer Science
(2008 Pattern) (New)

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

Instructions to the candidates:

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

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

a) Define Moore Machine.

b) Construct NFA with e-moves for following regular expression: $(0 + 1)^*$.

c) Let X = {*aa, b*}. Write all the strings in X* which are having length 3.

d) State pumping lemma for regular sets.

e) Construct DFA for the language over alphabet {0, 1} ending with 1.

f) Let G be the grammar with productions {S $\rightarrow$ OAS/O, A $\rightarrow$ S1A/SS/ 10} give derivation of 010001100.

g) Define ID of PDA (Instantaneous Description)

h) Eliminate useless symbols from CFG

G = {S $\rightarrow$ AB, A $\rightarrow$ O, B $\rightarrow$ 1 / 1C, D $\rightarrow$ O}

i) Write regular expression to accept all strings starting with *ab* & haring even no. of *a*, ending with *a*.

j) Define language accepted by PDA.

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

i) Construct DFA for languages described below.

I) Set of strings over {*a, b*}, containing substrib *ab*.

II) Set of strings over {0, 1} in which no. of '1' is divisible by three.

ii) Convert following ∈ -NFA to DFA.
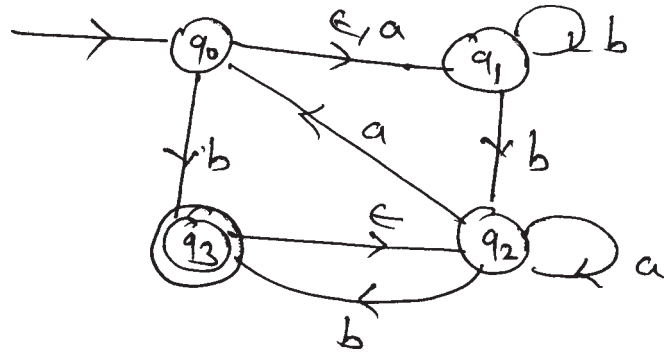
b) Attempt any <u>two</u> of the following: **[10]**

i) Convert following NFA to DFA.

δ	0	1
p	{a, s}	q
*q	r	{q, r}
r	s	p
*s	φ	p

ii) Construct FA for $(0 + 11)* (1 + 0) (1 + \infty)*$.

iii) Construct Moore machine to output residue mod 3 for binary string treated as integer (e.g. 10 - output is 2).

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

i) Construct regular grammar for.

1)
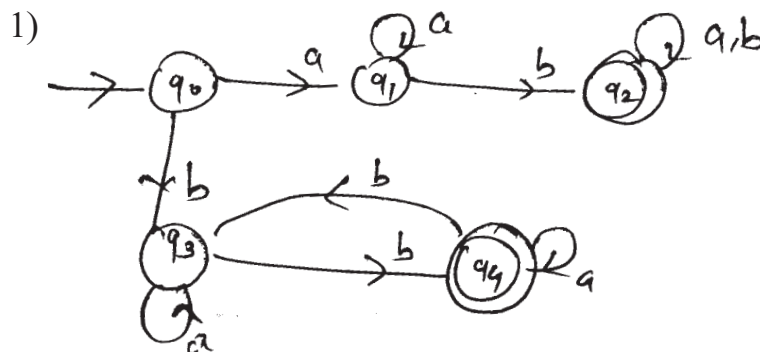
2) $L = a * (ba)* b$.

ii) Minimize following FA.

δ	0	1
A	E	B
*B	B	A
C	B	D
D	H	C
E	A	F
F	B	E
G	H	B
H	D	H

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

i) Show that L = {$0^n 1^n / n \geq, 1$} is not regular.

ii) Construct CFG for language

L = {$a^n b^m c^n / n \geq 1, m \geq 0$}

iii) Check whether following grammar is ambiguas

S → aB / ab

A → aAB / a

B → ABb / b

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

i) Convert following CFG to GNF

{S → AB, A → SB/a, B → AB / b}

ii) Convert following grammar to CNF.

{S → aAab. / Aba, A → aS/bB, B → ASb/a}

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

i) Show that L = {$a^{n^2} / n \geq, 1$} is not a CFL.

ii) Explain Chomsky Heirarchy.

iii) Construct PDA that accepts language

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

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

    i) Construct PDA for CFG G = (V, T, P, S)

       where P : S → OA1

$$A \rightarrow OA1/B$$

$$B \rightarrow 1B/1.$$

    ii) Construct CFG equivalent to PDA M = ({q_0, q_1}, {0, 1}, {R, B}, δ, q_0, R, ϕ) where δ is

$$\delta(q_0, O, R) = \{(q_0, BR)\}$$

$$\delta(q_0, O, B) = \{(q_0, BB)\}$$

$$\delta(q_0, 1, B) = \{(q_1, B)\}$$

$$\delta(q_1, O, B) = \{(q_1, \in)\}$$

$$\delta(q_1, \in, R) = \{(q_1, \in)\}$$

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

    i) Construct Turing Machine to recognize language L = {$a^n b^n a^n$ / n ≥, 1}

    ii) Show that context free languages are not closed under intersection.

    iii) Explain Universal Turing machine.

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P849

[4041] - 401

M.Sc. Tech. - II (Sem. - IV)
MATHEMATICS
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 401 : Topology
(2008 Pattern) (New)

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

Instructions to the candidates:

    1)   *All questions are compulsory.*

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

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

    a)   Define a basis for a topology. Give an example.

    b)   Is arbitrary union of closed set closed? Justify.

    c)   Let R be a topological space with usual metric i.e. R is a metric space. Describe open sets in R.

    d)   Give a non identity homeomorphism from R to R.

    e)   Give an example of a non Hausdorff space. Justify.

    f)   State the Tychonoff theorem.

    g)   State the Urysohn's Metrization theorem.

    h)   Is the space R_l connected. Justify.

    i)   Show that the real line R satisfies the first and second countability axioms.

    j)   Find interior and closer of set A in R. $A = (0, 1) \cup \left\{ \dfrac{3}{2} \right\} \cup [5, 6)$

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

       i)   Prove that the topologies of R_l, and R_k are strictly finer than the standard topology on R, but are not comparable with one another.

       ii)   Let Y be a subspace of a topological space X and $A \subset Y$. The prove that A is closed in Y if and only if it equals the intersection of a closed set of X with Y.

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

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

    ii)   Prove that the continuous image of a compact set is compact.

    iii)   State and prove the intermediate value theorem.

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

    i)   State and prove the intermediate value theorem.

    ii)   Give an example of a connected space with uncountably many path components. Justify.

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

    i)   State and prove the tube lemma.

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

    iii)   Show by an example that the intersection of two compact spaces need not be compact.

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

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

    ii)   Give an example of a connected space which is not locally connected. Justify.

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

    i)   Suppose that X has a countable basis. Then prove that every open covering of X contains a countable subcollection covering X.

    ii)   Prove that a subspace of a regular space is regular; a product of regular spaces is regular.

    iii)   Prove that every metrizable space is normal.

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

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

  ii) Prove that product of two Lindelöf spaces need not be Lindelöf, by a suitable example.

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

  i) Prove that the space R_k is Hausdorff but not regular.

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

  iii) Let A be topological space R with finite complement topology. Then which of the following statements are correct? Justify.

  I) A is Hausdorff.

  II) Every open set in A is compact.

  III) A is regular.

  IV) A is normal.

  V) A is completely regular.

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[4041] - 402

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 402 : Computer Networks

(New Course) (2008 Pattern)

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

Instructions to the candidates:

   1)   All questions are compulsory.

   2)   All questions carry equal marks.

   3)   Figures to the right indicate full marks.

   4)   Neat diagrams must be drawn wherever necessary.

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

   a)   What is Polling and Token Passing?

   b)   Define: Data rate and Signal rate.

   c)   Explain single bit error and burst error with suitable example.

   d)   Discuss the role of VA and MTA used in SMTP protocol.

   e)   Write a short note on spanning tree bridges?

   f)   What is Piggybacking? Give it's advantages.

   g)   Explain the fields of UDP packet header.

   h)   Give the examples of any two guided media.

   i)   Explain BSS and ESS components of IEEE 802.11 protocol.

   j)   Show the NRZ - L and Manchester encoding for the bit pattern 11001100.

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

     i)   Explain in detail: bridges, switches and repeaters.

     ii)   Describe the services of data link layer.

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

     i)   What do you mean by pipelining? Explain selective repeat protocol.

     ii)   Explain channelization with suitable example.

     iii) Write a note on distance vector routing.

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

    i)   How network layer implements connectionless and connection oriented services.

    ii)   What is CSMA and CSMA/CD? Explain 1, P and n persistent CSMA/CD protocols.

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

    i)   What are the different characteristics of line coding?

    ii)   Explain TCP/IP reference model.

    iii)   Why packet switching is better than circuit switching? Justify your answer.

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

    i)   Explain with suitable example! physical, logical and port addresses.

    ii)   Describe any two methods of framing with example of each.

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

    i)   Write a note on PAM.

    ii)   Explain the connection release in transport protocol.

    iii)   Write a note on classless addressing.

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

    i)   Write a note on remote procedure call.

    ii)   What are the responsibilities of session layer and presentation layer in the OSI model?

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

    i)   Discuss serial transmission in detail.

    ii)   Describe traditional ethernet.

    iii)   Explain PAR protocol.

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P851

[4041] - 403

M.Sc. Tech. - II (Sem. - IV)
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 403 : Web Technology
(2008 Pattern) (New)

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

Instructions to the candidates:

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

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

   a)   List primitive data types supported by Javascript.

   b)   List any four most commonly changed Apache directives.

   c)   Give general format for URLs.

   d)   What are the align and valign attributes of the <tr> tag?

   e)   How Java scripts are embedded in HTML files?

   f)   What is XML? What is form of every XML document?

   g)   List 2 sting operators used in Perl.

   h)   How data specified in a form can be sent to the CGI program?

   i)   What is use of explode & implode functions in PHP?

   j)   List any two methods used of Http servlet class.

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

   a)   Give advantages of servlet over CGI.

   b)   Explain any four sorting functions for associative arrays of PHP.

   c)   Write short note on web servers.

   d)   Explain different Popup boxes supported by Javascript with suitable example.

   e)   Explain concept of definition list with suitable example.

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

    a)   What is session Tracking? How session tracking is done in Java?

    b)   What is file variable? Explain various file use Indicators in PHP.

    c)   What is reference and dereference in Perl? Explain with suitable example the referencing & dereferencing in Perl.

    d)   Explain concept of URL.

    e)   Explain any two loop constructs provided by Javascript with example.

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

    a)   Give use of following string functions in Perl.

        i)   Chomp   ii)   length

        iii)   lc   iv)   uc

    b)   Create XML document for storing student details as:- name, address (city, pin), class, age

    c)   Write a short note on MIME.

    d)   What is query string? Describe format of a query string.

    e)   Create a HTML page that displays the following:

        -     Define the frameset document main.html.

        -     In left frame, fruits. html document is loaded which contains 2 links <u>apple</u> and <u>grapes</u> each of which when clicked, the respective file opens in the frame named right.

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

    a)   Explain Response phase of HTTP protocol.

    b)   Write a Perl program to count and display number of employees who earn $\lambda = 10,000$.

        (Assume that the input file employee.txt contains employee data in following format - name : designation: salary : department)

    c)   Write short note on CGI.pm module.

    d)   Explain any four predefined character classes of Javascript.

    e)   Explain XSLT processing with suitable diagram.

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[4041] - 404

P852

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 404 : Design and Analysis of Algorithms

(New Course)

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

Instructions to the candidates:

   1) *All questions are compulsory.*

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

   3) *Use of scientific nonprogrammable calculator is allowed.*

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

   a) Define 0 notation. Is $2^{n+1} = 0(2^n)$?

   b) Define tree edge and back edge.

   c) Explain the terms: Flow, Residual network in a graph.

   d) What is minimum cut? State Max - flow min cut theorem.

   e) Explain divide and conquer strategy.

   f) Find n_0 such that for all $n \geq n_0$

     $20n < 5n^2 < n^3$ is true.

   g) What is prefix codes? Does Huffman algorithm produce prefix codes?

   h) State Master's theorem.

   i) Show that $7n^3 + 1$ is $\theta(n^3)$.

   j) Define Time complexity and space complexity.

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

   a) Order the following functions in ascending order of their growth rates.

     $8n$, $n \log n$, 4^n, $\log n^2$, n^n.

   b) Explain Kruskal's algorithm to find minimum spanning tree. What is its time complexity?

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

d)   What is Pseudocode conventions? Explain.

e)   Use Huffman coding to encode the following symbols with the frequencies listed

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

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

a)   Explain activity selection problem. Explain it on the following problem instance.

Activity	1	2	3	4	5	6	7	8
Start Time	3	5	2	0	7	8	12	10
Finish time	7	9	4	7	12	12	20	15

b)   Solve Matrix chain multiplication problem for following sequence (5, 10, 10, 20, 5)

c)   What is longest common subsequence problem. Give the algorithm based on dynamic programming to compute length of sequences (1, 0, 0, 1, 0) and (0, 0, 1, 0, 1, 0)

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

a)   Explain Dijkstra's algorithm and illustrate it on the following graph
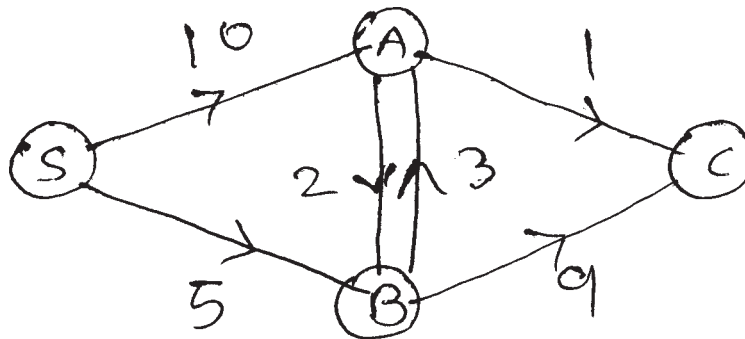
b)   Explain Quick sort algorithm.

c)   Explain Ford Fulkerson algorithm to find maximum flow.

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

a)   Define NP complete problem. Prove that vertex cover problem is NP - complete.

b)   Explain in detail elements of greedy strategy.

c)   Write a note on Amortized analysis.

[4041] - 501

P853

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 501 : OPERATIONS RESEARCH AND OPTIMIZING TECHNIQUES
(New Course) (2008 Pattern)

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

Instructions to the candidates:

   1)   *All questions are compulsory.*

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

   3)   *Use of single memory, non - programmable scientific calculator is allowed.*

   4)   *Graph papers will be supplied on demand.*

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

   a)   Define the following:

      i)   Standard form of the linear programming problem.

      ii)   Surplus variables.

   b)   Draw the feasible region for the following linear programming problem.

$$5x_1 + 2x_2 \le 20$$
$$x_1 \ge 30$$
$$x_2 \le 5,$$
$$x_1, x_2 \ge 0$$

   c)   Find the IBFS of transportation problem by North - West corner rule.

Ware houses

Factories	W_1	W_2	W_3	W_4	Capacity Supply
F_1	21	16	25	13	11
F_2	17	18	14	23	13
F_3	32	27	18	41	19
Requirements	6	10	12	15	43

d) Match the following:

   i)   Linear programming   a) Least cost method.
   ii) Assignment problems   b) Simplex method.
   iii) Game Theory   c) Hungerian Method.
   iv) Transportation Problems   d) Saddle point

e) How the degeneracy is located in transportation problems?

f) Which is (are) the correct statement (s):

   For any primal problem and its dual:

   i)   Optimal value of objective function is same.
   ii) Primal will have an optimal solution if and only if dual does too.
   iii) Both primal and dual cannot be infeasible.
   iv) All of the above.

g) Solve the following assignment problem for minimum total time for doing all jobs.

	I	II	III
A	6	4	5
B	2	11	4
C	13	8	3

h) Determine the range of the values for λ such that the game is strictly determinable   Player B

		B_1	B_2	B_3
	A_1	λ	6	2
Player A	A_2	-1		-7
	A_3	-2	4	λ

i) Find a saddle point for the following game if it exists.

Player B

		B_1	B_2	B_3
	A_1	3	-4	8
Player A	A_2	-8	5	-6
	A_3	6	-7	6

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

a) Discuss the scope and limitations of operations research.

b) Solve the following linear programming problem by graphical method and comment on it.

Maximize $(Z) = 4x_1 + 3x_2$

Subject to the Constraints:

$$3x_1 + 4x_2 \leq 24$$
$$8x_1 + 6x_2 \leq 48$$
$$x_1 \qquad \leq 5$$
$$x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

c) What is infeasible solution of a linear programming problem? Discuss with example how infeasible solution is located while solving linear programming problem by graphical method?

d) Vitamins V and W are found in two different foods F_1 and F_2. One unit of food F_1 contains 2 units of vitamin V and 5 units of vitamin W. One unit of food F_2 contains 4 units of vitamin V and 2 units of vitamin W. One unit of food F_1 and F_2 costs Rs. 30/- and Rs. 25/- respectively. The minimum daily requirements (for a person) of vitamin V and W is 40 and 50 units respectively. Assuming that anything in excess of daily minimum requirement of vitamin V and W is not harmful; Find optimal mixture of food F_1 and F_2 at minimum cost which meets the daily minimum requirement of vitamins V and W. Formulate this L.P.P. to minimise the cost.

e) Consider the following L.P.P:

Maximize $(Z) = \qquad 32x_1 + 35x_2 + 45x_3$

Subject to the

Constraints: $\qquad 2x_1 + 3x_2 + 2x_3 \leq 120$
$$4x_1 + 3x_2 + x_3 \leq 160$$
$$3x_1 + 2x_2 + 4x_3 \leq 100$$
$$x_1 + x_2 + x_3 \leq 40$$
$$x_1, x_2, x_3 \geq 0$$

The final simplex table is given : below

C_B	C_j Basic Variables	Solution Values	32	35	45	0	0	0	0
	B	b	X_1	X_2	X_3	S_1	S_2	S_3	S_4
0	S_1	10	–½	0	0	1	0	½	–4
0	S_2	60	2	0	0	0	1	1	–5
45	X_3	10	½	0	1	0	0	½	–1
35	X_2	30	½	1	0	0	0	–½	2
	Z_j:	1500	40	35	45	0	0	5	25
	$C_j - Z_j$:		– 8	0	0	0	0	–5	–25

On the basis of the above information answer the following questions:
i)   Is the above solution feasible?
ii) Is the above solution optimal? If yes, What is the optimal solution?
iii) Is the above solution unbounded?
iv) Does this L.P. has multiple solution?

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

a)   Justify your answer for the statement:
     'Dual of a dual is a primal problem'.

b)   Write advantages of duality. (At least 3)

c)   Write the dual of the following primal:
     Maximize $(Z) = 20x_1 + 15x_2 + 18x_3 + 10x_4$
     Subject to the constraints:

$$4x_1 - 3x_2 + 10x_3 + 4x_4 \leq 60$$
$$x_1 + x_2 + x_3 \qquad = 27$$
$$-x_1 + 4x_3 + 7x_4 \qquad \geq 35$$
$$x_1, x_2, x_3 \geq 0 \text{ and } x_4 : \text{ is unrestricted in sign.}$$

d)   Define each of the following:
     i)   Optimal strategy.
     ii) Saddle point.
     iii) Fair Game.
     iv) Two person Zero - sum game.

e)   Solve the following game by an algebraic method.

Player B

		I	II
Player A	I	10	4
	II	7	8

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

a) Solve the following Transportation problem by Vogel's approximation method.

Distribution Centre

		A	B	C	D	availability
	W	8	16	16	0	152
Plant	X	32	48	32	0	164
	Y	16	32	48	0	154
Requirements.		144	204	82	40	470

b) Solve the following (2 x 3) game graphically

Player B

		I	II	III
Player A	I	1	3	11
	II	8	5	2

c) Reduce the following game by dominance principle and hence solve it.

Player B

		I	II	III	IV
	I	8	10	9	14
Player A	II	10	11	8	12
	III	13	12	14	13

d) Solve the following assignment model

Machines

		A	B	C	D	E
	1	–	4	7	3	4
Jobs	2	4	2	6	3	4
	3	7	6	5	7	5
	4	3	3	7	6	7
	5	4	4	5	7	3

[4041]-501(New) 5

e) A project consists of a series of tasks labelled A, B, ---, H, I with the following relationship:

$$A < B ; B < E, I ; C < G ; D < C, F, A;$$

$$E < I ; F < H ; G < B ; H < B.$$

Draw the network diagram for the above project.

Q5) Attempt any TWO of the following: [2 × 8 = 16]

a) Obtain the optimal solution of the following transportation problem by MODI method; Use VAM to calculate IBFS.

Distribution Centre

	D_1	D_2	D_3	D_4	availability
P_1	19	30	50	12	7
P_2	70	30	40	60	10
P_3	40	10	60	20	18
Requirements.	5	8	7	15	

Plants — (row labels P_1, P_2, P_3)

b) For the given L.P.P.

Maximize (Z) = $3x_1 + 5x_2$

Subject to the

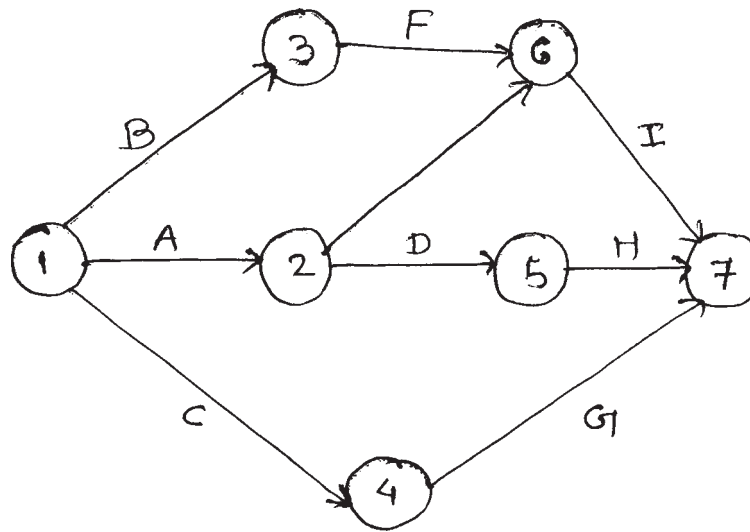Constraints : $3x_1 + 2x_2 \leq 18$

$$x_1 \qquad \leq 4$$

$$x_2 \leq 6$$

$$x_1, x_2 \geq 0.$$

i) Determine an optimum solution to above L.P.P.

ii) Discuss the effect on the optimality of the solution when the objective function is changed to

$$Z = 3x_1 + x_2$$

iii) A project is represented by the network shown below and has a following data:

Task	:	A	B	C	D	E	F	G	H	I
Least Time	:	5	18	26	16	15	6	7	7	3
Greatest Time	:	10	22	40	20	25	12	12	9	5
Most likely Time	:	8	20	33	18	20	9	10	8	4

Determine the following:
1) Expected task time . t_e
2) Task variance. σ^2
3) Critical Path.

[4041] - 501

P853

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 501 : Compiler Techniques

(2008 Pattern) (Old Course)

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

Instructions to the candidates:

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

  2)   *Write your assumptions clearly, if any.*

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

  a)   Define a compiler.

  b)   Describe the language accepted by regular expression a (a + b)* b in English over {a, b}.

  c)   What is the role of sentinel in scanning.

  d)   List the LR(O) items generated by production A   *xyz.*

  e)   'The number of states of SLR and LALR parse table are always different'. Is this statement true or false? Why?

  f)   What is an annotated parse tree?

  g)   Define scope rules of block structured languages.

  h)   Why code optimisation is performed by a compiler?

  i)   Is it possible to begin new activation of a procedure before the earlier one of the same procedure has not ended? Why?

  j)   'Inherited attribute values are defined in terms of the children nodes'. Comment on this statement with proper justification.

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

  i)   Write a Recursive Descent Parser (RDP) for the following grammar.

      S   aA/bB   A   aB/b   B   bA/a

  ii) Check if the following grammar is LL(1) or not.

      S   AB/   A   aAB/   B   bA

P.T.O

b) Attempt any two of the following: **[10]**
   i) Explain the analysis phase of a compiler briefly.
   ii) What are the functions performed by a scanner?
   iii) What are the conflicts observed in LR parsing? Explain with suitable examples.

Q3) a) Attempt any one of the following: **[6]**
   i) Check if the following grammar is SLR (1) or not.
   S   A/B   A   aA/b   B   dB/b
   ii) Compute the sets of LR(1) items for the following grammar
   S   BB   B   aB/b
   b) Attempt any two of the following: **[10]**
   i) Explain briefly the contents of the activation record.
   ii) Explain how compilation of control structures is performed with suitable examples.
   iii) Construct a directed acyclic graph for the expression
   $i + i *(j - k) + (j - k) * t$

Q4) Attempt any four of the following: **[16]**
   a) What is front end of a compiler? List the phases under it.
   b) What is input bufferring? What is its role in scanning?
   c) Explain ambiguous grammar with suitable examples.
   d) Explain different methods used for evaluating semantic rules.
   e) Explain following code optimisation methods with suitable examples.
      i) Compile - time evaluation.
      ii) Strength reduction.

Q5) Attempt any four of the following: **[16]**
   a) Write a note on displays.
   b) Explain call - by - reference method of parameter passing.
   c) 'An LL(1) grammar can be ambiguous'. Comment on this statement with proper justification.
   d) Define a syntax - directed definition.
   e) Convert following infix expressions to postfix form.
      i) $a + (b * c) - d + e$.
      ii) $i * j + k - (t - p)$

[4041] - 502

P854

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 502 : Numerical and Statistical Methods

(2008 Pattern) (New Course)

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

Instructions to the candidates:

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

    2)   *All questions are compulsory.*

    3)   *Use of non-programmable scientific calculator is allowed.*

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

    a)   Four cards are drawn at random from a well shuffled pack of 52 cards. Find the probability that all cards are of different suits.

    b)   State whether the following statement is true or false. Justify your answer.

          A and B are two events defined on a sample space Ω. P(A) = 0.8, P(B) = 0.7, P(A∩B) = 0.8.

    c)   If A and B are independent events with P(A) = 0.5 and P(B) = 0.4, find P(A∪B).

    d)   For two events defined on a sample Ω, define conditional probabilities P(A/B) and P(B/A).

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

          $f(x) = kx$, $x = 1, 2, \ldots\ldots 10$.

    f)   Define mean and variance of a discrete random variable X.

    g)   Let $X \rightarrow B(n, p)$. If E(x) = 6 and variance (x) = 4.2, find the values of n and p.

    h)   State 'Lack of Memory Property' of Exponential distribution.

    i)   Let $X \rightarrow N(3, 4)$. Find P(X > 5).

    j)   Co-efficient of correlation between two series X and Y is 0.85. If the covariance is 6.5 and Var (x) = 6.1, find standard deviation of Y series.

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

a) Define sample space of a random experiment. Distinguish between a discrete sample space and a continuous sample space giving suitable examples.

b) The probability that a construction job will be finished on time is 0.7. The probability that there will be no strikes is 0.6 and the probability that the job will be finished on time given that there are no strikes is 0.8.

   i) What is the probability that the job will be finished on time and there will be no strikes?

   ii) What is the probability that there will have been no strikes given that the job is finished on time?

c) Let P(x) be the p.m.f. of a discrete random variable X assuming values 0, 1, 2 and 3 such that $2P(X = 0) = 3P(X = 1) = P(X = 2) = 5P(X = 3)$. Find the p.m.f. and the distribution function of X.

d) Write the p.m.f. of Poisson distribution with parameter λ. State its mean and variance also state additive property of Poisson distribution.

e) Let a continuous random variable X has uniform distribution over $(-a, a)$. Determine a such that $P(X > 1) = \dfrac{1}{3}$. Also find the mean of X.

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

a) Define

   i) Probability density function and

   ii) Distribution function of a continuous random variable. State any two important properties of distribution function.

b) Suppose a continuous random variable X has

   pdf $f(x) = \dfrac{x^2}{3}, -1 \le x \le 2$

   $= 0$, o.w.

   If $A = \{x | x \ge 0\}$ and $B = \{x | -\dfrac{1}{2} \le x \le \dfrac{1}{2}\}$

   Find P(A), P(B) and P(A∩B).

c) State the pdf of Normal distribution with parameters (2, 16). State its mean, standard deviation, median and mode.

d) Define KarlPearson's coefficient of correlation (r).Draw scatter diagram for the following cases.

   i) $r = 0$ ii) $r = +1$ iii) $r = -1$.

e) Following results were obtained for a trivariate data:

$\bar{x}_1 = 68$ $\bar{x}_2 = 70$ $\bar{x}_3 = 74$

$\sigma_1^2 = 100$ $\sigma_2^2 = 25$ $\sigma_3^2 = 81$

$\gamma_{12} = 0.6$ $\gamma_{13} = 0.7$ $\gamma_{23} = 0.5$

Obtain the regression equation of X_1 on X_2 and X_3.

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

a) Define an exponential distribution with mean θ. Find its distribution function.

b) A monthly balance on the bank account of credit card holders is assumed to be normally distributed with mean Rs. 5000 and SD Rs. 1000. Find the proportion of credit card holders with balance.

     i)   Over Rs. 6500.

     ii)   Between Rs. 4000 and Rs. 6000.

c) Explain in brief the method of least squares to obtain the line of regression of Y on X.

d) Equations of the two lines of regression are:

$$4y - 15x + 530 = 0$$

$$20x - 3y - 975 = 0.$$

Find $\bar{x}, \bar{y}$ and the correlation coefficient γ_{xy}.

e) A coin is tossed 400 times and turned up head 210 times. Can the coin be regarded as fair? (Use 5% level of significance).

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

a) Define the following:

     i) $b_{13.2}$ ii) $b_{21.3}$

     iii) $\gamma_{12.3}$ iv) $R_{2.13}$

b) Let μ be the population mean of a random variable X with variance σ^2. Explain the test procedure for testing $H_0: \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$ at 1% level of significance. (Assume $n \geq 30$).

c) A certain stimulus is administered to each of 10 patients resulted in the following increase in blood pressure:

5, 2, 8, –1, 3, 0, –2, 1, 5, 0.

Can it be concluded that the administration of the stimulus in general will be accompanied by increase in blood pressure? (Use $\alpha = 0.05$).

d) A company introduces a new product in 4 locations A, B, C, D. The number of items sold during a weekend are as follows:

Location	A	B	C	D
No.of items sold	80	65	70	85

Test whether the sale of the items is dependent on the location at 10% level of significance.

e) In a study of automobile traffic and air pollution, air samples taken at four different times and at five different locations were analyzed to obtain the amount of particulate matter present in the air. Based on the collected data the following ANOVA table was obtained.

Source	Sum of squares (ss)	Degrees of freedom (df)
Time	1182.95	3
Location	1947.50	4
Error	441.30	12

Is there any difference in average amount of particulate matter present in the air due to different sampling times? (use $\alpha = 0.05$)

[4041] - 502

P854

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 502 : Software Engineering - I

(2008 Pattern) (Old Course)

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

Instructions to the candidates:

1) *All questions are compulsory.*

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

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

a) Define : Software.

b) How are test - case data generated.

c) Define : Coupling.

d) What are the parameters used to access the software quality?

e) Define : Test case.

f) What is the role of system Analyst?

g) What do you understand by Process model?

h) Give any 2 myths of Software Engineering.

i) Define : Feasibility study.

j) Define : Reverse Engineering.

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

a) Explain : System Development Life Cycle.

b) Compare Structured interview with unstructured interview.

c) Write a short note on : Incremental Process Model.

d) Explain : Fact finding Techniques.

e) Explain the purpose of "Decision Table" and give suitable example.

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

a) Consider the casestudy and draw the data flow diagram with assumptions. A small private airport database is used to keep track of airplanes, their owners, airport employees and pilots. The information is collected and stored. The system is capable of defining the owner and the purchase date of the flight, the employee record which maintains its service, A service record for the airplane which stores the maintenance record of the airplane. The system should process the complete details of airplane, the employees and owners of the airplane.

b) Explain the principles of testing methodology in detail.

c) Explain the usage of metrics related to software maintenance.

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

a) Explain aggregation and Association with an example.

b) Draw a State diagram for a telephone answering machine that records incoming messages and displays the number of accepted messages on an LED display. The system should allow the telephone owner to dial in, type a sequence of numbers and have the recorded messages replayed over the phone.

c) Draw a decision Tree for the following casestudy:

Pioneer company Ltd decides as per policy to give incentives for all its sales manager in category namely top order, middle order and freshers. Based on the following rules.

i) If the Sales Manager is permanent with a score value greater than 75 then the incentive is 3 times of his salary amt, he should be in Top order also.

ii) If the employee is in middle order with 5 years of experience then 2 months of salary as incentive.

iii) If the employee is in fresher grade with 2 years of experience then 1 month of salary as incentive.

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

a) Explain: "Structure chart" with an example.

b) Explain : Prototyping model in detail.

c) Write a brief note on : Information hiding.

d) Explain : Validation Testing.

e) Write a note on : Object Model.

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P855

[4041] - 503

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 503 : Digital Image Processing

(2008 Pattern) (New Course)

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

Instructions to the candidates:

1)   All questions are compulsory.

2)   Figures to the right indicate full marks.

3)   Use of Log table / Calculator is allowed.

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

a)   What are the different reasons for poor contrast?

b)   What is digital image?

c)   Justify the statement: 'Quality of picture depends on the number of pixels and the number of gray levels that represent the picture'.

d)   'Image can be obtained if histogram is given' - Comment.

e)   Justify the statememt: 'Laplacian is better than gradient for detection of edges'.

f)   If all the pixels in an image are shuffled, will there be any change in the histogram?

g)   'Image resulting from poor illumination cannot be segmented easily' - Comment.

h)   Define saturation in digital image.

i)   Justify the statement: 'All image compression techniques are not invertible'.

j)   State the difference between spatial resolution and intensity resolution.

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

a)   What are the elements of digital image processing system? Explain any one in detail.

b)   Differentiate between Image processing and Image analysis.

c)   Explain any one method of Image acquisition.

d)   Why do we process images? Explain with suitable examples.

e)   Describe the general compression system model.

P.T.O.

Q3) Answer any four of the following: **[4 × 4 = 16]**

a) Differentiate between image enhancement and image restoration.

b) Explain the RGB model of the color image.

c) Explain with example the difference between correlation and convolution.

d) How to filter an image in the frequency domain? Give its flowchart.

e) Discuss the smoothing operation in frequency domain.

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

a) What is threshold? Explain how to obtain the threshold for image segmentation.

b) Show that subtracting the Laplacian from an image is proportional to unsharp masking.

c) What do you understand by Gamma correction? Explain its role in the improvement of contrast.

d) Discuss the Discrete Fourier Transform. State its role in digital image processing.

e) Discuss the JPEG compression method of digital image file.

Q5) Answer any two of the following: **[2 × 8 = 16]**

a) Explain the method of Zooming of an image. Does it increase the information content of an image?

b) Explain basic principles of detecting following in the images.

   i) Points.   ii) Lines.   iii) Edges.

c) Explain the following image enhancement techniques in spatial domain.

   i) Image negative.   ii) Brightness.

   iii) Sharpening.   iv) Bit plane slicing.

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[4041] - 503

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 503 : Computer Networks
(2008 Pattern) (Old Course)

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

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

Q1) Attempt any eight of the following: **[16]**
 a) What is the size of MAC address, IPv4 and IPv6 address?
 b) State the difference between pure and slotted ALOHA.
 c) Mention two advantages of fiber optic medium.
 d) Define the terms de-facto and de-jure with respect to standards.
 e) Which routing mechanism is used in link state routing.
 f) Name the TCP fields used for connection establishment.
 g) What is a socket?
 h) What is the purpose of access point in 802.11?
 i) State the purpose of TELNET and FTP.
 j) State the purpose of RTS and CTS in CSMA / CA.

Q2) a) Attempt any one of the following: **[6]**
  i) What is a bridge? Explain its types.
  ii) Draw the packet format of IPv4 and explain its fields.

 b) Attempt any two of the following: **[10]**
  i) Compare TDM and FDM.
  ii) Explain how an e-mail is sent using SMTP.
  iii) Explain the service primitives in connection oriented service.

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

    i) Explain the methods of framing in data link layer.

    ii) Explain the architecture of IEEE 802.11.

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

    i) Compare virtual circuits and datagrams.

    ii) Explain the goals and benefits of networks.

    iii) Write a note on FTP.

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

    i) Explain various digital encoding mechanisms.

    ii) Explain the client - server architecture in www.

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

    i) Write a note on UDP.

    ii) Explain any one method of controlled Access.

    iii) Compare co-axial cables with fiber optic cables.

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

  a) A noiseless data channel occupies frequencies from 4kHz to 10kHz and uses 32 levels of signaling. Calculate the data rate of the channel.

  b) Can the header length of IPv4 datagram be less than 5? What is the header length if the value is 5? If the datagram is not fragmented, what will be the flaps?

  c) Show the three - way handshake packets sent between two TCP hosts. Assume sequence number 1000.

  d) A network has IP address 21.50.6.25. Which class does it belong to? What is its default subnet mask? If there are 32 subnets in the network, calculate the subnet addresses.

  e) A datalink layer frame has the following data. What will be the bit - stuffed data?

    10111111011111001

  Show the byte stuffed frame for the following data:

    DLE ESC ESC A B ESC DLE C

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[4041] - 504

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

COMPUTER SCIENCE

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 504 : Advanced Operating System

(New Course) (2008 Pattern)

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

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *All questions carry equal marks.*

    3)   *Draw neat diagram wherever necessary.*

Q1) Attempt any Eight.   **[8 × 2 = 16]**

    a)   Give the differences and similarities between the signal and interrupt.

    b)   Give any four functions of line discipline.

    c)   Explain context switch.

    d)   Discuss role of device drivers.

    e)   Define - buffer cache.

    f)   When does a kernel check for a receipt of a signal?

    g)   Define pregion. Also state existance of Pregion.

    h)   Explain expansion swap.

    i)   What is socket? Explain socket call?

    j)   Explain parameters of msgsnd system call.

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

        i)   Write note on process states and transitions.

        ii)   Explain with diagram elements of file system layout.

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

        i)   Explain algorithm for writing data to a terminal.

        ii)   What are the different states in which a page can reside if it is caused fault?

        iii)   What is file system? Explain the terms: boot block, super block, inode list, data blocks.

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

    i)   Write a note on image of an executable file.

    ii)   Explain the manipulation of the process address space.

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

    i)   Explain in detail about process creation.

    ii)   What is demand paging? Explain data structures for demand paging.

    iii) Write note on io<tl system call.

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

    i)   Describe various data structures for shared memory.

    ii)   What is service in Linux? Describe chkconfig command with all possible options.

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

    i)   Explain algorithm of handling interrupts.

    ii)   How Kernel can increase the size of any region?

    iii) Explain the role of fork in paging system.

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

    i)   Write note on "ntsysv" - a service management tool.

    ii)   State the advantages and disadvantages of buffer cache.

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

    i)   Write note on fork swap.

    ii)   Write note on rc.init and rc. local.

    iii) Write a program depicting the reason for death of child signal.

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[4041] - 504

M.Sc. Tech. (Sem. - V)
COMPUTER SCIENCE
INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS
MIM - 504 : Computer Graphics - I
(Old Course) (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)   4-connected method may not fill the polygons correctly. Justify.

   b)   Explain the use of computer graphics in Entertainment.

   c)   Differentiate movable and non movable joystick.

   d)   Define Scan Line.

   e)   Explain the need for homogeneous coordinates.

   f)   Explain random scan display device.

   g)   What are control points?

   h)   Explain the terms rotation.

   i)   Explain B - Spline in short.

   j)   What are desired characteristics of lines?

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

     i)   Explain CRT.

     ii)   Explain Bresenham's line generation algorithm.

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

     i)   Write a short note on Parallel projection.

     ii)   Explain mid point subdivision Line clipping algorithm.

     iii)   Write a note on vanishing points.

P.T.O.

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

   i) Discuss Z buffer algorithm.

   ii) Explain the conditions for smooth joining of curves and surface patches.

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

   i) Compare and contrast 'boundary fill' and 'flood fill' algorithm.

   ii) What is shearing transformation and gives the algorithm for reflection about any arbitrary line.

   iii) Write a short note on Tablet.

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

   i) Discuss Area subdivision method for hidden surface elimination.

   ii) Consider the triangle with vertices A(5, 3), B(3, 8) and C(9, 6). Find the transformation for magnifying the triangle twice its size by keeping point A(5, 3) as fixed. Find the new vertices of the triangle.

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

   i) Explain Depth sort method. Why it is called painter's algorithm.

   ii) Explain edge filling algorithm and how it can be improved by using a fence.

   iii) Write a short note on Hemite and Bezier cubic curves.

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

   i) Consider the line segment A[1, 2] and B[3, 6]. Give the transformation matrix for

      1) Rotating AB by angle 90 degree counterclockwise about it's mid point

      2) Rotating AB by angle 90 degree clockwise about the point A.

   ii) Explain Cabinet and Cavelier Oblique Projection.

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

   i) Write a note on Quadratic and spline surface.

   ii) Explain Polygon Meshed.

   iii) Explain the following algorithms.

      1) Floating horizon algorithm.

      2) Cohen Sutherland algorithm.

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[4041] - 503 A

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

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 503 : Modeling and Simulation

(2008 Pattern) (New Course)

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

Instructions to the candidates:

1) *All questions are compulsory.*

2) *All questions carry equal marks.*

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

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

a) Define simulation. What are its limitations?

b) What are the components of a system? Explain.

c) Write the procedure for chi - square test.

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

a) Define the term "Random Number". Write its properties.

b) Discuss in detail mid - square and linear congruential method for generating random numbers.

c) Write the *pmf* and *cdf* for discrete uniform distribution.

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

a) How do you generate random samples from Poisson distribution?

b) Describe the acceptance - rejection technique for Poisson distribution.

c) How do you reduce variance? Explain any two techniques.

Q4) Attempt any **TWO** of the following: [2 × 8 = 16]

   a)   Describe the simulation of single server queue.

   b)   State the salient features of SIMSCRIPT.

   c)   How do you validate the simulation model?

Q5) Attempt any **TWO** of the following: [2 × 8 = 16]

   a)   Define the following:

        i)   System.

        ii)   Entity.

        iii) Event.

   b)   With an example, discuss Monte Carlo Techniques.

   c)   Give a brief account of geometric Distribution.

[4041] - 503 B

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M.Sc. Tech.

INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS

MIM - 503 : Functional Analysis

(2008 Pattern) (New Course)

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

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

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

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

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

  c) State the Riesz representation theorem.

  d) If $x_1, x_2, ... x_n$ are orthogonal, then $||x_1 + x_2 + ... + x_n||^2 = ||x_1||^2 + ... + ||x_n||^2$.

  e) State Minkowaski's Inequality.

  f) State and prove the parallelogram law of Hilbert spaces.

  g) Show that in Hilbert space $S n S^\perp = \{0\}$.

  h) If A_1 and A_2 are self adjoint operators on a Hilbert space H, then show that $A_1 A_2$ is self adjoint if and only if $A_1 A_2 = A_2 A_1$.

  i) Define adjoint operator.

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

  i) Let H be a Hilbert space and $A \in$ BL (H) prove that there is a unique $B \in$ BL(H) such that for all $x, y \in$ H, $<A(x), y> = <x, B(y)>$.

  ii) Prove that a finite normed linear space is a Banach space.

P.T.O

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

    i) Let S be a non - empty subset of a Hilbert space, show that $S^\perp = S^{\perp\perp\perp}$.

    ii) Prove that a Linear map F from a normed space X to a normed space Y is a homeomorphism if and only if there are $\alpha, \beta \in R$ such that,

$$\beta \|x\| \le \| F(x)\| \le \alpha \|x\|, \ \forall \ x \in X.$$

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

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

    i) State and prove open mapping theorem.

    ii) Let H be a Hilbert space and F be a non empty closed subspace of H. Prove that $H = F + F^\perp$.

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

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

    ii) Let X be an inner product space. Let E be an orthonormal subset of X with $0 \notin E$ then prove that E is linearly independent and $\|x - y\| = \sqrt{2}$ for all $x \ne y$ in E.

    iii) Prove that if $1 < \rho < \infty$, then $\begin{pmatrix} 1^n \\ P \end{pmatrix}^* = 1^n{}_q$.

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

    i) If x and y are any two vectors in a Hilbert space, prove that $|<x, y>| \le \|x\|.\|y\|$.

    ii) Let H be a Hilbert space. If A is a self adjoint operator on H then prove that

$$\|A\| = \sup\{|<A(x), x>| / x \in H, \|x\| \le 1\}$$

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

   i) If X is a Hilbert space and $\sum_n |K_n|^2 < \infty$ then prove that $\sum_n K_n U_n$ converges in X.

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

   iii) Let M be a closed linear subspace of a normed linear space N. If the norm of the coset $x + M$ in a quotient space N/M is defined as $\|x + M\| = \inf\{\|x + m\| / m \in \underline{M}\}$ then show that * defines a norm.

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

   i) State and prove bounded inverse theorem.

   ii) Prove that an operator T on a Hilbert space H is normal if and only if its real and imaginary parts commutes.

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

   i) State and prove closed graph theorem.

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

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

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

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

   iii) In a Hilbert space H, show that

     $4 <x, y> = \|x+y\|^2 - \|x-y\|^2 + i\|x + iy\|^2 - i\|x-iy\|^2.$