(3 Hours)   [Total Marks : 100]

N.B. : (1) Question No. 1 is **compulsory**.
       (2) Answer any **four** out of remaining **six** questions.
       (3) Assume any **suitable** data whenever **required** and **justify** the same.

1. (a) Integrate xz along the line from A(1,1) to B(2,4) in the complex plane.   5

    (b) The matrix A is defined as $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -2 & 6 \\ 0 & 0 & -3 \end{bmatrix}$ 5

         find the eigen values of $3A^3 + 5A^2 + 6A + I$.

    (c) Find the dual of the following L.P.P.   5
         Max $Z = 2x_1 - x_2 + 3x_3$
         Subject to the constraints
         $x_1 - 2x_2 + x_3 \geq 4$
         $2x_1 + x_3 \leq 10$
         $x_1 + x_2 + 3x_3 = 20$
         $x_1, x_3 \geq 0$, x_2 is unrestricted.

    (d) Find K such that $\frac{1}{2} \log (x^2 + y^2) + i \tan^{-1}\frac{Kx}{y}$ is analytic.   5

2. (a) Represent the function $f(z) = \frac{4z + 3}{z(z-3)(z+2)}$ in Laurent's series   6

         (i)   Within $|z| = 1$

         (ii) In the annular region between $|z| = 2$ and $|z| = 3$.

    (b) Verify Cayley–Hamilton theorem for $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ and hence find A^{-1}.   6

    (c) Solve the following L.P.P. by Simplex method   8
         Max $Z = 3x_1 + 2x_2 + 5x_3$
         Subject to the constraints
            $x_1 + 2x_2 + x_3 \leq 430$
            $3x_1 + 2x_3 \leq 460$
            $x_1 + 4x_2 \leq 420$
            $x_1, x_2, x_3 \geq 0$

3. (a) Find a matrix P which diagonalizes the matrix $A = \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$ verify that $P^{-1} A P = D$,   6

         where D is the diagonal matrix.

    (b) Determine the residue at the poles for the function $f(z) = \frac{z^2}{(z^2 + 3z + 2)^2}$.   6

(b) Determine the residue at the poles for the function $f(z) = \dfrac{z^2}{\left(z^2 + 3z + 2\right)^2}$.   6

(c) Use Big M method to solve the following L.P.P.   8

Min $Z = 2x_1 + 3x_2$

Subject to $\quad x_1 + x_2 \geq 5$

$\qquad\qquad x_1 + 2x_2 \geq 6$

$\qquad\qquad x_1, x_2 \geq 0$

4. (a) Define minimal Polynomial and Derogatory matrix test whether the matrix   6

$$A = \begin{bmatrix} 7 & 4 & -1 \\ 4 & 7 & -1 \\ -4 & -4 & 4 \end{bmatrix} \text{ is derogatory.}$$

(b)   Evaluate $\displaystyle\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{z^2 + 3z + 2} \, dz$ 6

Where c is   (i) $|z| < 1$ (ii) $|z| < 2$

(c)   Using Duality solve the following :-   8

Max $Z = 2x_1 + x_2$

Subject to $2x_1 - x_2 \leq 2$

$x_1 + x_2 \leq 4$

$x_1 \leq 3$, $x_1, x_2 \geq 0$

5.   (a)   Use Dual Simplex method to solve the following L.P.P.   6

Max $Z = -3x_1 - 2x_2$

Subject to $x_1 + x_2 \geq 1$

$x_1 + x_2 \leq 7$

$x_1 + 2x_2 \leq 10$

$x_2 \leq 3$, $x_1, x_2 \geq 0$

(b)   If $A = \begin{bmatrix} 3/2 & 1/2 \\ 1/2 & 3/2 \end{bmatrix}$, then find e^A and A^{10}.   6

(c)   (i)   Show by the method of residue that –   8

$$\int_0^\pi \frac{a}{a^2 + \sin^2 \theta} \, d\theta = \frac{\pi}{1 + a^2}.$$

(ii)   Evaluate $\displaystyle\int_0^\infty \frac{dx}{x^4 + 16}.$

6. (a) Test whether the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ 2 & 2 & -1 \\ 1 & 2 & 1 \end{bmatrix}$ is diagonalizable. 6

(b) Find the bilinear transformation which maps the points $z = \infty, i, 0$ onto the points 6
0, i, ∞.

(c) Using Kuhn-Tucker condition solve the NLPP 8
$$\text{Max } Z = 2x_1^2 - 7x_2^2 + 12 x_1 x_2$$
$$\text{Subject to} \quad 2x_1 + 5x_2 \le 98$$
$$x_1, x_2 \ge 0$$

7. (a) Use method of Langrange's multipliers to solve LPP 6
$$\text{Optimize } z = 12x_1 + 8x_2 + 6x_3 - x_1^2 - x_2^2 - x_3^2 - 23$$
$$\text{Subject to } x_1 + x_2 + x_3 = 10 , \quad x_1, x_2, x_3 \ge 0$$

(b) If $f(z) = u + iv$ is analytic and $u+v = \dfrac{2\sin 2x}{e^{2y} + e^{-2y} - 2\cos 2x}$ 6
find $f(z)$.

(c) Show that the image of rectangular hyperbola $x^2 - y^2 = 1$ under the transformation 8
$w = \dfrac{1}{z}$ is the Lemniscate $\rho^2 = \cos 2\phi$.

Con. 3510-11.   **RK-1884**

(3 Hours)   [Total Marks : 100]

N.B. : (1) Question No. **1** is **compulsory**.
      (2) Attempt any **four** questions out of remaining **six** questions.

1. (a) Compare multi programmed, batch and Time sharing system.   5
   (b) What is semaphore ? Explain the application of semaphore.   5
   (c) What is segmentation ? State its usage.   5
   (d) Explain operating system design issues.   5

2. (a) Explain process and state diagram for PCB.   10
   (b) What is Paging ? Explain the structure of Page table.   10

3. (a) Solve dinning philosopher problem.   8
   (b) Given memory partition of 100 KB, 500KB, 200 KB, 300KB and 600 KB   12
      (in order), how would first-fit, best-fit and worst-fit algorithms place processes
      of 212 KB, 417 KB, 112KB, and 426 KB (in order) ? Which algorithm makes
      the most efficient use of memory ?

4. (a) What is Belady's anomaly ? Explain LRU, FIFO, Optimal page replacement   10
      algorithms. Which algorithm suffers from Belady's anomaly ?
   (b) Explain deadlock and condition for avoidance and prevention of deadlock.   10

5. (a) Give the components of LINUX system. Describe the role of Kernel model.   10
   (b) Explain process and thread management in LINUX.   10

6. (a) Consider the following set of processes with length of cpu burst given in Ms.   10

Job	Arrival Time	Burst Time
1	0	8
2	1	4
3	2	9
4	3	5

      (i) Give Gantt chart illustrating the execution of these jobs using FCFS,
         SJF Round Robin (Quantum = 1). Processes arrived in order 1,2,3,4
      (ii) Which algorithm will give minimum average waiting time for given
         set of jobs ?
   (b) Explain Linked and Indexed allocation of file system.   10

7. Write short notes on any **two** of following –   20
      (a) Disk Scheduling Algorithms
      (b) Page Fault Handling
      (c) Real Time Operating System
      (d) Virtual Memory.

Con. 3378-11.

(3 Hours) [Total Marks : 100]

N.B. : (1) Question No. **1** is **compulsory**.

 (2) Answer any **four** out of the remaining **six** questions.

 (3) Assume suitable data wherever **necessary**.

1. (a) Write a note on Asymptotic notations. Explain the procedure to analyze
   and measure time complexity.   10
  (b) What is Hamiltonian Cycle? Write an algorithm to find all Hamiltonian cycles 10

2. (a) What are tries ? Write a routine to delete a word from tries   10

  (b) Calculate variable length Huffman code for following frequencies 10

   A=2 B=3 C=1 D=7 E=6 F=5 G=16 H=21

3. (a) Describe 8 Queens Problem using backtracking method   10

  (b)Explain Quick sort algorithm. Evaluate complexity with suitable example 10

4. (a) Explain the usage of Branch and bound method to solve 15 puzzle using Least cost search 10

  (b) Write a routine to calculate the series   10

$$S = \sum_{i=1}^{n} i!$$

5. (a) Explain with suitable examples job sequencing with deadlines   10

   (b) With suitable example explain difference in pattern matching techniques of Brute Force and

   Knuth-Morris-Pratt Algorithm   10

6. (a) Explain Strassens Matrix Multiplication.Write an algorithm that multiplies two n X n   10

   Matrices using $O(n^3)$ operations

   (b) Perform Radix sort on the following set of data   10

   85, 26, 12, 15, 48, 55, 92, 9, 28, 79, 17

   (Give the output at every stage)

7. Write a Short notes on :-   20

   a) Randomized Algorithm

   b) Travelling Salesman problem with Branch and Bound

   c) Diffrentiate between Dynamic Programming and Branch & Bound

   d) Optimal storage on Tape.

(3 Hours)   [Total Marks : 100

N.B. : (1) Question No. 1 is **compulsory**.
       (2) Solve any four questions from the remaining **six**.
       (3) Figures to the **right** indicate **full marks**.
       (4) Make **suitable** assumptions where **neccessary**.

1. Solve any **four** :—

   (a) Why modulation is needed in communication ?   5
   (b) Explain the fuctioning of a practical diode detector.   5
   (c) Explain the concept and use of 'Eye Pattern'.   5
   (d) Compare TDM and FDM.   5
   (e) State and explain Shannon's Theorem.   5

2. (a) Define Amplitude Modulation. Draw a neat waveform for an AM wave. Derive   10
       expression for an AM wave and total transmitted power.
   (b) State and prove Sampling Theorem for low pass signal.   10

3. (a) Classify and explain in detail all types of noises that affect communication.   10
   (b) Draw a neat blocks diagram and waveforms for PCM transmitter and receiver   10
       and explain the working.

4. (a) Explain the functioning of a Binary Phase Shift Keying transmitter and receiver   10
       with the help of a neat diagram.
   (b) Explain the following :—   10
       (i)   Information
       (ii) Information rate
       (iii) Entropy
       (iv) Channel capacity.

   A message source generates on of four messages every microsecond. The
   probabilities of these messages are 0·4, 0·3, 0·2 and 0·1. Each message is
   independent of the other messages. Find the entropy and rate of information.

5. (a) Compare PAM, PWN, and PPM. 10
   (b) What is minimum Shift Keying ? Draw the transmitter block diagram and explain 10
       with the help of waveforms.

6. (a) What is Syndrome decoding ?   Draw and explain a syndrome decoder for an (n, k) 10
       block codes.
   (b) Draw the block diagram of a Super Heterodyne Radio Receiver and explain the 10
       working with the help of waveforms.

7. Write short notes on any **four** :— 10
       (a) Pre-emphasis and De-emphasis
       (b) Delta Modulation
       (c) Line Codes
       (d) Matched Filter
       (e) Cyclic Codes.

Con. 3363-11.   RK-1869

(3 Hours)   [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**

(2) Attempt any **four** out of **remaining**.

(3) Assume **suitable** data if **necessary** and **justify** the assumptions.

(4) **Figures** to the **right** indicate f ill marks.

1. [A] What are different Applications of computer graphics?   05

   [B] Explain inside outside test used in filling algorithms   05

   [C] Explain in brief Raster-scan display System   10

2. [A] Explain with example Scan line fill algorithm   10

   [B] Derive matrix for 2-D Rotation about an arbitrary point.   10

3. [A] Derive the transformation matrix, when point P(x, y) is reflected about a line 10
        y=mx+c

   [B] Give the steps along with the transformation matrix for the mapping of the 2-D 10
        object from window to viewport.

4. [A] Give the line clipping algorithm which uses area codes for the end points of the 15
        line segment. Test it for a line P1P2 Where P1=(9, 9) and P2=(50,20) against
        the window with (Xwmin, Ywmin)=(10, 10) and (Xwmax, Ywmax)=(20, 20).

   [B] Explain bit map method for character generation   05

5. [A] Develop an algorithm and give the steps for the moving car (side View). 10

   [B] Develop an algorithm and give the steps to continuously rotate a Triangle 10
        about a point.

6. [A] Give the properties of B-spline curve   10

   [B] Explain Cyrus Beck line clipping algorithm   10

7.   Write short notes on any four of the following :-   20
        (a)Fractal
        (b)Back face removal technique
        (c)Perspective Projections
        (d)Color models
        (e)Halftoning
        (f)Octree.

Con. 3266–11.

RK–1882

(3 Hours)

[Total Marks : 100]

N.B. 1) Question No. 1 is compulsory.

2) Attempt any four out of remaining six questions.

3) Figures to the right indicate full marks.

Q.1. a) Draw E-R diagram for online Railway Ticket Reservation system. Convert E-R   10
diagram into tables.

b) Describe the overall Architecture of DBMS with the diagram.   10

Q.2. a) Explain why 4NF is a normal form more desirable than BCNF.   10

b) Give the advantages of DBMS over file system.   10

Q.3. a) Explain Organization of records in files, in the sequential file organization, why is   10
an overflow block used even if there is, at the moment, only one overflow record?

b) What is transaction? Discuss ACID properties of transaction.   10

Q.4. a) Explain the distinction between closed and opened hashing. Discuss the relative   10
merits of each technique in database application

b) For given database, write SQL queries.   10

Employee (EID, Name, Street, City)

Works(EID, CID, Salary)

Manager (EID, Manager_Name)

Company(CID, Company_name, City)

i) Modify the database so that 'PRATHAM' now lives in "USA"

ii) Find all employees in the database who live in the same cities as the
company for which they work.

iii) Give all employees of 'SHARAYU Steel' a 10% raise in salary.

Q.5. a) What is recoverable schedule? Why is recoverability of schedule desirable? Are   10
there any circumstances under which it would be desirable to allow non-
recoverable schedule? Explain your answer.

b) Explain the type of constraints with an example.   10

Q.6. a) When a transaction is rolled back under timestamp ordering, it is assigned a new   10
timestamp. Why can it not simply keep its old timestamp?

b) Explain in detail Log-Based recovery.   10

Q.7. Write short notes on any TWO: 20

a) B+ Tree

b) Shadow Paging

c) Group by and order by clause in SQL.

d) Triggers