Q.P. Code : 5067

(3 Hours)   **[Total Marks : 80**

Instructions:

1) Question No. 1 is compulsory.

2) Attempt any **THREE** of the remaining.

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

Q 1. A) Find Laplace of $\{t^5 cosht\}$ (5)

B) Find Fourier series for $f(x) = 1 - x^2$ in (-1, 1)   (5)

C) Find a, b, c, d, e if,

$f(z) = (ax^4+bx^2y^2+cy^4+dx^2-2y^2)+i(4x^3y-exy^3+4xy)$ is analytic   (5)

D) Prove that $\nabla\left(\dfrac{1}{r}\right) = -\dfrac{\bar{r}}{r^3}$ (5)

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

B) Find inverse Z-transform of $f(z) = \dfrac{z+2}{z^2-2z+1}$ for $|z| > 1$ (6)

C) Find Fourier series for $f(x) = \sqrt{1 - cosx}$ in (0, 2π)

Hence, deduce that $\dfrac{1}{2} = \sum_1^\infty \dfrac{1}{4n^2-1}$ (8)

Q.3) A) Find $L^{-1}\left\{\dfrac{1}{(s-2)^4(s+3)}\right\}$ using Convolution theorem   (6)

B) Prove that $f_1(x) = 1$, $f_2(x) = x$, $f_3(x) = (3x^2-1)/2$ are orthogonal over (-1, 1)   (6)

C) Verify Green's theorem for $\int_c \bar{F}.\overline{dr}$ where $\bar{F} = (x^2 - y^2)i + (x+y)j$ and c is the

triangle with vertices (0,0), (1,1), (2,1)   (8)

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Q.4) A) Find Laplace Transform of $f(t) = |sinpt|$, $t \geq 0$ (6)

B) Show that $\bar{F} = (ysinz-sinx) i + (xsinz+2yz) j + (xycosz+y^2) k$ is irrotational. Hence, find its scalar potential. (6)

C) Obtain Fourier expansion of $f(x) = x + \dfrac{\pi}{2}$ where $-\pi < x < 0$

$$= \dfrac{\pi}{2} - x \text{ where } 0 < x < \pi$$

Hence, deduce that (i) $\dfrac{\pi^2}{8} = \dfrac{1}{1^2} + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \ldots$

(ii) $\dfrac{\pi^4}{96} = \dfrac{1}{1^4} + \dfrac{1}{3^4} + \dfrac{1}{5^4} + \ldots$ (8)

Q.5) A) Using Gauss Divergence theorem to evaluate $\iint_S \bar{N}.\bar{F} ds$ where $\bar{F} = 4xi - 2y^2 j + z^2 k$ and S is the region bounded by $x^2 + y^2 = 4$, $z = 0$, $z = 3$ (6)

B) Find $Z\{2^k cos(3k + 2)\}$, $k \geq 0$ (6)

C) Solve $(D^2 + 2D + 5)y = e^{-t} sint$, with $y(0) = 0$ and $y'(0) = 1$ (8)

Q.6) A) Find $L^{-1}\left\{tan^{-1}\left(\dfrac{2}{s^2}\right)\right\}$ (6)

B) Find the bilinear transformation which maps the points 2, i, -2 onto points 1, i, -1 by using cross-ratio property. (6)

C) Find Fourier Sine integral representation for $f(x) = \dfrac{e^{-ax}}{x}$ (8)

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QP Code : 5180

(3 Hours) [Total Marks : 80]

N.B. : (1) Question No. **1** is **compulsory**.
  (2) Answer **any three** out of remaining questions.
  (3) Assume suitable data if necessary.
  (3) **Figures** to the **right** indicate **full marks**.

1 (a) Explain with example 3
    (i) Degree of tree
    (ii) Height of tree
    (iii) Depth of tree
  (b) What is linked list? Give its applications. 3
  (c) Define Graph. List the types Graph with example. 3
  (d) What is Asymptotic Notations. 3
  (e) Write down the properties of Red-Black tree. 3
  (f) What are linear and non-linear data structures. 3
  (g) Define minimum spanning tree. 2
    List the techniques to compute minimum spanking tree.

2 (a) Write a program to implement Queue ADT using array 10
  (b) Define Binary search tree. Write an algorithm to implement Insertion and Deletion 10
    Operation.

3. (a) Write a program to convert INFIX expression into POST FIX expression. 10
  (b) Define AVL tree? Construct AVL tree for following data [Mention type of rotation 10
    for each case]
        1, 2, 3, 4, 8, 7, 6, 5, 11, 10, 12

4. (a) Using Prim's and kruskal's algorithm find minimum spanning tree for the following Graph 10

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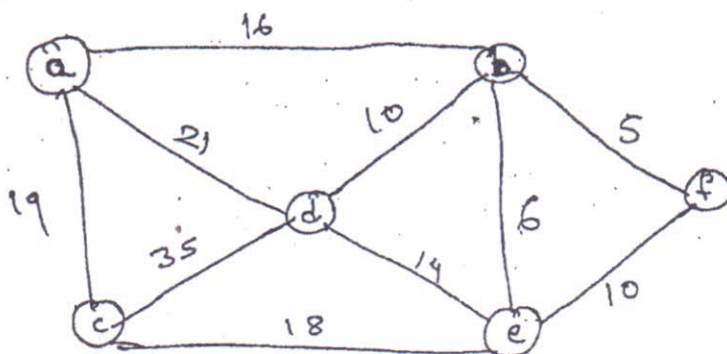
(b) Write an algorithm to implement shell sort. 10

5. (a) Write a program to create singly linked list and display the list. 10
    (b) Explain BFS and DFS algorithm with example. 10

6. Write short note on **any four** 20
      (a) B- Tree
      (b) Red Black Trees
      (c) Searching Algorithms
      (d) Sparse Matrix
      (e) Euclids algorithm
      (f) Merge Sort

Q.P. Code : **5229**

(3 Hours) [Total Marks :100

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

(2) Solve any **three** questions out of remaining questions.

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

I. Solve any five 20

    (a) Convert

        (i) $(174.03125)_{10}$ in octal number and $(DB.94)_{16}$ in binary

        (ii) Make subtraction using 2's complement method $(52)_{10} - (65)_{10}$

    (b) Compare schottky barrier diode and PN junction diode

    (c) Derive the relation between α and β.

    (d) List the ideal characteristics of OPAMP

    (e) Prove that NAND gate is universal gate.

    (f) Convert T-FF to D-FF

2. (a) Draw block diagram of a shunt voltage regulator and explain the working   4

   (b) Derive the expression for the stability factor 'S' of a voltage divider bias circuit   8

   (c) Draw circuit diagram of differentiate using OPAMP and explain   8

3. (a) Explain inverting summing amplifier using OPAMP. Derive the expression for output voltage.   8

   (b) $Y = ABC + B\overline{C}D + \overline{A}BC$ simplify this equation and realize using basic gates.   4

   (c) Minimize the following expression using K-map   8

    $Y = \sum m \ (1,2,9,10,11,14,15)$

    Implement the circuit using minimum number of gates

4. (a) Design on 8 bit comparator using IC 7485   8

   (b) Implement the following function using 8:1 Mux   4

    $F (A, B, C, D) = \sum m \ (0,1,2,4,6,9,12,14)$

   (c) What is shift register? Mention different modes of operation of shift register.   8

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5. (a) What are advantages of VHDL 8
Write VHDL program for full adder
(b) Design 4 bit synchronous up counter using T-FF 8
(c) Draw the circuit of JK FF using NAND gates and write the truth table 4

6. (a) Design on astable multivibrator using IC 555 timer to generate an output 5
of 1KHz with 60% duty cycle
(b) Draw the circuit diagram of regulated power supply to produce out put 5
voltage of +5V
(c) Draw drain characteristics of n-channel JFET and explain various regions 5
(d) What is excess 3 code? Why it is called self complementary code? 5

(3 Hours)   **[Total Marks : 80]**

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

    (2) Solve any three questions out of the remaining questions.

    (3) Make suitable assumptions if needed.

Q1) a) What is a database? Explain with examples. Also list the advantages of a database system. (5)

    b) Compare ER and EER models. (5)

    c) Describe ACID properties. (5)

    d) Write a note on views in SQL (5)

Q.2) a) Draw an ER diagram for the education database that contains the information about an in-house company education training scheme. The relevant relations are: (10)

    Course (course-no, title)

    Offering (course-no, off-no, off-date, location)

    Teacher (course-no, off-no, emp-no)

    Enrolment (course-no, off-no, stud-no, grade)

    Employee (emp-no, emp-name, job)

    Student (stud-no, stud-name, ph-no)

    b) Refer education database mentioned in 2(a), write SQL queries for the following. (10)

     i) List all the teachers who conduct the course titled "Database Systems"

     ii) List all the courses offered in 'Thane' on 15/8/15.

     iii) Find the course/s enrolled by "Monali".

     iv) List all the employees who work as Teachers.

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TURN OVER.

Q.3) a) Discuss what is meant by each of the following terms (any 2)   (10)

     i) Database Authorization

     ii) Referential Integrity

     iii) Trigger

   b) Describe concurrency control based on timestamp ordering.   (10)

Q.4) a) Describe the Shadow Paging recovery technique.   (10)

   b) Describe the following Relational Algebra operations.   (10)

     i) Select   ii)Project   iii) Natural Join   iv) Set Intersection

Q. 5) a) Describe BCNF and 4NF in detail.   (10)

     b) What is system catalog or metadata? Explain.   (10)

Q. 6) a) Write a short note on (any 2)   (20)

     i) Query Optimization

     ii) Relational Calculus

     iii) Deadlock handling

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QP Code : 5133

(3 Hours) [Total Marks : 80]

N.B. : (1) Question No. 1 is **compulsory**.
    (2) Attempt any **three** questions from the **remaining** questions.
    (3) Assume **suitable** data, if **necessary**.
    (4) Figures to **right** indicate **full** marks.

1. Solve any **four** :—   20
    (a) Explain pre-emphasis and De-emphasis.
    (b) Explain the following (i) Shot noise (ii) Equivalent Noise temparature.
    (c) A single tone FM single is given by $V_{FM(t)} = 10 \sin (16 \pi \times 10^6 \, t + 20 \sin 2 \pi \times 10^3 \, t)$
       Find   (a) Maximum frequency deviation
              (b) BW of FM by using Carson's rule.
    (d) What are the drawbacks in DM system and how these drawbacks can overcome.
    (e) Explain the need for modulation.

2. (a) Explain the basic principle, working of Transmitter and receiver and BPSK. Also   10
       draw the BPSK Waveform for the following binary signal 10110110.
   (b) Draw the data formats (linecodes) of any five for the given binary signal 10101101.   10

3. (a) Explain PWM generation and degeneration method.   10
   (b) Describe PCM and also explain the PCM encoder and decoder with block diagram.   10

4. (a) Explain Foster seeley discriminator and Compare the performance of Foster seeley   10
       and Ratio detector.
   (b) A sinusoidal carrier has an amplitude of 20v and a frequency of 200kHz. It is amplitude   10
       modulated by a sinusoidal voltage of amplitude 6v and frequency 1kHz. Modulated
       voltage is developed across a 80Ω resistance.
       (i) Write the equation for the modulated wave.
       (ii) Determine the modulation index.
       (iii) Draw the spectrum of modulated wave.
       (iv) Calculate the total average power.

5. (a) Explain the generation and demodulation of SSBSC.   10
   (b) State and prove the following properties of Fourier Traulform.   10
       (i) Time Shifting
       (ii) Differentiation in Time domain.

6. Answer any **four** :—   20
    (a) QPSK   (d) Image frequency and its rejection
    (b) PCM-TDM   (e) Sampling theorem.
    (c) Friss formula

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