Con. 3009-10.   AN–2569

(3 Hours)   [Total Marks : 100]

N.B.   1)   Question No. **1** is <u>compulsory</u>
           2)   Attempt any <u>FOUR</u> questions from remaining <u>SIX</u> questions.

1.   a) Write a program to implement a STACK ADT using Linked list.   10
     b) Explain Huffman Coding and construct Huffman code for the following   10
             "JAVA DATA STRUCTURES"

2.   a) Construct the binary tree for the inorder and post order traversal sequence given below
             In order: "INFORMATION "   10
             Post order: "INOFMAINOTR "
     b) Write and explain Radix sort algorithm with suitable example.   10

3.   a) Write an algorithm for merge sort and comment on its complexity.   10
     b) Calculate and draw the minimum cost spanning tree using Kruskal's algorithm for the 10
         following graph.
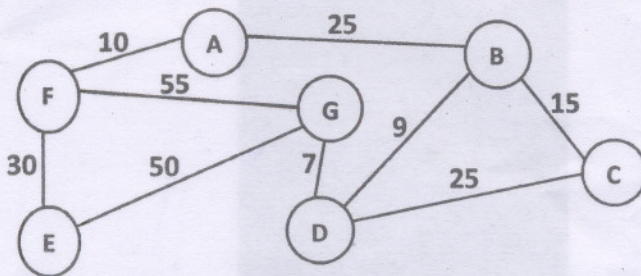
4.   a) Explain how Interfaces and Packages are created and accessed with their syntax.   10
     b) Write any Pattern Matching Algorithm and explain it with suitable example.   10

5.   a) Write a program to implement queue using array.   10
     b) Write a program to search an element in an array using binary search technique.   10

6.   a) Write algorithm for heap sort and explain Ascending heap with suitable example.   10
     b) Hash the following in a table of size 11. Use any two collision resolution technique   10
             99   67   41   0   17   2   98   20   94   27

7.   Write short note on any four of the following: –   20
     i)   AVL Trees
     ii)   Red and Black Trees
     iii) Asymptotic Notation
     iv)   Recursion
     v)   Graph traversal technique
     vi)   Abstract data type.

(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.
      (4) Make **suitable** assumptions if **required** and justify the same.

1. (a) Find the orthogonal trajectory of the family of curves $x^3y - xy^3 = c$ 5
   (b) Find the Laplace transform of —   5

   (i) $\sin\sqrt{t}$ (ii) $\dfrac{\cos\sqrt{t}}{\sqrt{t}}$

   (c) Show that $\left[\,\text{diag}(\alpha\ \beta\ \gamma)\right]^{-1} = \text{diag}\left(\dfrac{1}{\alpha}, \dfrac{1}{\beta}, \dfrac{1}{\gamma}\right)$ if $\alpha\ \beta\ \gamma \neq 0$.   5

   (d) If $f(x) = x - x^2$ for $-1 < x < 1$ obtain Fourier series of $f(x)$ in $(-1, 1)$.   5

2. (a) Find the Fourier series for the function $f(x) = |x|$ in $(-\pi, \pi)$ and hence deduce   6

   that $\dfrac{\pi^2}{8} = 1 + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \dots$

   (b) Show that $u = \cos x \cosh y$ is a harmonic function. Find its harmonic conjugate   7
       and corresponding analytic function.

   (c) Determine l, m, n and find A^{-1} if $A = \begin{bmatrix} 0 & 2m & n \\ l & m & -n \\ l & -m & n \end{bmatrix}$ is orthogonal.   7

3. (a) Show that $\displaystyle\int_C \log z\, dz = 2\pi i$ where C is the unit circle in the z plane.   6

   (b) Using Convolution Theorm, find the inverse Laplace transform of —   7

   $$\dfrac{s^2 + 2s + 3}{\left(s^2 + 2s + 2\right)\left(s^2 + 2s + 5\right)}$$

   (c) Show that the set of function $\cos nx$ is orthogonal function in $(0, 2\pi)$.   7

4. (a) Find the Fourier series for the function $f(x) = x$ in $(-\pi, \pi)$ and hence deduce   6

   that $1 - \dfrac{1}{3} + \dfrac{1}{5} - \dfrac{1}{7} + \dots = \dfrac{\pi}{4}$

   (b) Find an analytic function whose real part is $\dfrac{1}{2}\log\left(x^2 + y^2\right)$. Also find its imaginary   7

   part using Milne Thompson's method.

   (c) Using partial fraction method find the inverse Laplace transform of $\dfrac{s + 2}{s^2(s + 3)}$.   7

[**TURN OVER**

Con. 3028-AN-2578-10.

5. (a) If $f(x) = c_1 \phi_1(x) + c_2 \phi_2(x) + c_3 \phi_3(x)$ where c_1, c_2, c_3 are constant and ϕ_1, ϕ_2 and ϕ_3 6

are orthonormal sets of function on (a, b). Then show that $\int_a^b [f(x)]^2 dx = c_1^2 + c_2^2 + c_3^2$

(b) Find the adjoint of the coefficient matrix of the following system and determine   8
its inverse matrix. Hence solve the system :—
$$x + y + z = \alpha$$
$$x + 2y + 3z = \beta$$
$$2x + 3y + 8z = \gamma$$

(c) Expand a function $\cos z$ in a Taylor's series about $z = \dfrac{\pi}{4}$.   6

6. (a) If $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$, find two matrices P and Q such that PAQ is in normal form.   6

(b) Evaluate the following using Cauchy Residue Theorem —   7

     (i) $\displaystyle\int \frac{(z+4)^2}{z^4 + 5z^3 + 6z^2} dz$ where c is $|z| = 1$

     (ii) $\int \csc z\, dz$ where C is $|z| = 1$

(c) Prove that necessary and sufficient condition for a square matrix A to possess   7
the inverse is that $|A| \neq 0$.

7. (a) Solve : $2x - y + 3z = 0$ 6
$$3x + 2y + z = 0$$
$$x - 4y + 5z = 0$$

(b) Find the Laplace transform of —   8
     (i) $e^{4t} \sin^{3t}$ (ii) $\sin^{4t}$ (iii) $(t\sinh_2 t)^2$

(c) Solve the equation by Laplace transform method :—   6

$$\frac{d^2 x}{dt^2} + 4x = 0$$

given $x(0) = 1$, $x^1(0) = -2$

I.B. : (1) Question No. 1 is **compulsory**.
      (2) Attempt any **four** questions out of remaining **six** questions.
      (3) Assume **suitable** data if **necessary**.
      (4) Figures to **right** indicate **full marks.**

1.   Answer any Four: 20

   (a)   State and Explain Barkhausen's criterion for Oscillators.

   (b)   Draw the circuit diagram of Dual input Balanced
          output Differential amplifier and write formulae for
          A_d, A_c, CMRR, R_{in} and R_o.

   (c)   List down the ideal characteristics of OPAMP.

   (d)   Draw the Pin Diagram of IC 555, neatly identifying name
          of each pin and Explain the use of pin no. 5.

   (e)   Draw the neat labeled Diagram of R-2R type DAC.

2. (a)   With the help of neat labeled circuit diagram, Explain   10
         the working of Practical Integrator . Also Explain its
         advantages over a simple Integrator.

   (b)   Draw and Explain the working of a Square and Triangular   10
         Wave Generator using OPAMP.

3. (a)   Design a Wein Bridge Oscillator for a frequency of 1000 Hz.   5

   (b)   Explain using an OPAMP the operation of a wein Bridge   5
         Oscillator.(No Derivation).

   (c)   Explain the working of a Non Inverting Adder using OPAMP.   10

4. (a)   Design an Astable multivibrator using IC 555 for f_o 5KHz   10
         and duty cycle of 75%.

   (b)   Draw and Explain Successive Approximation Register   10
         type ADC.

5. (a)   Draw and Explain the circuit diagram of First Order   10
         Butterworth Low Pass Filter.

   (b)   Design a First Order Low Pass Filter for cut-off frequency of 10
         1KHz and Pass band gain of 10.

                                                        [TURN OVER

6. (a) Explain the working of IC 723 as a Low Voltage Regulator　　10
   (b) For a CE amplifier with Bypass capacitor, $R_1 = 100K\Omega$,　　10
   $R_2 = 10k\Omega$, $R_c = 2.2k\Omega$, $R_E = 680\Omega$, $V_{cc} = +16V$, $V_{BE} = 0.6V$, $\beta = 200$,
   $r_e = 25\Omega$, $R_L = 50K\Omega$. Determine:
   DC bias point(V_{CEQ} and I_{CQ}),
   Current Gain(I_o/I_{in}),
   Output Resistance(R_o).

7.　　　Write Short Notes on (Any Four)　　20
   (a) Stability Factor for Biasing circuits.
   (b) Switching Regulators.
   (c) Level Shifting Circuits.
   (d) IC 555.
   (e) Three Terminal Regulators.
   (f) Advantages of Active Filters.

1 : 1st half-Exm. 10-Mina-(e)

Con. 3013-10.

Digital Logic Design & Appliat **AN-2572**

(3 Hours) [Total Marks : 100

N.B. (1) Question No. **1 compulsory**.
   (2) Answer any **four** questions out of remaining **six** questions.
   (3) **Assume** suitable data if **required**.

1. (a) Convert the following sign-magnitude numbers to a decimal equivalent :— 5
      (i) 0011 011 0
      (ii) 1010 1110

   (b) Consider a number FD34H as a input to 16 bit controlled inverter. Give the 5
      output of the inverter in hexadecimal notation and binary notation.
      Design the required circuit.

   (c) Implement the following Boolian function using 8 : 1 MUX :— 5
      $F (P, Q, R, S) = \Sigma m (0, 1,3, 4, 8, 9, 15)$.

   (d) Show that :— 5

      (i) $A \left(\overline{B} + C \right) = (A + \overline{B} + \overline{C}) (\overline{A} + \overline{B} + C)$

      (ii) $(A + \overline{B} + \overline{C}) (\overline{B} \, \overline{D} + \overline{D} \, \overline{E}) = (\overline{B} + \overline{E}) (\overline{D} + \overline{E})$.

2. (a) Design and implement a BCD to excess 3 code converter using suitable decoder 10
      and minimum number of logic gates.

   (b) Convert :— 10
      (i) SR F/F to JKF/F
      (ii) JK to D F/F.

3. (a) Design and implement 8 × 4 bit ROM using suitable decoder. 10
   (b) A and B are the two 2 bit input to the comparator for the following condition :— 10
      A = B
      A < B
      A > B.

5. (a) Implement the following SOP using PAL and PLA :— **10**

$$F_0 = \overline{A}\,\overline{B} + A\,\overline{C}$$

$$F_1 = A\,\overline{C} + B$$

$$F_2 = \overline{A}\,\overline{B} + B\,\overline{C}$$

$$F_3 = B + AC$$

(b) Draw the logic diagram for J K master slave configuration. Explain the same **10** using suitable waveform. State its application.

6. (a) On certain railway station consisting of seven platforms. For the following situation :— **10**
  (i) train has entered station
  (ii) train is haulted on platform
  (iii) train is about to leave the platform
  Design a suitable control system for mointoring in the control room.
(b) Explain the essential features of VHDL. Write a VHDL for full adder. **10**

7. Write short notes on any **three** of the following :— **20**
  (a) Carry look-ahead generator
  (c) CAD tools
  (b) FGPA architecture
  (d) Bidirectional shift registers.

Con. 3019–10.   **AN–2575**

(3 Hours)   [Total Marks : 100

N.B.: (1) Question no. **1** is compulsory.
    (2) Answer any **four** out of the remaining questions.

1. (a) What do you mean by E-R diagram ?Draw E-R diagram for university database
      consisting of four entities : Student, department, Class ,faculty   10
      - student has a unique id,the student can enroll for multiple classes
        and has at most one major.
      - Faculty must belong to department and faculty can teach multiple classes
      - Each class is taught by only one faculty
      - Every student will get grade for the class he/she has enrolled.
   (b) Describe the overall architecture of a DBMS with a diagram   10

2. (a) Explain following Relational algebra operators with suitable examples :-   10
      (i)   Select
      (ii) Project
      (iii) Join
      (iv) Division
      (v) Cartesion product
   (b) Give four advantages that a DBMS has over that of a file system.   10

3. (a) Explain the following controls of Visual basic : –   10
      (i)   Listbox
      (ii) Command button
      (iii) Combo Box
      (iv) Message box
      (v) Checkbox
   (b) Explain Murphy's law of GUI Design with the help of an example.   10

4. (a) Design Active X control for the following GUI screen and explain the procedure for
      Adding the control to component dialog box   10

Calendar.OCX	
	Set date

   (b) Discuss ADO and COM Remote Architecture.   10

5. (a) What do you understand by deadlocks in database system ? Explain how it is prevented .   10

   (b What is transaction ? Discuss state transition diagram and properties of transaction.   10

6. (a) For the given employee database give an expression in SQL for the following : –   10

   Employee(empname,street,city)
   Works(empname,company-name,salary)
   Company (company-name , city)
   Manages (empname , manager-name)

   (i)   Create table ,insert values for all the tables given
   (ii)   Modify the database so that 'jones' now lives in 'Newtown'
   (iii)   Give all employees of First bank corporation a 10 percent raise.

   (b) Define Serializability ? Explain conflict and view serializability .   10

7. Write short notes on :-   20
   (i)   Validation Based protocol
   (ii)   Total participation, Partial participation, Unique key , primary key and partial key
   (iii)   Logbased and checkpoint based recovery mechanisms .

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Con. 3013-10.
AN-2572

(3 Hours)
[Total Marks : 100

N.B. (1) Question No. **1 compulsory**.
      (2) Answer any **four** questions out of remaining **six** questions.
      (3) **Assume** suitable data if **required**.

1. (a) Convert the following sign-magnitude numbers to a decimal equivalent :—   5
        (i)   0011 011 0
        (ii)   1010 1110
  (b) Consider a number FD34H as a input to 16 bit controlled inverter. Give the   5
      output of the inverter in hexadecimal notation and binary notation.
      Design the required circuit.
  (c) Implement the following Boolian function using 8 : 1 MUX :—   5
      F (P, Q, R, S) = Σm (0, 1,3, 4, 8, 9, 15).
  (d) Show that :—   5

      (i) $A\left(\overline{B} + C\right) = (A + \overline{B} + \overline{C})(\overline{A} + \overline{B} + C)$

      (ii) $(A + \overline{B} + \overline{C})(\overline{B}\,\overline{D} + \overline{D}\,\overline{E}) = (\overline{B} + \overline{E})(\overline{D} + \overline{E}).$

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  (b) Convert :—   10
      (i)   SR F/F to JKF/F
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3. (a) Design and implement 8 × 4 bit ROM using suitable decoder.   10
  (b) A and B are the two 2 bit input to the comparator for the following condition :—   10
      A = B
      A < B
      A > B.

4. (a) For the following sequence :—   10
      0110 0111010 011
      Design a sequence generator using Mealy method.
  (b) Design a Mod 5 asynchronous counter using T flip-flop. What is a gliten problem ?   10
      How is it over comed ?

5. (a) Implement the following SOP using PAL and PLA :— **10**

$$F_0 = \bar{A}\bar{B} + A\bar{C}$$

$$F_1 = A\bar{C} + B$$

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