S.E / com / Sem III
Data structure files

(3 Hours)   [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** question from Q. No. **2 to 7**.
(3) Use **diagrams** wherever **necessary**.
(4) Assume **suitable** data wherever **required** but **justify** the same.

1. (a) Explain different types of data structure with example.   05

(b) Write recursive java method that finds minimum and maximum values in an array   05
of int values without using any loops.

(c) Define i) Abstract Data Type ii) Binary Tree iii) Graph   05

(d) Write short note on Priority queue .Explain with example.   05

2. (a) Write a program in java to delete a node from the given binary search tree.   10
Consider all cases.

(b) write a program in java to perform insertion sort.   10
Sort the following using insertion sort
10 , 3 , 8 , 4 , 2

3. (a) Construct binary tree for the preorder and inorder traversal sequences   10
Given below.

Preorder : A B D G C E H I F
Inorder : D G B A H E I C F

(b) Write a program which will read a text and count all occurrences of particular word .   10

4. (a) Write a program to reverse the circular linked list.   10

(b) Hash the following in a table of size 11 .Use any two collision resolution techniques   10
23 , 0 , 52 ,61 , 78 , 33 , 100 , 8 , 10 , 90 ,14

5. (a) Write a program in java to create a doubly linked list and perform following   12
Operations.
i)Insert into list ii) Search for data iii) Delete from list iv) Display

(b) What are different methods to represent graph in memory?   08
What are applications of graph.

4 (a) Write a program to reverse the circular linked list.   10

   (b) Hash the following in a table of size 11 .Use any two collision resolution techniques   10
       23 , 0 , 52 ,61 , 78 , 33 , 100 , 8 , 10 , 90 ,14

5 (a) Write a program in java to create a doubly linked list and perform following   12
      Operations.
        i)Insert into list ii) Search for data iii) Delete from list iv) Display

   (b) What are different methods to represent graph in memory?   08
       What are applications of graph.

6 (a) Write a program to implement conversion of a given number to its equivalent   10
      Binary form using stack.

   (b) Write a program in java to read data from file .Read file name from command line.   10

7 Write notes on: 20

   (a) AVL Tree

   (b) Array Representation of linked list

   (c) Binary Search

   (d) Graph traversal algorithms

Con. 5530-10.   **GT-6234**

(3 Hours)   [Total Marks : 100

N.B. (1) Question No. 1 is **compulsory**.
  (2) Attempt any **four** questions out of remaining **six** questions.
  (3) **Figures** to the **right** indicate **full** marks.

1. (a) Find Z-transform of $\{ \cos(ax+b) \}$, $k \geq 0$ 5

   (b) Evaluate $\displaystyle\int_0^\infty \frac{\sin 2t}{t}\, dt$ using Laplace transform.   5

   (c) Express the matrix $A = \begin{bmatrix} 3 & -2 & 6 \\ 2 & 7 & -1 \\ 5 & 4 & 0 \end{bmatrix}$ as the sum of symmetric and skew-   5

   symmetric matrix.

   (d) 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 constants and ϕ_1, ϕ_2, ϕ_3 5

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

2. (a) Find $L\,[\,\sin h^5 t\,]$ 6
   (b) Find Fourier sine transform of $f(x)$ 6

   if $f(x) = \begin{cases} 0 & 0 < x < a \\ x & a \leq x \leq b \\ 0 & x > b \end{cases}$

   (c) Find a Fourier series of $f(x) = x^2$ in $(0, 2\pi)$ and hence deduce that—   8

   $$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots$$

3. (a) Express the function $f(x) = \begin{cases} -e^{kx} & \text{for } x < 0 \\ e^{-kx} & \text{for } x > 0 \end{cases}$ as a Fourier integral and   6

   hence prove that $\displaystyle\int_0^\infty \frac{w \sin wx}{w^2 + k^2}\, dw = \frac{\pi}{2} e^{-kx}$ if $x > 0$, $k > 0$

   (b) Find $L\left[\dfrac{\cos 2t \sin t}{e^t}\right]$ 6

   (c) Find the inverse of B and then the matrix BAB^{-1} where—   8

   $$B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \text{ and } A = \frac{1}{2}\begin{bmatrix} 5 & 2 & 1 \\ 1 & 4 & -1 \\ -1 & -2 & 3 \end{bmatrix}.$$

[TURN OVER

4. (a) Find the Fourier series for $f(x) = 1 - x^2$ in $(-1, 1)$.   **6**

    (b) Find inverse Laplace transform of $\dfrac{s}{\left(s^2 + a^2\right)\left(s^2 + b^2\right)}$ by using convolution   **6**

    theorem.

    (c) Find the rank of matrix A by reducing it to normal form where—   **8**

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

5. (a) Find Z transform of $f(k) = 5^k$ for $k < 0$ **6**
    $\qquad\qquad\qquad\qquad\quad = 3^k$ for $k \geq 0$

    (b) Obtain the complex form of Fourier series for $f(x) = e^{ax}$ in $(0, a)$.   **6**

    (c) Find the inverse Laplace transform of—   **8**

$$\text{(i)}\ \frac{3s+1}{(s+1)\left(s^2 + 2\right)} \qquad \text{(ii)}\ \frac{s^2}{(s+a)^3}$$

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) Find $L\left[t \cdot \sqrt{1 + \sin t}\,\right]$ **6**

    (c) Find Fourier expansion for $f(x) = x - x^2$, $-1 < x < 1$.   **8**

7. (a) Obtain half range cosine series for—   **6**
    $\qquad\qquad f(x) = x$ in $0 < x < 2$

    (b) Solve the following system of equations—   **6**
    $\qquad\qquad x + y + z = 3$
    $\qquad\qquad 2x + 5y + 7z = 14$
    $\qquad\qquad 2x + y - z = 2$

    (c) Use Laplace transform to solve :   **8**

$$\frac{d^2 y}{dt^2} + 4\frac{dy}{dt} + 8y = 1 \quad \text{where } y(0) = 0,\ y'(0) = 1.$$

Con. 5676–10.

GT–6243

Electronic Devices (3 Hours) & Linear Circuits

[Total Marks : 100

N.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.

Q .1. Attempt any four of the following: 20

a) Compare BJT & FET.

b) Why Common Emitter Configuration is widely used in amplifier circuits?

c) What do you mean by CMRR? What are the various methodes to improve CMRR?

d) Explain summing amplifier.

e) List features of IC 555.

Q .2. a) Classify & explain feedback amplifiers. 10

b) Explain graphical determination of the h- parameters using charecteristic curves of C.E. amplifier. 10
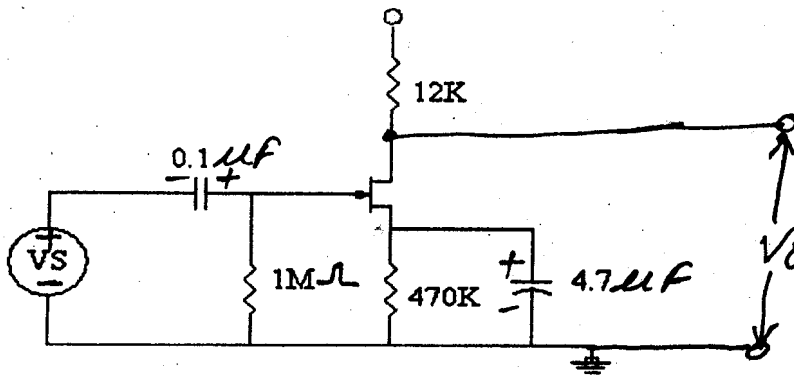
Q .3. a) FET amplifier shown below has following parameters 10

IDSS = 3mA, V_P = -4V   rd >>RD

Determine, V_{GS}, I_D, V_{DS} & A_V (small signal voltage gain)

V_{DD} = 30V

b) Explain construction & working of n- channel JFET with the help of charecteristic curves. 10

Q. 4. a) Explain any two applications of Astable multivibrator using IC 555. 10

b) Explain any two applications of IC 565 PLL. 10

Q .5. a) Explain a high voltage low current regulator & low voltage high current regulator. 10

b) Design a regulator using LM 723 for V_O = 9V & I_O = 3Amps. 10

Q .5. a) Explain a high voltage low current regulator & low voltage high current regulator.   10

   b) Design a regulator using LM 723 for V_0 = 9V & I_0 = 3Amps.   10

Q . 6. a) Draw and explain successive Approximation Resister type ADC.   10

   b) Explain working of practical Integrator. Also explain its advantages over a simple integrator.   10

Q . 7. Write a short notes on (any <u>four</u>) :   20

   a) Switching regulators

   b) Differentiator

   c) Digital to analog convertor using R - 2Rregisters.

   d) Virtual ground of Op-Amp

   e) Inverting Schmitt trigger.

S. E. (Comp & IT) Sem III

E. N. 6/1/2011

Con. 6010-10.   **GT-8277**

(3 Hours)   **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
     (2) Attempt any **four** questions from remaining **six** questions.
     (3) Assume **suitable data** if **necessary**, with proper **justification**.

1. (a) Explain Source transformation and shifting.   **20**
   (b) Explain the effect of initial conditions of inductance and capacitance on transients in electrical circuits.
   (c) For a two port network, derive the condition for symmetry in terms of T parameters. Explain the principle of Duality.

2. (a) For the network shown in **fig. 2.a.** Obtain 'I' (current through 8 Ω) by using source trans-   **10**
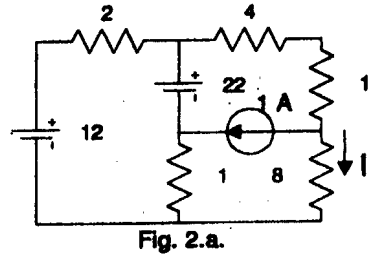formation and shifting.

Fig. 2.a.

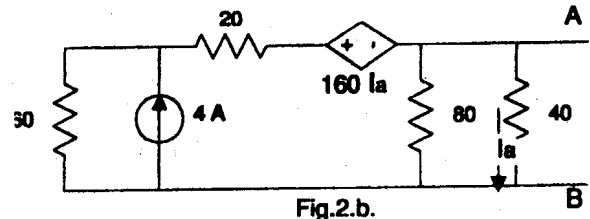   (b) For the network shown in **fig. 2.b.**, obtain Thevenin's equivalent circuit w.r.t terminals A and B.   **10**

Fig.2.b.

3. (a) In the network shown in **fig-3.a**, the switch is closed at t = 100 sec. Obtain the expression   **10**
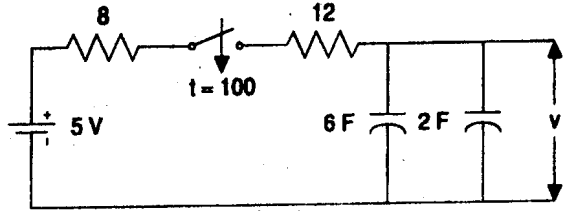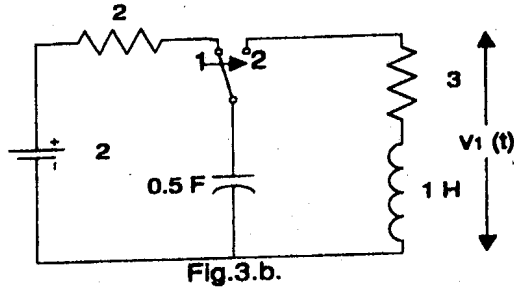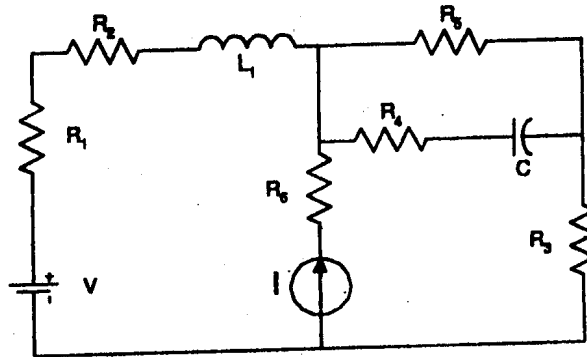for v(t) if v(100) = − 3 V.

Fig.3.a.

(b) A In the network shown in **fig-3.b**, initially the switch is in position '1' for a long time to **10** establish a steady state at position '1'. At t = 0, the switch is changed to position '2'. Obtain the expression for $V_1(t)$.

Fig.3.b.

4. (a) Draw the dual of network shown below :— **10**

(b) Linear graph of a network is shown in **fig-4.b**. For the given tree, obtain :—   **10**
     (i)   incidence matrix
     (ii)   fundamental cut set matrix
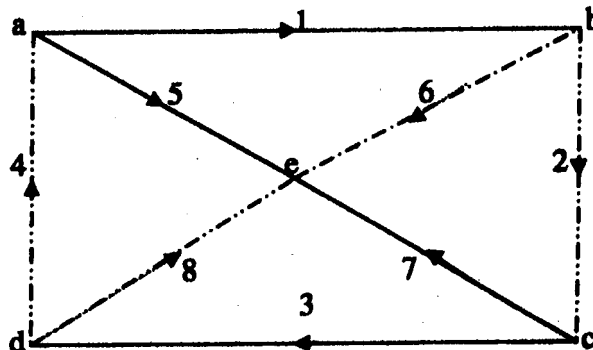   (iii)   fundamental tie set matrix.

Fig-4.b.

5. (a) For the two port network shown in **fig-5.a**, determine $\dfrac{V_2(s)}{V_1(s)}$ and $\dfrac{I_2(s)}{V_1(s)}$.   **10**
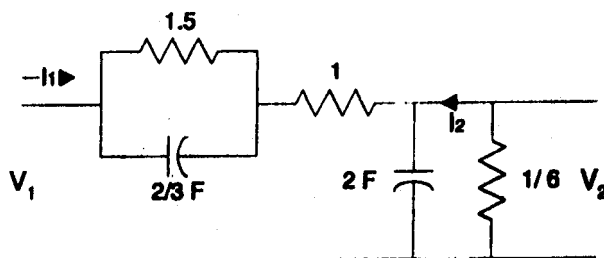

Fig.5.a.

(b) Sketch Bode plot for the following transfer function :—   **10**

$$G(s)\,H(s) = \frac{100(s + 10)}{s(s + 5)(s + 50)}$$

6. (a) What are the properties Hurwitz polynomial ?   **4**

(b) Which of the following are Hurwitz ?   **6**
     (i) $S^5 + 8\,s^4 + 24\,s^3 + 28\,s^2 + 23\,s + 6$
     (ii) $S^3 + 2\,s^2 + 4\,s + 2$
     (iii) $s^4 + 2\,s^3 + 3\,s^2 + 4\,s + 5$.

(c) Test the following functions for positive realness :—   **10**

     (i) $Y(s) = \dfrac{1 + 4s + 3s^2}{1 + 3s + 1\cdot 25s^2}$ (ii) $Z(s) = \dfrac{(s + 1)(s + 3)}{(s + 0\cdot 5)(s + 2\cdot 5)}$

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(ii) $Z(s) = \dfrac{(s + 1)(s + 3)}{(s + 0 \cdot 5)(s + 2 \cdot 5)}$.

(a) What are the properties of LC impedance or admittance function ? **4**

(b) Which of the following are LC functions ? **6**

(i) $\dfrac{K.s^2 \left(s^2 + 4\right)}{\left(s^2 + 1\right)\left(s^2 + 3\right)}$

(ii) $\dfrac{2\left(s^2 + 1\right)\left(s^2 + 9\right)}{s.\left(s^2 + 4\right)}$.

(c) Synthesize the following :— **10**

(i) $Z(s) = \dfrac{(s + 1)(s + 3)}{(s + 0 \cdot 5)(s + 2 \cdot 5)}$ in Cauer I form

(ii) $Z(s) = \dfrac{3s(s + 8/3)}{(s + 1)(s + 3)}$ in Foster I form.

————s————

59-p3-upq-Con No. File

Con. 5577-10.   (REVISED COURSE)   GT-6237

(3 Hours)   [Total Marks : 100]

Instructions :
- Q. 1 is compulsory.
- Attempt any four out of remaining Questions.

Q.1 A] Main memory has 3 pages and the processor requires pages from virtual memory in the following order.

2 3 2 1 5 2 4 5 3 2 5 2   show the implementation of FIFO, LRU, LFU.   [10]

B] Explain SPARC Processor in detail. Draw and explain n bit windows architecture of SPARC processor.   [10]

Q.2 A] Explain systolic processor with suitable examples .   [10]

B] What is cache memory ? explain cache coherence strategies in single and multiprocessor systems .   [10]

Q.3 A] Compare & contrast DMA, Programmed I/O . & interrupt driven I/O.   [10]
B] What is RAID ? Explain different RAID levels in detail.   [10]

Q.4 A] Explain different bus arbitration schemes with suitable diagrams .   [10]
B] What is pipelining? Explain six stage instruction pipeline with suitable diagram   [10]

Q.5 A] Explain with suitable example booth's algorithm.   [10]
B] Explain microinstructions, micro operations , micro-program in detail.   [10]

Q.6 A] Explain RISC and CISC architectures in detail.   [10]
B] explain Flynn's classifications with suitable diagrams . also comment on design issues of pipeline architecture .   [10]

Q.7 Write short notes on: ANY FOUR   [20]
1. PCI Bus
2. Memory characteristics
3. Micro instruction sequencing and execution.
4. loop buffer
5. interleaved memory

Con. 5530-10.   Maths III   **GT-6234**

(3 Hours)   [Total Marks : 100

N.B. (1) Question No. **1** is **compulsory**.
   (2) Attempt any **four** questions out of remaining **six** questions.
   (3) **Figures** to the **right** indicate **full** marks.

1. (a) Find Z-transform of { cos (ax + b) }, $k \geq 0$ 5

   (b) Evaluate $\int\limits_{0}^{\infty} \dfrac{\sin 2t}{t}\, dt$ using Laplace transform.   5

   (c) Express the matrix $A = \begin{bmatrix} 3 & -2 & 6 \\ 2 & 7 & -1 \\ 5 & 4 & 0 \end{bmatrix}$ as the sum of symmetric and skew-   5

   symmetric matrix.

   (d) 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 constants and ϕ_1, ϕ_2, ϕ_3 5

   are orthonormal sets on (a, b). Show that $\int\limits_{a}^{b} [\, f(x)]^2\, dx = c_1^2 + c_2^2 + c_3^2$

2. (a) Find $L [\sin h^5 t]$ 6
   (b) Find Fourier sine transform of f(x)   6

   if $f(x) = \begin{cases} 0 & 0 < x < a \\ x & a \leq x \leq b \\ 0 & x > b \end{cases}$

   (c) Find a Fourier series of $f(x) = x^2$ in $(0, 2\pi)$ and hence deduce that—   8

   $$\dfrac{\pi^2}{12} = \dfrac{1}{1^2} - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + \ldots$$

3. (a) Express the function $f(x) = \begin{cases} -e^{kx} & \text{for } x < 0 \\ e^{-kx} & \text{for } x > 0 \end{cases}$ as a Fourier integral and   6

   hence prove that $\int\limits_{0}^{\infty} \dfrac{w \sin wx}{w^2 + k^2}\, dw = \dfrac{\pi}{2} e^{-kx}$ if $x > 0, \ k > 0$

   (b) Find $L\left[\dfrac{\cos 2t \sin t}{e^t} \right]$ 6

   (c) Find the inverse of B and then the matrix BAB^{-1} where—   8

   $$B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \text{ and } A = \dfrac{1}{2}\begin{bmatrix} 5 & 2 & 1 \\ 1 & 4 & -1 \\ -1 & -2 & 3 \end{bmatrix}.$$

[TURN OVER

4. (a) Find the Fourier series for $f(x) = 1 - x^2$ in $(-1, 1)$.   **6**

   (b) Find inverse Laplace transform of $\dfrac{s}{\left(s^2 + a^2\right)\left(s^2 + b^2\right)}$ by using convolution   **6**

       theorem.

   (c) Find the rank of matrix A by reducing it to normal form where—   **8**

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

5. (a) Find Z transform of $f(k) = 5^k$ for $k < 0$ **6**
                              $= 3^k$ for $k \geq 0$

   (b) Obtain the complex form of Fourier series for $f(x) = e^{ax}$ in $(0, a)$.   **6**

   (c) Find the inverse Laplace transform of—   **8**

       (i) $\dfrac{3s+1}{(s+1)\left(s^2 + 2\right)}$ (ii) $\dfrac{s^2}{(s+a)^3}$

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) Find $L\left[t \cdot \sqrt{1 + \sin t}\right]$ **6**

   (c) Find Fourier expansion for $f(x) = x - x^2$, $-1 < x < 1$.   **8**

7. (a) Obtain half range cosine series for—   **6**
              $f(x) = x$ in $0 < x < 2$

   (b) Solve the following system of equations—   **6**
$$x + y + z = 3$$
$$2x + 5y + 7z = 14$$
$$2x + y - z = 2$$

   (c) Use Laplace transform to solve :   **8**

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 1 \quad \text{where } y(0) = 0, \ y'(0) = 1.$$

5. a) Prove that if $(F, +, .)$ is a field then it is an integral domain. [10]

b) Consider the group $G=\{1,2,3,4,5,6\}$ under multiplication modulo 7. [10]

   i) Find multiplication table of G , is G abelian Group.

   ii) Find the identity and inverse of each element

6. a) Find the solution of recurrence relation: $a_n = 5\, a_{n-1} - 6a_{n-2} + 7n$ [4]

b) Consider the (2,5) group encoding function – [6]

   e:B2→B5 defined by

   $e(00) = 00000$ $e(10)= 10101$ $e(01)= 01110$ $e(11)=11011$

   Decode the following relative to maximum likelihood decoding function.

   i)   11110   ii) 10011   iii) 10100

c) R=\{0,2,4,6,8\} Show that R is commutative ring under addition and multiplication

   modulo 10 [6]

d) Define subgroup and normal subgroup with example [4]

7. a) Determine whether   lattice D_{30} is distributive, complemented or both. Justify [6]

   Your answer.

b) Let G be the group of integers under the operation addition, and H be group of all

   even integers under the operation of addition, show that the function f: G→ H is

   an isomorphism. [6]

c) Define and explain bipartite graph, complete bipartite graph with example. [4]

d) Find all spanning trees of the following graph [4]

Con. 5820–10.

(3 Hours)   [Total Marks : 100
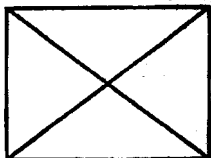
N.B. a) Questions No. 1 is compulsory

   b) Attempt any four questions out of remaining six questions

1. a) Using Mathematical Induction prove that 5^n-1 is divisible by 4 for n>=1   [5]

   b) What is the minimum   number of students required in Discrete Structure class

      to be sure that at least six will receive the same grade. If there are five possible grades

      A,B,C,D,E ?   [5]

   c) Show that if relation on set A is transitive and irreflexive then it is symmetric   [5]

   d) Draw the Hasse diagram of D60 and check if it is lattice?   [5]

2. a) Among the integers 1 to 1000 :   [10]

   (i) How many of them are not divisible by 3, nor by 5, nor by 7?

   (ii) How many are not divisible by 5 and 7 but divisible by 3?

   b) Define Universal and Existential quantifiers. Transcribe the following into logical

      notation . Let the universe of discourse be the real numbers.   [10]

   (i) There are positive values of x and y such that x.y > 0

   (ii) For every value of x there is some value of y such that x . y = 1

   (iii) There is a value of x such that if y is positive then x+y is negative.

3. a) Explain Warshwall's algorithm. Let A = { 1,2,3,4,5 } and let R be a relation on A

      Such that R = { (1,1),(1,4), (2,2),(3,4),(3,5),(4,1),(5,2),(5,5)}

      Find transitive closure of R by Warshwall's algorithm .   [10]

   b) Define Equivalence relation. Let Z be set of integers. Define R on Z

      iff 6 divides (a-b). Show that R is equivalence relation. Find Z/R.   [10]

4. a) Let f: R→R f(x)= x^3, g: R→R g(x)=$4x^2$+1 , h:R→R h(x)= 7x-2   [6]

      Find i) go(hog) ii) go(hof)

   b) Define with example injective , surjective and bijective function   [6]

   c) Define Hamiltonian path and Hamiltonian circuit and find it in K4,3   [4]

   d) Define with example Reflexive closure and symmetric closure   [4]

[TURN OVER

Digital Logic Design & Application

GT-6240

(3 Hours) [Total Marks : 100]

Digital Logic Design & Applications

N.B. : (1) Question No. **1** is **compulsory**.
    (2) Attempt any **four** questions out of remaining **six** questions.
    (3) Assume **suitable** data and it **clearly**. S. E. /Com / Sem-III

1. (a) Convert $(1234.56)_{10}$ to Octal, Hexadecimal.   **4**

   (b) Perform following operation without converting to any other base.   **8**

      (i) $(ABC)_H - (FEDC)_H$

      (ii) $(234.12)_5 + (432.34)_5$

      (iii) $(76)_8 * (67)_8$

      (iv) $(10101011)_2 \div (101)_2$

   (c) Represent $(29)_{10}$ into Excess–3 code and Gray code.   **4**

   (d) Design (1 : 16) Demultiplexer using (1 : 4)   **4**

2. (a) (i) Subtract using 1's and 2's complement method $(73)_{10} - (49)_{10}$ **2**

      (ii) Perform BCD addition for number 56 and 65   **2**

      (iii) Perform $(11010)_2 \div (101)_2$ **2**

      (iv) Write Hamming code for number 0111.   **2**

   (b) Simplify using Boolean Theorms and braw Logic Diagram for the following :–   **12**

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

      (ii) $A [B + C \overline{(AC + AB)}]$

      (iii) $\overline{AB} (B + C) + AB (\overline{B} + C)$.

3. (a) Minimize the following logic function and realize using NAND gates   **10**
      $f(A, B, C, D) = \Sigma m(1, 3, 5, 8, 9, 11, 15) + d(2, 13)$

   (b) Simplify using Quine-McCluskey method. Realize the equation using any universal gate.   **10**
      $F(A, B, C, D) = \Pi m (0, 2, 3, 6, 7, 8, 9, 12, 13)$

4. (a) Design a MOD-6 synchronous Up counter and explain its working.   **10**

   (b) What is shift register ? Explain 4 bit bi-directional shift register.   **10**

5. (a) Implement the following Boolean function using 4 : 1 MUX   **10**
      $F(A, B, C, D) = \Sigma m(1, 2, 4, 6, 9, 12, 14)$

   (b) Convert SR flip flop to D and T flip flop and draw the circuit.   **10**

6. (a) Draw 2-input TTL NAND gate and explain its operation.   **10**

   (b) Prove that NAND and NOR gates as universal gate.   **10**

7. Write notes on following :–   **20**
      (a) ALU
      (b) PLA and PAL
      (c) Multiplexer and Demultiplexer
      (d) Race around condition in JK flip flop.