

Con. 3915-11.

(3 Hours)

[Total Marks : 100

- N.B.
- Question number 1 is compulsory
 - Answer any four other questions from the remaining six questions
 - Assumptions made should be clearly stated
 - Assume any suitable data wherever required but justify the same
 - Figures to the right indicate marks
 - Illustrate answers with sketches wherever required
 - Answers to the questions should be grouped and written together i.e. all answers to sub questions of individual questions like Q1, Q2, Q3 etc. should be answered one below the other.

1. a) Find $L\{(t + e^{-t} + \sin t)^2\}$ (5)

b) Find the Z-transform of $\{2^k k^2\}$

c) Find Fourier series of the function $f(x) = |x|$; $-1 < x < 1$ (5)

d) Express $A = \begin{bmatrix} 2 & -4 & 9 \\ 14 & 7 & 13 \\ 3 & 5 & 11 \end{bmatrix}$ as $A = B + C$, where B is symmetric & C is skew-symmetric. (5)

Hence deduce that the matrix $(B + i C)$ is Hermitian. (5)

2. a) Find the inverse of the matrix $A = \frac{1}{6} \begin{bmatrix} -4 & 3 & 1 \\ 2 & -3 & 1 \\ 6 & 3 & -3 \end{bmatrix}$ (6)

b) Use Laplace transform to show that $\int_0^{\infty} \frac{e^{-\sqrt{2}t} \sin t \sinh t}{t} dt = \frac{\pi}{8}$ (6)

c) Find the Fourier series expansion of $f(x) = \frac{3x^2 - 6\pi x + 2\pi^2}{12}$ in $[0, 2\pi]$. (8)

Hence deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$

3. a) Find the values for k for which the matrix $A = \begin{bmatrix} k & k & 2 \\ 2 & k & k \\ k & 2 & k \end{bmatrix}$ has rank 1, rank 2, rank 3 (6)

b) Find (i) $L^{-1}\left\{\frac{s^2}{(s+1)^3}\right\}$ (ii) $L^{-1}\left\{e^{-s}\frac{s+1}{s^2+s+1}\right\}$ (6)

c) Find the Fourier series of $f(x) = \begin{cases} \pi x; 0 < x < 1 \\ \pi(x-2); 1 < x < 2 \end{cases}$ (8)

and hence deduce that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$

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4. a) Find a, b, c if $A = \begin{bmatrix} 0 & a & a \\ 2b & b & -b \\ c & -c & c \end{bmatrix}$ is orthogonal. Prove that adj A is orthogonal. (6)

b) Show that $f(x) = e^{-\frac{x^2}{2}}$ is self-reciprocal with respect to Fourier transform. (6)

c) Using Laplace Transform solve the differential equation (8)

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = e^{-t} \sin t; y(0) = 0, y'(0) = 1$$

5. a) Find inverse Z-transform of $\frac{1}{(z-1)^2}$ for $|z| < 1$ and $|z| > 1$ (6)

b) Show that $\frac{e^{ax} - e^{-ax}}{e^{a\pi} - e^{-a\pi}} = \frac{2}{\pi} \left[\frac{\sin x}{a^2 + 1^2} + \frac{2 \sin 2x}{a^2 + 2^2} + \frac{3 \sin 3x}{a^2 + 3^2} + \dots \right]$ in the interval $0 < x < \pi$ (6)

c) Find (i) $L\{(t^2 \sinh t)^2\}$ (ii) $L\left\{\frac{2 \sin t \sin 2t}{t}\right\}$ (8)

6. a) Find complex Fourier series of $f(x) = e^{-x}; -\pi < x < \pi$ (6)

b) Use the convolution theorem to find $L^{-1}\left\{\frac{1}{(s^2 + 1)^2}\right\}$ (6)

c) Find non-singular matrices P and Q such that PAQ is in the normal form. (8)

Also find the rank of A and inverse of A if $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

7. a) Derive $L\{\delta(t-a)\}$ (6)

b) Show that the set of functions $\frac{\sin x}{\sqrt{\pi}}, \frac{\sin 2x}{\sqrt{\pi}}, \frac{\sin 3x}{\sqrt{\pi}}, \dots$ is orthonormal over $(0, 2\pi)$ (6)

c) Determine the values of k for which the following system of equations has solutions and find all these solutions: $2x - 2y + z = kx, 2x - 3y + 2z = ky, -x + 2y = kz$ (8)

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

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

(3) Assume suitable data if necessary.

1. (a) Write a program in java to delete a node from a binary tree. Show all possible cases clearly. (10)
(b) Write a java program to implement DFS and BFS traversal of a graph. (10)
2. (a) Write a program in java to sort n given numbers using quick sort. Show the steps to sort the given numbers
25, 13, 7, 34, 56, 23, 13, 96, 14, 2 (10)
(b) What is a priority queue? Give applications of priority queues. (10)
3. (a) Write a program to convert an infix expression to postfix expression using stacks. (10)
(b) Explain Huffman encoding in detail with an example. (10)
4. (a) Write a program in java to create a doubly linked list. Also show insert, delete and search methods. (10)
(b) What is hashing. Show the hash table (size=11) entries for the given dataset using linear probing, quadratic probing and double hashing
7, 10, 0, 3, 28, 48, 5, 99, 23, 33 (10)
5. (a) Write a program in java that reads a text file and counts occurrences of a particular word. (10)
(b) Explain ADT. List the linear and non linear data structures with example. (10)
6. (a) Write a program in java to implement 'towers of Hanoi' using recursion (10)
(b) Write a program in java to implement Binary search Tree. (10)
7. Write short notes on any two: (20)
 - i) AVL tree
 - ii) Expression trees
 - iii) Array implementation of a linked list
 - iv) Circular Queue

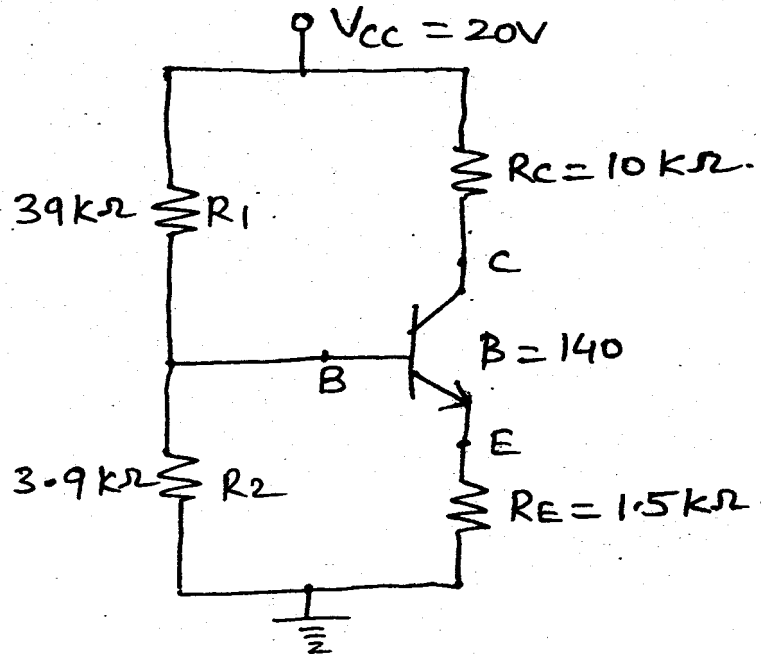
Con. 3046-11.

(3 Hours)

[Total Marks : 100]

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of the remaining **six** questions.
 (3) Assume **suitable** data if **necessary**.

1. (a) List the characteristic features of 555 timer. 20
 (b) Explain operational amplifier with a neat block diagram.
 (c) With a neat circuit diagram explain voltage follower and draw input-output waveforms.
 (d) Explain series voltage regulator.
2. (a) Draw small-signal n-parameter model of the BJT and define the terms h_{ie} , h_{re} , h_{fe} and h_{oe} for the same. 8
 (b) Determine the following for the circuit shown in figure below :- 12
 (i) I_{BQ} (ii) I_{CQ} (iii) V_{CEQ} (iv) V_{CQ} (v) V_{EQ} (vi) V_{BQ} .
 Use both, Exact and approximate analysis to solve the same.



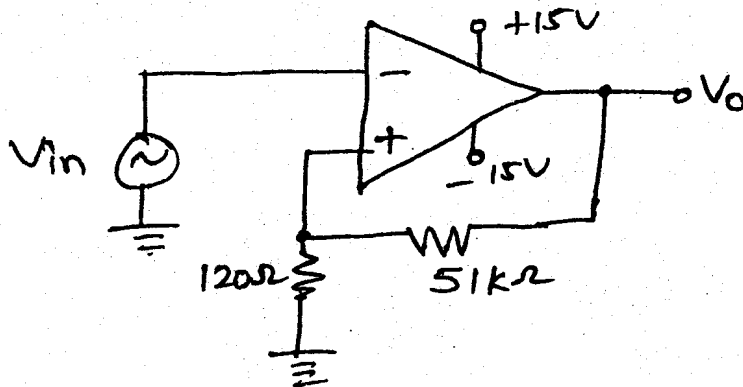
3. (a) Derive equations for Z_i , Z_o , A_v for common source configuration using voltage divider network (with unbypassed R_s). 10
 (b) Explain Instrumentation Amplifier using IC 741. Derive the expression for V_o . 10

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Con. 3046-RK-1263-11.

2

4. (a) Explain in detail any two applications of a monostable multivibrator. 10
 (b) Explain the digital ramp ADC with a neat block diagram. 10
5. (a) Design a regulator using IC 723 to meet the following specifications :- 10
 $V_o = 5V$; $I_o = 100 \text{ mA}$
 $V_{in} = 15 \pm 20\%$
 $I_{sc} = 150 \text{ mA}$
 $V_{sense} = 0.7V$
- (b) Explain successive Approximation Resistor A/D converter. 10
6. (a) For a Schmitt trigger shown in the figure, calculate threshold voltage levels 10
 and hysteresis. Assume $V_{sat} = 0.9 V_{cc}$.



- (b) Explain op-amp as an Practical Integrator. 10
7. Write short notes on any two :- 20
 (a) PLL
 (b) Inverting Schmitt trigger
 (c) Zero Crossing Detector
 (d) D/A converter using R-2R resistors.

Con. 3114-11.

RK-1257

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** from Question No. 2 to 7.
(3) Assume **suitable** data if **necessary**.

1. (a) Convert $(243.63)_8$ to decimal, binary and hexadecimal. 6
 (b) Perform directly without converting to any other base- 6
 - (i) $(BC\ 5)_H - (A2B)_H$
 - (ii) $(210.2)_4 + (312.2)_4$
 - (iii) $(56)_8 \times (45)_8$
- (c) Obtain hamming code for 1010. Prove that hamming code is an error detecting and correcting code. 8

2. (a) Design a 3 bit binary to gray code converter ? 10
 (b) Design a full adder circuit using half adders and some gates. 10

3. (a) Simplify using Q-M method and implement using NAND Gates. 10
 $f(A, B, C, D) = \sum m (4, 5, 8, 9, 11, 12, 13, 15)$
 (b) Implement the following expression using single 4 : 1 MUX. 10
 $f(A, B, C, D) = \sum m (2, 6, 8, 12, 13, 14).$

4. (a) Design a 24 bit comparator using IC 7485 ? 10
 (b) Design 1 : 28 line Demux using 1: 8 Demux ? 10

5. (a) Design a synchronous counter using JK FF for following sequence- 10
 $1 \rightarrow 0 \rightarrow 4 \rightarrow 2 \rightarrow 5 \rightarrow 3 \rightarrow 1$
 (b) Convert JK FF to SR and D FF. 10

6. (a) Draw a 3 bit ring counter and draw timing wave form. Prove that it is a divide by 3 network. 10
 (b) Explain the operation of 4 bit Universal shift register. 10

7. Write short notes on :- 20
 - (a) Race around condition in JKFF.
 - (b) TTL v/s CMOS
 - (c) ALU
 - (d) Priority encoder.

7/6/2011

127-mk : 1stHf-11.

Con. 3644-11.

S.E COMP III (kw)
Discrete structure &
Graph theory.
RK-1252

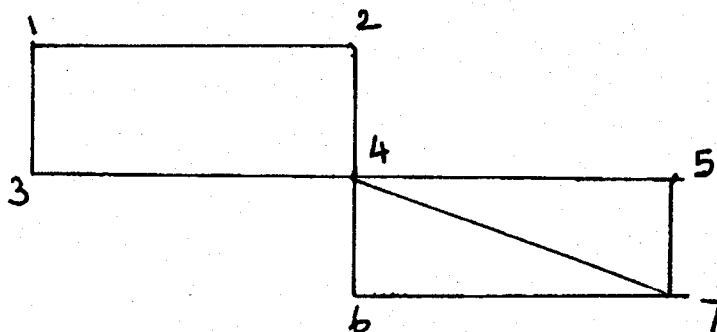
(3 Hours)

[Total Marks : 100

- N.B.** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining **six** questions.
 (3) Assumptions made should be **clearly** stated.
 (4) **Figures** to the **right** indicate **full** marks.

1. (a) Use Mathematical Induction to show that, 5
 $1 + 5 + 9 + \dots + (4n - 3) = n(2n - 1)$.
 (b) Let T is an equilateral triangle of side 1 unit. Prove that if 5 points are chosen 5
 inside or on the triangle, then two of them are not more than $1/2$ unit apart.
 (c) Translate the following statement into symbolic form : 5
 If the utility cost goes up or the request for additional funding is desired,
 then a new company will be purchased if and only if we can show that the
 current computing facilities are indeed not adequate.
 (d) Draw the Hasse diagram of D_{60} and check if it is lattice. 5
2. (a) Consider the set $S = \{ 1, 2, 3, 4 \}$ and a Relation R on S given by — 10
 $R = \{ (4, 3), (2, 2), (2, 1), (3, 1), (1, 2) \}$
 (i) Show that R is not transitive
 (ii) Find transitive closure of R by Warshall's algorithm.
 (b) Let $f : R \rightarrow R$ $f(x) = x^3$ 6
 $g : R \rightarrow R$ $g(x) = 4x^2 + 1$
 $h : R \rightarrow R$ $h(x) = 7x - 2$
 Find : (i) $g \circ (h \circ g)$ (ii) $g \circ (h \circ f)$.
 (c) Find solution of Recurrence Relation — 4
 $a_n = 5a_{n-1} - 6a_{n-2} + 7n$.

3. (a) Prove that set $G = \{ 1, 2, 3, 4, 5, 6 \}$ is a finite Abelian group of order 6 with 10
 respect to multiplication modulo 7.
 (b) Find out Hamiltonian path and Hamiltonian cycle. 6



- (c) Find the number of vertices of the graph having 16 edges if degree of each 4
 vertex is 2.
4. (a) Define Equivalence relation. 10
 Let Z be set of integers. Define R on Z if and only if 6 divides $(a - b)$.
 Show that R is equivalence relation find Z/R .

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- (b) Given a ring $\langle \{a, b, c, d\}, +, \cdot \rangle$ whose operations are given by the following table :— 6

+	a	b	c	d
a	a	b	c	d
b	b	c	d	a
c	c	d	a	b
d	d	a	b	c

·	a	b	c	d
a	a	a	a	a
b	a	c	a	c
c	a	a	a	a
d	a	c	a	a

Is it Commutative ring ?

Does it have an identity ?

Find the additive inverse of each of its element.

- (c) Define with an example Reflexive Closure and Symmetric Closure. 4
5. (a) Show that the function $f : R - \{2\} \rightarrow R - \{0\}$ where R is a set of real Numbers 10
defined by $f(x) = \frac{1}{x-2}$ is a bijection.

Find inverse.

- (b) Let Z^+ be a set of positive integers and a relation R defined on Z^+ by $a R b$ if and only if $a \mid b$ then prove that R is a partial order relation and (Z^+, R) is a poset. 6
- (c) Let $A = \{a, b, c, d, e\}$ and $R = \{(a, a), (a, b), (b, c), (c, e), (c, d), (d, e)\}$. 4
Compute — (i) R^2 (ii) R^∞ .
6. (a) A survey of 500 television watchers produced the following information :— 10
285 watch football games
195 watch hockey games
115 watch basketball games
45 watch football and basketball games
70 watch football and hockey games
50 watch hockey and basketball games
50 do not watch any of the 3 kinds of games.
- (i) How many people in the survey watch all 3 kinds of games ?
(ii) How many people watch exactly one of the sports ?
- (b) Determine the Hasse diagram for the relation on $A = \{1, 2, 3, 4, 5\}$ whose 6
matrix is shown :—

$$M_R = \begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 & 5 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{matrix} & \left[\begin{array}{ccccc} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{array} \right] \end{matrix}$$

(c) Show that the graph given are planer.

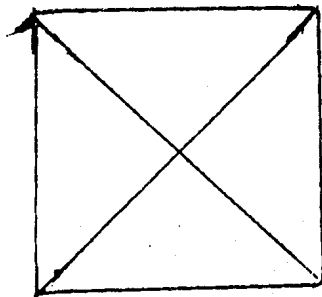


Fig. 6.1

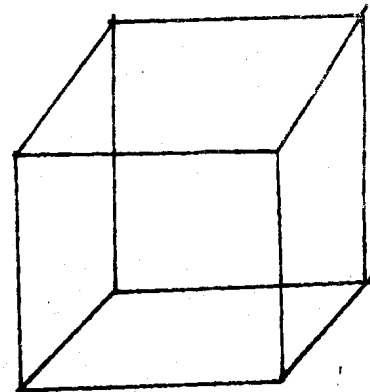


Fig. 6.2

7. (a) Consider $(2, 6)$ encoding function $e : B^2 \rightarrow B^6$ defined as —

$$e(00) = 000000$$

$$e(01) = 011110$$

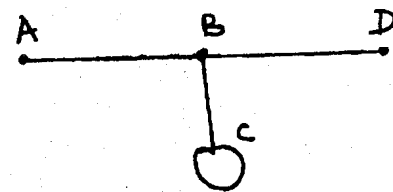
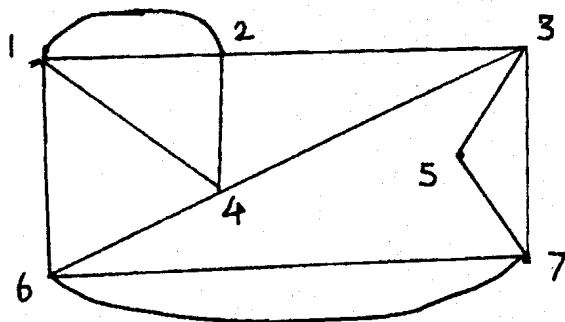
$$e(10) = 101010$$

$$e(11) = 111000$$

(i) Find the minimum distance.

(ii) How many error can 'e' detect ?

(b) Find out Euler path and Euler circuit for the graph :—



(c) Check if the set $A = \{ 2, 4, 12, 16 \}$ is a Lattice under divisibility.

11/6/2011

SE SEM-III Computer
Computer Organization Architecture

34 : 1st half-11(d)-JP

Con. 3668-11.

RK-1260

(3 Hours)

[Total Marks : 100

- N.B.** (1) Question No. 1 is **compulsory**.
 (2) Solve any **four** questions out of remaining **six** questions.
 (3) Draw the **diagrams** if **necessary**.

1. Explain IEEE format for floating :—
 - (a) Point number representation 10
 - (b) Explain RISC and CISC architectures in details. 10

2. (a) Explain different bus arbitration schemes with suitable diagrams. 10
 (b) Explain Van Neumann Architecture in detail. 10

3. (a) Describe in detail the organization of a typical CPU. It should include program control unit, data processing unit and appropriate registers. 10
 (b) Distinguish between :— 10
 - (i) Hardwire control and microprogrammed control
 - (ii) Horizontal and vertical microprogrammed control unit.

4. (a) Explain the different RAID levels. 10
 (b) A winchester magnetic disk unit has densities of 40×10^6 bits per square inch of surface. 10
 - (i) If the inner diameter of recording area is 4 inches and outer diameter is 7 inches, what is average bit density along a track if radial track spacing density is 2000 tracks/inch.
 - (ii) What is data transfer rate in bytes/sec at a rotational speed of 3600 rpm ?

5. (a) Write short notes on :— 10
 - (i) DMA
 - (ii) Interrupt driven I/O.
 (b) Explain Flynn's classifications with suitable diagrams. Also comment on design issues of pipeline architecture. 10

6. Explain SPARC processor in detail.
 - (a) Draw and explain n bit windows architecture of SPARC processor 10
 - (b) Describe wave front arrays. 10

7. (a) Explain page replacement algorithm. Find out page fault for following string using LRU method. Consider page frame size = 3 10
 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1
 (b) What is Virtual Memory ? Explain how paging is useful in implementing virtual memory. 10