

(Time: 3 hours )

Max. Marks: 80

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

(2) Answer any three questions from Q.2 to Q.6.

(3) Use of Statistical Tables permitted.

(4) Figures to the right indicate full marks.

Q1 (a) Find Laplace transform of  $\frac{\cos\sqrt{t}}{\sqrt{t}}$  given that  $L\{\sin\sqrt{t}\} = \frac{\sqrt{\pi}}{2s^{3/2}} e^{-(1/4s)}$  [5]

(b) Calculate Spearman's rank correlation coefficient for the following data: [5]

X	32	55	49	60	43	37	43	49	10	20
Y	40	30	70	20	30	50	72	60	45	25

(c) Find inverse Laplace transform of  $\frac{2s-1}{s^2+8s+29}$  [5]

(d) If  $f(z) = qx^2y + 2x^2 + ry^3 - 2y^2 - i(px^3 - 4xy - 3xy^2)$  is analytic, find the values of p, q, and r [5]

Q2 (a) Find Laplace transform of  $e^{3t} f(t)$  where  $f(t) = \begin{cases} t-1, & 1 < t < 2 \\ 3-t, & 2 < t < 3 \\ 0, & \text{otherwise} \end{cases}$  [6]

(b) Two unbiased dice are thrown. If X represents sum of the numbers on the two dice. Write probability distribution of the random variable X and find mean, standard deviation, and  $P(|X-7| \geq 3)$  [6]

(c) Obtain Fourier series for  $f(x) = x \sin x$  in the interval  $0 \leq x \leq 2\pi$ . [8]

Q3 (a) Using Milne-Thompson's method construct an analytic function  $f(z) = u + iv$  in terms of  $z$  where  $u + v = e^x(\cos y + \sin y) + \frac{x-y}{x^2+y^2}$  [6]

(b) Using convolution theorem find the inverse Laplace transform of  $\frac{(s+3)^2}{(s^2+6s+5)^2}$  [6]

(c) Fit a parabola  $y = a + bx + cx^2$  to the following data and estimate y when  $x=10$  [8]

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	9

Q4 (a) Find Laplace transform of  $e^{-(1/2)t} t f(3t)$  if  $L\{f(t)\} = \frac{1}{s\sqrt{s+1}}$  [6]

- (b) Find half range sine series for  $f(x) = x - x^2$ ,  $0 < x < 1$ . [6]

Hence deduce that 
$$\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - \frac{1}{7^3} + \dots = \frac{\pi^3}{32}$$

- (c) Given regression lines  $6y = 5x + 90$ ,  $15x = 8y + 130$ ,  $\sigma_x^2 = 16$ .  
Find i)  $\bar{x}$  and  $\bar{y}$ , ii)  $r$ , iii)  $\sigma_y^2$  and iv) angle between the regression lines [8]

- Q5 (a) Can the function  $u = r + \frac{a^2}{r} \cos\theta$  be considered as real or imaginary part of an analytic function? If yes, find the corresponding analytic function. [6]

- (b) An unbiased coin is tossed three times. If  $X$  denotes the absolute difference between the number of heads and the number of tails, find moment generating function of  $X$  and hence obtain the first moment about origin and the second moment about mean. [6]

- (c) Evaluate  $\int_0^\infty e^{-2t} \cos t \int_0^t u^2 \sinh u \cosh u \, dt$  [8]

- Q6 (a) Find inverse Laplace transform of  $\frac{1}{(s-2)^4(s+3)}$  using method of partial fractions. [6]

- (b) If a continuous random variable  $X$  has the following probability density function [6]

$$f(x) = \begin{cases} k e^{-\frac{x}{4}}, & \text{for } x > 0 \\ 0, & \text{elsewhere} \end{cases} \quad \text{find } k, \text{ mean and variance.}$$

- (c) Find half range cosine series for  $f(x) = x$ ,  $0 < x < 2$ . [8]

Hence deduce that i) 
$$\frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \frac{1}{7^4} + \dots = \frac{\pi^4}{96}$$

ii) 
$$\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} + \dots = \frac{\pi^4}{90}$$

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(3 Hours)

Total Marks: 80

- N.B:** 1. Question No. 1 is compulsory  
2. Attempt any 3 from remaining questions  
3. Assume any suitable data if necessary and justify the assumptions

- Q.1 Attempt any **Four**. 20
- a) Give difference between random scan display and raster scan display.
  - b) Define Aliasing, Describe different antialiasing techniques.
  - c) Compare DDA and BRESENHAM line drawing algorithm.
  - d) Explain point clipping algorithm.
  - e) Give fractal dimension for KOCH curve.
- Q.2 a) Derive formula for mid-point circle algorithm. 10
- b) Given a line AB where A(3,1) and B(0,0) calculate all the points of line AB using DDA algorithm. 10
- Q.3 a) With neat diagram explain Composite transformation. 10
- b) Describe what is Homogeneous coordinates. 10
- Q.4 a) With neat diagram explain window to viewport coordinate transformation. 10
- b) With neat diagram explain Sutherland Hodgman polygon clipping algorithm. 10
- Q.5 a) Define projection, with neat diagram describe planar geometric projection. 10
- b) Describe properties of BEZIER curve. 10
- Q.6 a) Describe various principles of traditional animation. 10
- b) Write short note on Depth buffer algorithm. 10

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(3 Hours)

Total Marks: 80

- N.B:** (1) Question No. 1 is compulsory.  
 (2) Attempt any three questions out of the remaining five questions.  
 (3) Figures to the right indicate full marks.  
 (4) Make suitable assumptions wherever necessary.

- Q.1 (a) Compare linear and non-linear data structures. [05]  
 (b) Explain the advantage of circular queue over linear queue. Write a function in C language to insert an element in circular queue. [05]  
 (c) Define binary search tree. Discuss the case of deletion of a node in binary search tree if node has both the children. [05]  
 (d) Write a C function to search a node in doubly linked-list. [05]

- Q.2 (a) Construct AVL tree for the following sequence: [10]  
 67,34,90,22,45,11,2,78,37,122  
 (b) Write algorithm for postfix evaluation. Demonstrate the same step by step for the expression:  $9\ 6\ 7\ * \ 2\ / \ -$  [10]

- Q.3 (a) Write a program to perform following operations on a circular linked list: [10]  
 i) insert a node from the end of the list, ii) delete first node,  
 iii) count the number of nodes with even values, iv) display the list.  
 (b) Write a C program to simulate linear queue as linked list. [10]

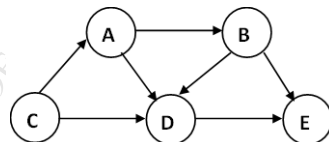
- Q.4 (a) Construct Huffman tree and find the Huffman codes for each symbol given below with frequency of occurrence: [10]

Symbol	p	g	e	r	i
Frequency	20	17	33	25	40

- (b) Explain the various ways to represent graph in the memory with example. [05]  
 (c) Construct binary search tree from given traversal sequences: [05]

In-order traversal	D	E	B	A	C	F	G	I	H	J
Pre-order traversal	F	E	D	C	B	A	G	H	I	J

- Q.5 (a) Apply linear probing to hash the following values in a hash table of size 11 and find the number of collisions: 67,44,90,12,83,52,23,87,79. [10]  
 (b) Define topological sorting. Perform topological sorting for the following graph: [10]



- Q.6 (a) Construct a B tree of order 3 by inserting the following given elements as: [10]  
 77,97,75,64,53,14,26,49,82,59.  
 Show the B tree at each step of insertion.  
 (b) Write a function in C for DFS traversal of graph. Explain DFS graph traversal with suitable example. [10]

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- Q1 A Convert 05  
 i) 123 in to binary  
 ii)  $(AB9)_{16}$  in to Decimal  
 iii)  $(351)_8$  in to decimal  
 iv) 129 in to BCD  
 v) 64 in to gray code
- B Draw the single and double precision format for representing floating point number 05  
 using IEEE 754 standards and explain the various fields
- C Explain SR Flip Flop 05
- D Differentiate between Hardwired control unit and Micro programmed control unit 05
- Q2 A Draw the flow chart of Booths algorithm for signed multiplication and Perform - 10  
 $5 \times 2$  using booths algorithm
- B Explain the different addressing modes. 10
- Q3 A For 132.65 obtain the IEEE 754 standards of Single precision and Double precision 10  
 format
- B Explain Micro instruction format and write a microprogram for the instruction 10  
 $ADD R_1, R_2$
- Q4 A Consider a 4-way set associative mapped cache with block size 4 KB. The size of the 10  
 main memory is 16 GB and there are 10 bits in the tag. Find-
1. Size of cache memory  
 2. Tag directory size
- B Explain Flynn's classification 10
- Q5 A Explain different types Distributed and Centralized bus arbitration methods 10
- B Describe the detailed Von-Neumann Model with a neat block diagram 05
- C Describe the characteristics of Memory. 05
- Q6 Write Short notes on 20
- a) Grey code, BCD, Excess-3 Code with example  
 b) Encoder and Decoder  
 c) Cache coherence  
 d) Instruction Pipelining

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