

Total Marks:80  
 Duration: 3Hrs

NB 1. Question No.1 is compulsory

2. Attempt any three from the remaining six questions
3. Figures to the right indicate full marks

Q1a If the Laplace Transform of  $e^{-t} \int_0^t u \cos 2u \, du$  [20]

b Prove that  $f(z) = \sinh z$  is analytic and find its derivative

c Obtain Half range Sine Series for  $f(x) = x+1$  in  $(0, \pi)$

d Find a unit vector normal to the surface  $x^2y + 2xz = 4$  at  $(2, -2, 3)$

Q2 a Prove that  $\vec{F} = (2xy^2 + yz)i + (2x^2y + xz + 2yz^2)j - (2y^2z + xy)k$  is Irrotational.

Find Scalar Potential for  $\vec{F}$

[6]

b Find the inverse Laplace Transform using Convolution theorem

$$\frac{(s-1)^2}{(s^2 - 2s + 5)^2}$$

[6]

c. Find Fourier Series of  $f(x) = \begin{cases} \pi x; & 0 \leq x \leq 1 \\ \pi(2-x); & 1 \leq x \leq 2 \end{cases}$

[8]

Q3 a Find the Analytic function  $f(z) = u + iv$  if  $v = \frac{x}{x^2 + y^2} + \cosh x \cos y$

[6]

b Find Inverse Z transform of  $\frac{(3z^2 - 18z + 26)}{(z-2)(z-3)(z-4)}$ ,  $3 < |z| < 4$

[6]

c Solve the Differential Equation  $\frac{d^2y}{dt^2} + 2\frac{dy}{dx} + 2y = 5 \sin t$ ,  $y(0) = 0$ ,  $y'(0) = 0$  using Laplace Transform

[8]

Q4 a Find the Orthogonal Trajectory of  $3x^2y - y^3 = k$

[6]

b Find the Z-transform of  $2^K \sinh 3K$ ,  $K \geq 0$

[6]

c Express the function  $f(x) = \begin{cases} 1 & ; |x| < 1 \\ 0 & ; |x| > 1 \end{cases}$  as Fourier Integral. Hence evaluate  $\int_0^\infty \frac{\sin \lambda}{\lambda} \cdot \cos(\lambda x) d\lambda$

[8]

Q5 a Evaluate using Stoke 's theorem  $\int_C (2x - y)dx - yz^2 dy - y^2 z dz$  where C is the circle  $x^2 + y^2 = 1$  corresponding to the sphere  $x^2 + y^2 + z^2 = 1$  above the XY plane

b Show that  $w = \frac{2z + 3}{z - 4}$  maps the circle  $x^2 + y^2 - 4x = 0$  into straight line  $4u + 3 = 0$

c Find Inverse Laplace Transform i)  $e^{-s} \tanh^{-1} s$  ii)  $\frac{6}{(2s + 1)^3}$

Q6 a Find the Laplace transform of  $f(t) = \frac{2t}{3}, 0 \leq t \leq 3, f(t+3) = f(t)$

b Find Complex Form of Fourier Series for  $\sin(\alpha x); (-\pi, \pi), \alpha$  is not an integer

c Verify Green's theorem for  $\int_C (2x^2 - y^2)dx + (x^2 + y^2)dy$  where C is the boundary of the surface enclosed by lines  $x=0, y=0, x=2, y=2$

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Duration: 3 hrs

Total Marks: 80

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

1. (a) Explain different types of Data Structures with example. (05)  
 (b) What are the various techniques to represent Graphs in memory? (05)  
 (c) What is recursion? Write a recursive function in 'C' to find sum of digits of a number. (05)  
 (d) Convert the following expression to postfix. (05)  

$$(f - g) * ((a + b) * (c - d)) / e$$
2. (a) What is Huffman coding? Construct the Huffman Tree and determine the code for each symbol in the sentence "ENGINEERING". (10)  
 (b) Write a 'C' program to implement singly linked list which supports the following operations (10)
  - (i) Insert a node in the beginning
  - (ii) Insert a node in the end
  - (iii) Insert a node after a specific node
  - (iv) Deleting element from the beginning
  - (v) Displaying the list
  - (vi) Exit
3. (a) Using Linear probing and Quadratic Probing insert the following values in a hash table of Size 10. Show how many collisions occur in each iteration: (10)  
 $28, 55, 71, 67, 11, 10, 90, 44.$   
 (b) Write a program in 'C' for Quick Sort. (10)
4. (a) Write a Program in 'C' to implement Doubly linked list with methods insert, delete and search. (10)  
 (b) Compare Quick Sort and Radix Sort based on their advantages and disadvantages. (5)  
 (c) Discuss some practical applications of trees (5)
5. (a) Explain AVL trees. Insert the following elements in a AVL search tree: (10)  
 $63, 52, 49, 83, 92, 29, 23, 54, 13, 99$   
 (b) Write a 'C' program to search a list using Indexed Sequential Search. What are the advantages of using Indexed Sequential Search over Sequential Search. (10)
6. (a) What is Heap? Sort the following numbers using Heap Sort. (10)  
 $67, 12, 89, 26, 38, 45, 22, 79, 53$   
 (b) Give ADT for the queue data structure. Discuss any two applications of queue data structure (5)  
 (c) Explain Threaded Binary Tree. (5)

Dt- 30/5/2017

(3 Hours)

[Total Marks : 80]

- N.B.** 1) Question number 1 is compulsory.  
2) Attempt any 3 questions from the remaining 5 questions.  
3) Each question carries 20 marks.  
4) Within a question, each sub-question carries equal marks.

1. a) Convert  $(-124)_{10}$  to its equivalent sign magnitude form. 02  
b) Convert decimal 214.32 into base 7. 02  
c) Add  $(7)_{10}$  and  $(6)_{10}$  in BCD 02  
d) Simplify  $(B+A)(B+D)(A+C)(C+D)$ . 02  
e) Construct Hamming code for BCD 0110. Use even parity. 02  
f) Prove that "A positive logic AND operation is equivalent to a negative logic OR operation". 02  
g) List the applications of shift registers. 02  
h) Minimize the following standard POS expression using K-map 03  
 $Y = \Pi M(0,2,3,5,7)$   
i) Write the entity declaration construct in VHDL for NOR gate. 03
2. a) Obtain the minimal expression using Quine-Mc Cluskey method. 10  
 $F(A,B,C,D) = \Sigma m(1,5,6,12,13,14) + d(2,4)$   
b) Compare TIL, CMOS and ECL families with respect to gate, voltage level, fan-in, fan-out, propagation delay, power dissipation, speed and noise margin. 10
3. a) Design a logic circuit to convert BCD to Gray code. 10  
b) Implement the following using 8:1 MUX. 05  
 $F(A,B,C,D) = \Sigma m(0,1,3,5,7,10,11,13,14,15)$   
c) Explain Astable multivibrator. 05
4. a) Explain Master-Slave J-K flipflop. 05  
b) Design 1:16 Demultiplexer using 1:4 demultiplexer. 05  
c) Explain Data flow modelling and Behavioural modelling in VHDL. 10

(TURN OVER)

5. a) Convert JK flipflop to SR flipflop and D flipflop. **10**  
b) Design mod 12 asynchronous UP counter. **10**

6. **Write short note on (any four):-**

- a) Ring Counter  
b) State table  
c) 2-bit Magnitude comparator  
d) 3 to 8 line decoder  
e) Universal shift register

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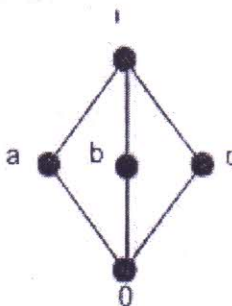
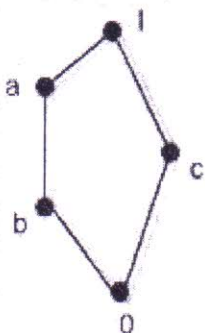
(3 Hours)

[Total Marks: 80]

- N.B.** (1) Question No 1 is compulsory  
 (2) Solve any three question out of remaining five questions  
 (3) Assumption made should be clearly stated  
 (4) Figure to the right indicates full marks

1. (a) Prove using Mathematical Induction 05  

$$2+5+8+ \dots +(3n-1)=n(3n+ 1)/2$$
  
 (b) Find the generating function for the following finite sequences 05  
 i) 1,2,3,4, ... ii) 2,2,2,2,2  
 (c) Find solution of  $a_{r+2}+2a_{r+1}-3a_r=0$  05  
 (d) Find the complement of each element in  $D_{30}$ . 05
2. (a) Let  $A=\{a,b,c,d,e,f,g,h\}$ . Consider the following subsets of A 04  
 $A1=\{a,b,c,d\}$      $A2=\{a,c,e,g,h\}$   
 $A3=\{a,c,e,g\}$      $A4=\{b,d\}$      $A5=\{f,h\}$   
 Determine whether following is partition of A or not. Justify your answer.  
 i)  $\{A1, A2\}$     ii)  $\{A3,A4,A5\}$   
 (b) Prove that set  $G = \{1,2,3,4,5,6\}$  is a finite abelian group of order 6 with 08  
 respect to multiplication module 7.  
 (c) Explain distributive Lattice. Show that following diagrams represent non- 08  
 distributive lattice.



3. (a) Show that  $(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$  04  
 (b) Consider the  $\{3,5\}$  group encoding function defined by 08
- |                |                |
|----------------|----------------|
| $e(000)=00000$ | $e(001)=00110$ |
| $e(010)=01001$ | $e(011)=01111$ |
| $e(100)=10011$ | $e(101)=10101$ |
| $e(110)=11010$ | $e(111)=11000$ |

TURN OVER