

(3 Hours)

(Total Marks: 80)

**N.B.:** 1. Question No.1 is compulsory.

2. Answer any three out of remaining questions.

3. Assume suitable data if necessary.

4. Figures to the right indicate full marks.

- Q1.** a) Explain the difference between declarative and imperative programming paradigms. (05)  
b) Explain lifecycle of a thread. (05)  
c) Explain different types of Inheritance in OOP. (05)  
d) Explain what is concept of higher order function? Explain working of any 2 higher order functions from Haskell Prelude library (05)
- Q2.** a) What are Scripting Languages? Explain characteristics of scripting languages. (10)  
b) What is the role of an Exception Handler in a programming language? Briefly explain important tasks it performs. (10)
- Q3.** a) Explain different storage allocation mechanisms. (10)  
b) What is logic programming? Explain Facts, Rules and Queries along with an example. (10)
- Q4.** a) Explain Type and Type classes in Haskell. (10)  
b) Explain the different communication and synchronization techniques in Concurrent Programming model. (10)
- Q5.** a) Define a Haskell function named “addUs” that adds 2 input numbers. Using this function as a building block, define a Haskell function “multiplyUs” that multiplies two input numbers. The multiplyUs function should cater to following:  
i. Inputs may be signed numbers e.g. “multiplyUs (-2) \* (3)” should result in “-6” and “multiplyUs (-2) \* (-6)” should result in “12”  
ii. It should use guard expressions and recursion.  
iii. No need to write the main function to do user interaction. Writing definition for “addUs” and “multiplyUs” is sufficient. Explain type signature for your code.  
b) Explain the unification and resolution in prolog with example. (10)

**Q6.** Short note on: (Any 4)

**(20)**

- a) Static Scoping vs. Dynamic Scoping.
- b) Types of bindings in Programming Languages.
- c) Lazy versus Eager evaluation order for function parameters.
- d) List operations in Prolog.
- e) Need for Thread Synchronization in concurrent programming.

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Q1 (20)

- (a) Write a short note on DDL Commands.
- (b) Explain Characteristics of databases.
- (c) Explain generalization and Specialization.
- (d) Explain binary relational operations in relational algebra.

Q2.

- (a) Draw and explain DBMS System architecture. (10)
- (b) Explain stored procedures and functions with example. (10)

Q3

- (a) Draw EER diagram for Library management System. (10)
- (b) Explain join operations in relational algebra. (10)

Q4.

- (a) Explain steps for Mapping the ER and EER Model to the Relational Model. (10)
- (b) Write SQL Syntax for (10)

Course Table

Cid	Course_Name	Staff_name	Durati on(in weeks)	fees
1	DBMS	Menon	6	45000
2	PCPF	Rai	4	28000
3	JAVA	Rajput	2	16000
4	DSA	Govilkar	5	32000

Student Table

Sid	name	Location	Cid
1	Anaya	Thane	1
2	Rajiv	Navi_mumbai	4
3	Suyog	Dadar	2
4	Pari	Andheri	3
5	Dhariya	CST	1

- (i) Create above course table also insert values.
- (ii) Create student table with c\_id as foreign key.
- (iii) Arrange courses in descending order of fees .
- (iv) Find name of course student name 'Rajiv 'has enrolled for.
- (v) List down names of all students whose course duration is more than 3.

Q5

- (a) Define normalization. Explain 1NF,2NF and 3NF with example. (10)  
(b) Explain Serializability with types. (10)

Q6.write short note on (Any four) (20)

- (a) Role of DBA.  
(b) Need of Normalization.  
(c) Primary key and Foreign key.  
(d) ACID properties.  
(e) Nested and Sub queries in SQL.

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(3 Hours)

[Marks: 80]

- N.B.:** 1) Question No. 1 is compulsory.  
 2) Answer any three out of remaining questions.  
 3) Assume suitable data if necessary.  
 4) Figures to the right indicate full marks.

- Q1. (a) Define Graph. List down the applications of graph. (5)  
 (b) Explain winding and unwinding phase of recursion. (5)  
 (c) Explain the concept of Buddy system. (5)  
 (d) Explain different types of link list. (5)

- Q2. (a) Design an algorithm to perform the following operations on circular link list: (10)  
 i) Insert node at the end  
 ii) Delete the first node  
 iii) Count number of nodes

- Q2. (b) Explain selection sort with example by giving its algorithm and comment on its complexity. (10)

- Q3. (a) Construct a B-tree of order 5 for the following set of data: (10)  
 1,12,8,2,25,6,14,28,17,7,52,16,48,68,3,26,29,53,55,45,67

- Q3. (b) Write an algorithm for Breadth First Search (BFS) and traverse the graph shown in figure 1 using BFS. (10)

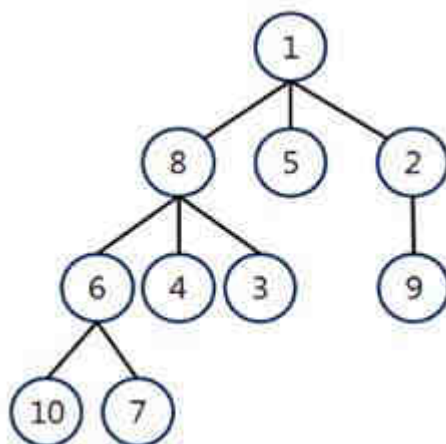


Figure 1

Q.4. (a) Write a program to implement Stack ADT using Linked list. (10)

Q.4. (b) Explain in brief: - (10)

- i. Directed Graph
- ii. Weighted Graph
- iii. Minimum Spanning Tree
- iv. Adjacency Matrix Representation
- v. Adjacency list Representation.

Q.5 (a) Write a program to implement queue using array. (10)

Q.5 (b) Sort the following data in ascending order using Heap Sort. 20,14,50,3,5,7,11,8,12,15.  
Show all the steps. Write an algorithm for Heap Sort.

Q.6. Write Short note on any four: - (20)

- i. AVL Tree
- ii. Circular Queue
- iii. Binary Search
- iv. Hashing Techniques
- v. Dijkstra's Algorithm

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Time: 3 Hours

Max. Marks: 80

N.B.

1. Question No.1 is Compulsory
2. From Remaining 5 Questions You are Required to Solve any 3 Questions.
3. Assume the data if Necessary

- 1 Define/state the following - (10\*2) 20
- i) Modulation ii) baseband signal iii) noise factor iv) modulation index in AM
- v) Image frequency vi) quantization process vii) multiplexing viii) sampling theorem
- ix) balanced modulator x) pre-emphasis in FM
- 2 Attempt the Following 20
- a) Explain/derive in detail Friss formula (noise actor of amplifier in cascade) Noise.
- b) Compare PAM, PWM and PPM.
- 3 Attempt the Following 20
- a) What are drawbacks of TRF receiver & how it is overcome in Super heterodyne receiver.
- b) Explain in detail Pulse code Modulation generation and degeneration.
4. Attempt the Following 20
- a) Draw and explain in detail FM demodulator: Foster Seeley discriminator.
- b) In an AM radio receiver the loaded Q of the antenna circuit at the input to the mixer is 100. If the intermediate frequency is 455 KHz, calculate the image frequency and its rejection at 1 MHz.
- 5 Attempt the Following 20
- a) Derive the mathematical expression of AM in detail.
- b) Write short Note on
1. Delta modulation
  2. Need of modulation
- 6 Attempt the Following (any four) 20
- a) Draw and explain Electromagnetic Spectrum and application
- b) Write short note on space wave propagation
- c) Discuss time and frequency shifting, unit step, delta and gate function of Fourier Transform.
- d) Compare Digital Band Pass Modulation Techniques ASK and FSK & PSK
- e) Explain Amplitude Modulation Technique DSBFC.

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

- 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  $\int_0^\infty e^{-2t} \cos t \int_0^t u^2 \sinh u \cosh u \, du \, dt$  [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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