(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? Explain different types of graph. (5)
    (b) Explain first fit, best fit and worst fit method with example. (5)
    (c) Explain threaded binary tree. (5)
    (d) Briefly explain memory fragmentation. (5)

Q2. (a) Design an algorithm to perform the following operations on queue: (10)
        i)   Enqueue
        ii)   Dequeue
        iii)   Display

Q2. (b)Explain quick sort by giving its algorithm and sort the following data using quick sort.
        27, 43, 3, 9, 82, 10,38

Q3. (a) Evaluate the following expression using stack- (10)
        (2-3+4) * (5+6*7)

Q3. (b) Explain Priority Queues and variants of Priority Queues. (10)

Q4. (a) Construct a minimum spanning tree for the graph shown in Figure 1, using Kruskal's
    and Prim's Algorithm and find out the cost with all intermediate steps. (10)
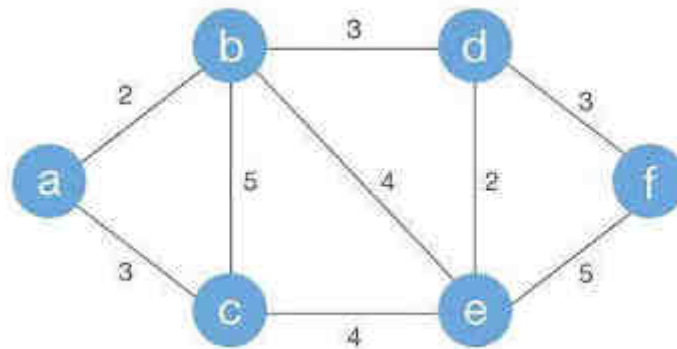

Figure 1: Graph

Q4. (b) Define AVL tree. Step by step construct an AVL tree for the following data: (10)
    30,20,10,25,40,50,55,22,23

Q5. (a) Explain different hash functions. Assume a table has 8 slots (m=10). Using Linear probing,
    insert the following elements into the hash table. 44, 36, 18, 77, 457 64, 10, 5, and 15 are
    inserted in the order. (10)

Q5. (b) Define Binary Search Tree. Construct the binary search tree from following traversal: (10)
        In-order: D B H E A I F J C G
        Pre-order: A B D E H C F I J G
Determine the post-order of the tree drawn.

Q6. Solve any Four: (20)
  a) Graph Traversal Algorithm
  b) Game Tree
  c) Radix Sort
  d) B-tree
  e) Round Robin Scheduling

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Duration: 3 Hours   **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
       (2) Attempt any three questions out of the remaining five.
       (3) All questions carry equal marks.
       (4) Assume suitable data, if required and state it clearly.

1			
	a	What are the responsibilities of a Database Administrator (DBA)?	**[5]**
	b	Differentiate between Strong and Weak Entity.	**[5]**
	c	Explain the aggregate/group functions in SQL with examples.	**[5]**
	d	Explain the GROUP BY and HAVING clause in SQL with an example.	**[5]**
2	a	Draw and explain the overall system structure of DBMS.	**[10]**
	b	Design an ER diagram for a Hospital Management System and convert it into a relational schema.	**[10]**
3	a	Explain various JOIN types (INNER, LEFT OUTER, RIGHT OUTER, FULL OUTER) with SQL syntax and output examples.	**[10]**
	b	Explain different relational algebra operators with examples.	**[10]**
4	a	Explain Conflict Serializability in concurrency control.	**[10]**
	b	What is Normalization? Explain 1NF, 2NF, and 3NF.	**[10]**
5	a	Explain the concept of Transactions and ACID Properties.	**[10]**
	b	What are the recovery techniques in DBMS? Discuss log-based recovery.	**[10]**
6	a	What is Indexing in DBMS? Explain clustered and non-clustered indexing with examples.	**[10]**
	b	Write a JDBC program to retrieve and display data from a database table.	**[10]**

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TIME: 03 HOURS   **MAX. MARKS : 80**

Note:
1. Question **No. 1** is compulsory.
2. Attempt **any three** questions out of remaining **five** questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicate full marks.

Q.1		Answer the following **(Any four)**	**Marks**
	a.	Find the Laplace transform of t sin^3t.	**05**
	b.	Calculate the Spearman's rank correlation coefficient R.	**05**

X	10	12	18	18	15	40
Y	12	18	25	25	50	25

c. Find the constants a, b, c, d ,e if f (z) =   **05**
$(a\,x^3 + bx\,y^2 + 3x^2 + cy^2 + x) + i\,(dx^2y - 2y^3 + e\,x\,y + y)$ is
analytic.

d.   Find inverse Laplace transform of $tan^{-1}\left(\frac{s+a}{b}\right)$.   **05**

Q.2 a.   Evaluate by using Laplace transform of $\int_0^\infty \left(\frac{\sin 3t + sn\, 2t}{te^t}\right)$ dt.   **06**

b. If the mean of the following distribution is 16 find m, n and variance   **06**
X   :   8   12   16   20   24
P (X= x) : $\frac{1}{8}$ m   n $\frac{1}{4}$ $\frac{1}{12}$

c.   Obtain the Fourier expansion of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in $(0, 2\pi)$ **08**

Hence show that $\frac{\pi^2}{12}$ = $\frac{1}{1^2}$ - $\frac{1}{2^2}$ + $\frac{1}{3^2}$ - $\frac{1}{4^2}$ ....

Q.3 a.   Find the analytic function f (z) = u + i v in terms of z   **06**
if u + v = e^x (cos y + sin y) + $\frac{x-y}{x^2+y^2}$.

b. Find the coefficient of regression and hence the equations of the lines   **06**
of regression for the following data

X	78	36	98	25	75	82	90	62	65	39
Y	84	51	91	60	68	62	86	58	53	47

c.   Using convolution theorem Find the inverse Laplace transform of   **08**
$\frac{1}{(s^2 + 4\,s+13)^2}$

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Q.4 a. Obtain Fourier series of f (x) = |sin x| in ((−π, π). 06

b. If X denotes the outcome when a fair die is tossed, find the moment generating function of x and hence find the mean and variance of X. 06

c. Evaluate by using Laplace transforms of $\int_0^\infty e^{-t} (t \int_0^t e^{-4u} \cos u \, du) dt$. 08

Q.5 a. Find the orthogonal trajectories of family of curves
$3 x^2 y + 2x^2 − y^3 − 2y^2 =$ c. 06

b. Find the inverse Laplace transform of $\frac{s+29}{(s+4)(s^2+9)}$. 06

c. Fit a second-degree parabolic curve to the following data and estimate the
Production in 1982. 08

Year (X)	1974	1975	1976	1977	1978	1979	1980	1981
Production (y)(in tons)	12	14	26	42	40	50	52	53

Q.6 a. Obtain half range Sine series for   f (x) = x- x^2 in 0≤ x ≤ 1. 06
Hence show that $\frac{\pi^3}{32}$ = $\frac{1}{1^3}$ - $\frac{1}{3^3}$ + $\frac{1}{5^3}$ - $\frac{1}{7^3}$ ……..

b. Show that the function v = $e^{2x}(y \cos 2y + x \sin 2y$ is harmonic.
And find its corresponding analytic function f (z) = u + i v. 06

c. Find the value of k if the function   f (x) = k $x^2(1 − x^3)$,   0≤ x ≤ 1 08
f (x) = 0   otherwise .
Is a probability density function. Also find p (0≤ x ≤$\frac{1}{2}$) find mean and variance.

(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) What are the different programming paradigms?   **(05)**
        b) What are the different problem domains of scripting languages?   **(05)**
        c) Explain List comprehension in Haskell with suitable examples.   **(05)**
        d) Explain function overloading as one of the types of Polymorphism with a suitable **(05)**
            example code.

Q2. a) What is exception handling? What is the difference between checked and unchecked exceptions?
            Explain with suitable example.   **(10)**
         b) Write a Haskell function to find factorial of a number using   **(10)**
               i. Recursion with pattern matching
               ii. If then else and Recursion
               iii. Gated Expressions and Recursion

Q3. a) What are the parameter passing methods? Explain each with suitable example.   **(10)**
         b) What is the need of synchronization in multi-threading? Write a Java program to explain how
             multiple threads are executed simultaneously   **(10)**

Q4. a) What is type checking? Also explain the difference between type equality, compatibility and **(10)**
             Inference.
         b) Represent following statements in prolog   **(10)**
                i. Ram studies in SE class.
                ii. Shyam studies in SE classmate.
                iii. Students who study in same class are called classmates.
                iv. Find out if Ram and Shyam are classmates.
                v. Find out who is classmate of Ram.
             Mention which of the above are facts, rules and queries.

Q5. a) Explain different storage allocation mechanisms.   **(10)**
         b) Explain Type and Type classes in Haskell.   **(10)**

Q6.   Short note on: **(Any 4)**   **(20)**

           a) Lambda Calculus
           b) Message passing
           c) Database manipulation in prolog
           d) Types of Inheritance in OOP
           e) Innovative features of scripting languages

(3 Hours) [Total 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 Attempt Any Four: - 20
    a) Compare Analog and Digital Communication System.
    b) Define and draw ground wave and sky wave propagation.
    c) State and Explain Friss formula.
    d) Differentiate Between Amplitude Modulation and Frequency Modulation.
    e) Explain Pulse code Modulation generation.

2 Attempt the Following 20
    a) Explain in detail what are the different Types of Noise.
    b) Compare PAM, PWM and PPM generation and Degeneration.

3 Attempt the Following 20
    a) Draw and discuss Super heterodyne receiver with its characteristics- Sensitivity, Selectivity, Fidelity, double spotting, Image frequency and its rejection.
    b) Explain in detail Sampling theorem for low pass and band pass signals with proof.

4 Attempt the Following 20
    a) Draw and explain in detail FM demodulator: Foster Seeley discriminator.
    b) Explain in detail Orthogonal Frequency Division Multiplexing.

5 Attempt the Following 20
    a) Draw and Explain in detail Armstrong method block diagram and waveforms.
    b) Write short Note on
        1. Adaptive Delta modulation
        2. Tropospheric scatter propagation

6 Attempt the Following (any four) 20
    a) Draw and explain Electromagnetic Spectrum and application.
    b) Draw and Explain 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 PSK and QPSK.
    e) Explain Amplitude Modulation Technique generation of DSB using Balanced modulator.