Time: 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. Attempt All questions   20M
(a) Explain the need of normalization in database.
(b) Discuss select and where clause in SQL.
(c) Discuss various ER notations.
(d) Explain the role of JDBC in database applications.

Q2.
(a) Discuss normalization process to improve the database design.   10M
(b) Explain relational algebra with suitable examples in detail.   10M

Q3
(a) Draw EER diagram for Train Ticket Booking Information System   10M
(b) Draw and explain notations in EER diagram   10M

Q4.
(a) Explain how various DDL and DML commands used in SQL with example   10M
(b) Write SQL Syntax for(Assume data wherever required)   10M
(i)   Create flight table(flight_id,name,source_station,destination_station,duration(in hours),cost)
(ii)   Create passenger table (pid,name,phone_number,flight_id) with flight_id as foreign key.
(iii) Arrange flights in descending order of cost.
(iv) Find flight name which passenger no 1 had board.
(v) Find destination_station for flight no E123.

Q5
(a) Discuss functional dependencies in detail   10M
(b) Write relational algebra query for(Assume data wherever needed)
(i) Find names of students who live in city 'Mumbai from student table   3M
(ii) Find department of student whose roll_no is 2 from info table   3M
(iii) Find name of students whose marks are greater than   22   4M

Q6.write short note on   20M
(a) Procedures in SQL
(b) Order by and Group by in SQL
(c) Integrity constraints in SQL
(a) Discuss functional dependencies in detail.

****

30857

Time: 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. Attempt All questions   20M
(a) Explain generalization and Specialization with example.
(b) Discuss primary key and foreign key with example.
(c)Write a short note on conflict serializability
(d) Explain DCL commands in detail.

Q2.
(a)Draw and explain Database System architecture   10M
(b) Explain different type of attributes with example in Entity Relational Model   10M

Q3
(a) Draw EER diagram for railway reservation management System   10M
(b) Draw and explain notations of ER/EER diagram   10M

Q4.
(a) Explain the DDL and DML Commands with suitable example.   10M
(b) Discuss procedure, functions and cursors with example.

Q5
(a) Define normalization. Explain 1NF in detail with example   10M
(b) Explain ACID properties in details with example.

Q6. write short note on   20M
(a) Constraints in SQL
(b) Need of normalization in Database Design
(c) Group by clause
(d) JDBC Connection

****

30854

(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) Explain Linked lists in detail (5)
    (b) List down the applications of stack. (5)
    (c) Explain winding and unwinding phase of recursion. (5)
    (d) Briefly explain memory fragmentation. (5)

Q2. (a) Design an algorithm to implement circular queue using an array. (10)
Q2. (b) Explain quick sort with example by giving its algorithm and comment on its complexity.
(10)

Q3. (a) Write an algorithm to covert infix expression to postfix expression. (10)
Q3. (b) Explain various collision resolution techniques in hashing. (10)

Q4. (a) Define Minimum Spanning Tree. Construct a minimum spanning tree shown in figure 1 using Kruskal's and Prim's Algorithm and find out the cost with all intermediate steps. (10)
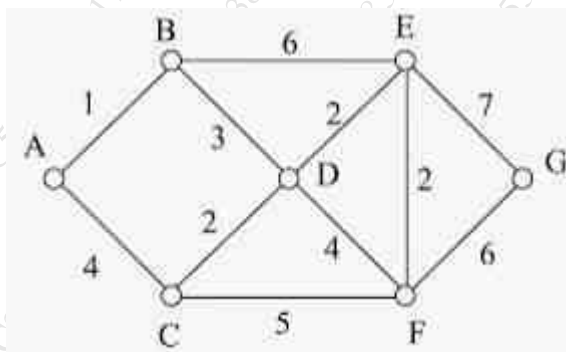

Figure 1

Q4. (b) Define AVL Tree. Step by step construct a AVL tree for the following data
    23, 12, 25, 01, 45,63, 27, 29 ,90,78,5,6,10 (10)

Q5. (a) Write down the algorithm for addition of two polynomials. (10)
Q5. (b) Define Binary Search Tree. Give the algorithms for various tree traversals. (10)

832B53B5C36918DC5921A86F17E23884

Q6. Solve **any Four:** (20)

a) Threaded Binary Tree
b) Depth First Search
c) Game Tree
d) Selection Sort
e) B+-tree

****

30183 Page **2** of **2**

(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) Figures to the right indicate full marks

Q.1 a) Find $L(t + e^t + \cos t)^2$ [5]

Q.1 b) Find the Fourier series for $f(x) = x \, sinx$ in $(-\pi, \pi)$ [5]

Q.1 c) Find Karl Pearson's coefficients of correlation between X and Y from
   the following data   [5]

X	100	200	300	400	500
Y	30	40	50	60	70

Q.1 d) If $f(z) = (x^3 + axy^2 + bxy) + i(3x^2y + cx^2 + y^2 + dy^3)$
   is analytic, then find a, b, c, d [5]

Q.2 a) A random variable X has the following probability function   [6]

X	1	2	3	4	5	6	7
P(X=x)	k	2k	3k	k^2	k^2+k	$2k^2$	$4k^2$

Find i) k,   ii) P(X$\geq$ 4),   iii) P(X < 5)

Q.2 b) Determine the analytic function whose real part is $u = e^x \cos y$ [6]

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

Q.3 a) Obtain the Fourier series for $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval $(0, 2\pi)$ [6]

Q.3 b) A continuous random variable X has the p.d.f. $f(x) = kx^2 e^{-x}, \; x \geq 0$ [6]

Find i) k, ii) $P(1 \leq x \leq 2)$

Q.3 c) Find $L^{-1}\left[\frac{s+29}{(s+4)(s^2+9)}\right]$ using partial fraction method   [8]

Q.4 a) Find $L[f(t)], \; where \; f(t) = \cos t, 0 < t < \pi \; and \; f(t) = 0, \; t > \pi$ [6]

Q.4 b) Compute Spearman's rank correlation coefficient for the following data   [6]

X	18	20	34	52	12
Y	39	23	35	18	46

Q.4 c) Obtain the Fourier series for [8]

$$f(x) = \begin{cases} 1, & 0 \leq x \leq \pi \\ 2 - \dfrac{\pi}{x}, & \pi \leq x \leq 2\pi \end{cases}$$

Q.5 a) Find $L^{-1}\left[\dfrac{4s+13}{s^2+8s+13}\right]$ [6]

Q.5 b) Find $L[(1 + sin2t)^2]$ [6]

Q.5 c) Find the line of regression of Y on X for the following data [8]

X	5	6	7	8	9	10	11
Y	11	14	14	15	12	17	16

Q.6 a) Find mean and variance for the following distribution [6]

X	8	12	16	20	24
P(X = x)	1/8	1/6	3/8	1/4	1/12

Q.6 b) Find i) $L^{-1}[cot^{-1}2s]$ ii) $L^{-1}\left[\log\left(1 + \dfrac{4}{s^2}\right)\right]$ [6]

Q.6 c) Prove that the function $f(z) = e^{2z}$ is analytic. Also, find its derivative. [8]

****

(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 the Laplace transform of $t \sqrt{1 + \sin t}$ [5]

(b)   Find the constants a, b ,c, d, e if   [5]

f(z) = $(a x^3 + b x y^2 + 3 x^2 + c y^2 + x) + i (d x^2 y - 2 y^3 + e x y + y)$ is analytic.

(c)   Calculate the Spearman's rank correlation coefficient R   [5]

X   :   85 ,   74 ,   85 ,   50,   65,   78,   74,   60,   74,   90

Y   :   78   91,   78,   58,   60,   72,   80,   55,   68,   70

(d)   Find inverse Laplace transform of $tan^{-1} \left(\frac{s + a}{b}\right)$.   [5]

Q2.

(a) Find the Laplace transform of $e^{-4t} \int_0^t u \sin 3u \, du$ [6]

(b) find the value of k if the function   f (x) = k x^2 (1 $- x^3$) ,   0 $\leq$ x $\leq$ 1.

F (x) = 0   otherwise

Is a probability density function. find mean and variance.   [6]

(c) Obtain the Fourier series to represent f (x) = x^2 in (0, 2π)

Hence show that $\frac{\pi^2}{12}$ = $\frac{1}{1^2}$ - $\frac{1}{2^2}$ + $\frac{1}{3^2}$ - $\frac{1}{4^2}$ …….   [8]

Q3.

(a)   Find the analytic function f (z) = u + iv such that   [6]

u +v = $\frac{2 \sin 2x}{e^{2y} + e^{-2y} - 2 \cos 2x}$.

27291   **Page 1 of 2**

(b) Using convolution theorem Find inverse Laplace transform of $\frac{s^2}{(s^2+9)(s^2+4)}$. [6]

(c) Fit a second-degree parabolic curve to the following data

Year (x)   : 1974   1975   1976   1977   1978   1979   1980   1981

Production (y) : 12   14   26   42   40   50   52   53.   [8]

Q4.

 (a)   Obtain the   Fourier series to represent f (x) = 9 - x^2 in (-3, 3).   [6]

(b) . Find the coefficients of regression and hence obtain the equation of the lines 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.   [6]

(c) Prove that $\int_0^\infty e^{-t} \frac{\sin 2t + \sin 3t}{t}$ dt = $\frac{3\pi}{4}$.   [8]

Q5.

(a) Find the orthogonal trajectories of the family of curves 3 x^2y + 2x^2 - y^3- 2 y^2 = c. [6]

(b)   If X denotes the outcome when a fair die is tossed, find Moment generating function

      Of X and hence find the mean and variance of X.   [6]

(c)   Obtain the half range cosine series of   f (x) = x ($\pi - x$) in (0, π)

 Hence show that $\frac{\pi^4}{96}$ = $\frac{1}{1^4}$ + $\frac{1}{2^4}$ + $\frac{1}{3^4}$ +$\frac{1}{4^4}$ ……..   [8]

Q6.(a) Find inverse Laplace transform of $\frac{s+29}{(s + 4)(s^2+9)}$.   [6]

(b)   The probability density function of a random variable X is

     X   : 0   1   2   3   4   5   6

   P (X =x) : k   3k   5k   7k   9k   11k   13k

   Find k , p (X < 4), P (3 < X $\leq$ 6) .   [6]

(c)   Verify Laplace equation for u = $\left(r + \frac{a^2}{r}\right)$ cos θ.also find v and f (z) .   [8]

****

(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) With a neat diagram explain different types of link list. (10)

Q1.(b) Define Graph. With a neat diagram explain different types of graph. (10)

Q2. (a)Write an algorithm to covert infix expression to postfix expression. Convert the following infix expression to postfix expression using stack- (10)

$$K+L-M*N+(O \wedge P)*W/U$$

Q2. (b)Write an algorithm to perform following operations on circular link list: (10)
   i)   Insertion from the End
   ii)   Deletion from End
   iii)   Display the contents of list

Q3. (a) Define B-tree. Step by step construct a B-tree for the following data for order 5: (10)

   20,30,35,15,85,10,55,60,25,89,90,100

Q3.(b) Define AVL tree. Construct an AVL tree from the following data and mention the rotations in each step 51,26,11,6,8,4,31,21,9,16 (10)

Q4. (a) Define Minimum Spanning Tree. Construct a minimum spanning tree shown in figure 1 using Kruskal's and Prim's Algorithm and find out the cost with all intermediate steps. (10)
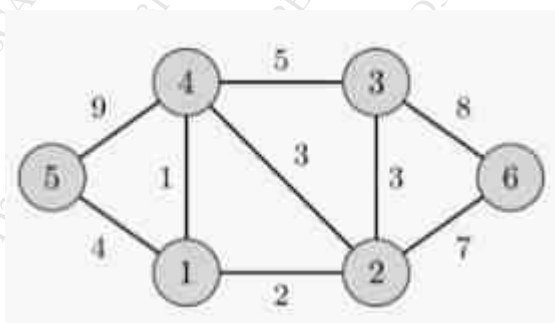

Figure 1

30181   Page **1** of **2**

Q4.(b) Explain graph traversal algorithms and traverse the graph shown in figure 2 using Breadth and Depth first search techniques:
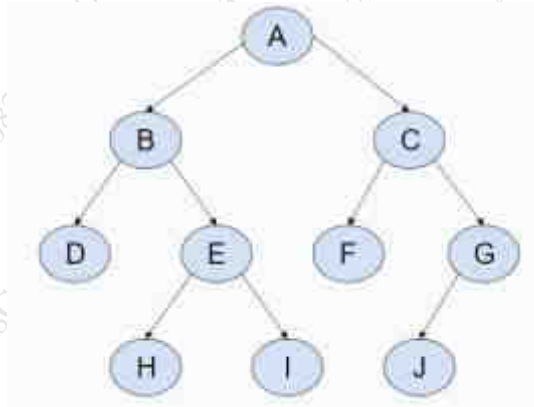

Figure 2: Graph

Q5.(a) Explain the method of collision resolution. With the help of example explain linear probing collision resolution technique. (10)

Q5.(b) Define Binary Tree. Construct the binary tree from following data: (10)

In-order Traversal: 4,2,1,7,5,8,3,6

Post-orderTraversal:4,2,7,8,5,6,3,1

Q6. Solve **any Four:** (20)

a) Game Tree
b) Threaded Binary Tree
c) B+-tree
d) Graph Representation Techniques
e) Huffman Coding

****