FYCS

(Time: 2 ½ Hours)   [Total Marks: 75]

N.B.   1) All questions are compulsory.
        2) Figures to the right indicate marks.
        3) Illustrations, in-depth answers and diagrams will be appreciated.
        4) Mixing of sub-questions is not allowed.

Q. 1   **Attempt All (Each of 5 Marks)**   (15M)
(a)   **Select correct answer from the following:**
        1. A relation R on a set A is said to be _____ if aRb, bRc and aRc
            for all $a, b, c \in A$.
            a) Reflexive b) Symmetric c) Transitive d) Antisymmetric
        2. The value of P(3, 2)=_____
            a) 6   b) 9   c) 8   9) 5
        3. Two vertices V_1 and V_2 in a graph G are said to be _____ to each
            other iff they are the end vertices of the same edge e.
            a) Adjacent b) Parallel c) loops   d) None
        4. In _____ ways 8 different beads can be arranged to form a
            necklace
            a) 8!   b) 7!   C) 9!   D) None
        5. Diagrammatic representation of a relation R defined on a set is
            called_____.
            a) Diagraph b) Multigraph c) Hasse diagram d) None

(b)   **Fill in the blanks:**
        (Indegree, 45, 21, 35, increase, Lattice, POSET, Injective, Surjective)
        1. A Set together with a partial order relation is called_____
        2. An onto function is called as _____ function
        3. The number of incoming edges on a vertex v is called _____ of a
            vertex.
        4. The value of C(10, 8)=_____.
        5. In _____ ways 4 questions can be selected form 7 questions.

(c)   **Define the following.**
        1. Equivalence Relation
        2. Recurrence relation
        3. Simple graph
   4. Pigeonhole principle
        5. Pascal identity

Q. 2   **Attempt the following (Any THREE)**   (15M)
(a)   If f: R→R is defined by f(x) $=\frac{(2x-3)}{7}$, for all x∈ R, then show that f is a bijective
        function.

(b)   Define composition function. If f and g are two functions from the set of
        integers to the set of integers defined by $f(x) = x + 3$ and
        $g(x) = x^2$ then find fog(x) and gof(x).

57958   Page 1 of 4

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(c) Define equivalence relation and let R= {(1,1), (1,3),(2, 2), (2, 4), (3, 3), (3, 1), (4, 4), (4, 2) be the relation defined on A={1, 2, 3, 4}. Show that R is an equivalence relation.

(d) Describe the order pairs in the relation determined by the Hasse diagram of a poset (A, $\leq$) on the set A= {1, 2. 3. 4}
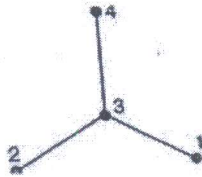
(e) Solve the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$, $n \geq 2$ with initial conditions $a_0=0$, $a_1= 1$ Using characteristic root method.

(f) Explain Tower of Hanoi and solve the puzzle.

Q. 3 **Attempt the following (Any THREE)** (15M)

(a) Prove that
(i) $C(n,0)=1$ (ii) $C(n,1)=n$ (iii) $C(n, n)=1$ (iv) $C(n, r)= C(n, n-r)$

(b) How many distinguishable permutations of the letters in the word SCIENCE are there?

(c) Draw a tree diagram to find how many bit strings of length four do not have two consecutive 1's.

(d) A class is composed of 2 brothers and 6 other boys. In how many ways can all the boys be seated at a round table so that the two brothers are not seated together?

(e) Let L= {a, ab, a^2} and M= {b^2, aba} be languages over A= {a, b} .
Find (i) LM (ii) MM

(f) Find the language L(G) over {a,b,c} generated by the grammar G with productions S-$\rightarrow$aSb, aS$\rightarrow$Aa, Aab$\rightarrow$c.

Q. 4 **Attempt the following (Any THREE)** (15)

(a) Define adjacency matrix and Draw the undirected graph G corresponding to given adjacency matrix.

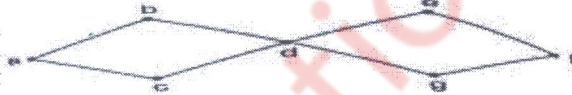$$A= \begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

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(b)   What is a planar graph? Draw a planar graph representation of the given graph.
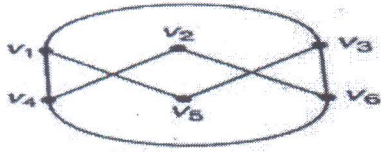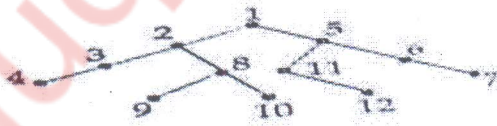

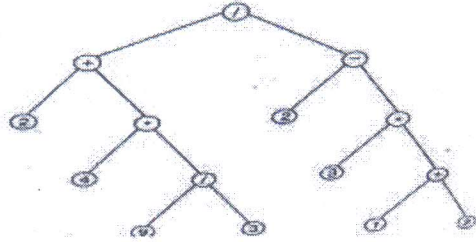(c)   Explain the operations on graphs also find union and intersection of the given graphs.

(d)   Use Depth first search algorithm to find a spanning tree for the given graph.

(e)   What is tree traversal and Find preorder, postorder and inorder search for the given tree.

(f)   Determine the value of the expression represented in a binary tree.

Q. 5   **Attempt the following (Any THREE)**   (15)
(a)   If A={1, 2, 3} and R be relation on A defined by xRy such that $x \le y$. Find R and draw
        its diagraph.
(b)   Using generating function solve the recurrence relation $a_n = 3\,a_{n-1} + 2$ with initial
        condition $a_0 = 1$.
(c)   What is the probability that a randomly selected number that is between
        100 and 999(both inclusive) will not contain the digit 7?

(d)   What is a Complete graph .Draw a regular graph with 5 vertices
(e)   Consider the language L={ab, c} over A={a,b,c}, Find : a) L^3; b) L^{-2}

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