Code No. E – 15170/N/CBCS

FACULTY OF INFORMATICS

M.C.A. (2 Years Course) I- Semester (CBCS) (Main) Examination, April/May 2023

Subject: Discrete Mathematics (For Fresh Batch)

Time: 3 Hours **Max. Marks: 70**

Note: I. Answer one question from each unit. All questions carry equal marks.
II. Missing data, if any, may be suitably assumed.

Unit – I

1. a) Prove that $n^3 - n$ is divisible by 3 for all positive integer $n,$ using mathematical induction.
   b) Prove cantors diagonal argument.

(OR)

2. a) Explain well-ordering principle.
   b) Explain fundamental theorem of arithmetic.

Unit – II

3. a) State and prove principle of inclusion exclusion for 3 sets.
   b) How many different passwords are there that involve 1,2, or 3 letters followed by 1,2,3, or 4 digits.

(OR)

4. a) State and prove pigeon-hole principle.
   b) Find the number of integers between 1 and 1000 inclusive that are divisible by none of 5,6,8.

Unit – III

5. a) Explain syntax, semantics, validity and Satisfiability with example.
   b) Explain proof of contradiction with example.

(OR)

6. a) Determine whether the following is a tautology or not
   $((p \to q) \wedge (r \to s) \wedge (p \vee r)) \to (q \vee s)$
   b) Verify the validity of the given argument
   $\forall x[p(x) \vee q(x)]$
   $\forall x[[\sim p(x) \wedge q(x)]] \to r(x)$
   $\therefore \forall x[\sim r(x) \to p(x)$

Unit – IV

7. a) Explain DNF with example.
   b) Define a subgroup of a Group G.

(OR)

8. a) State and prove lagranges theorem.
   b) Show that in a group $(G,*)$ for every $a, b \in G,\ (a*b)^2 = a^2 * b^2\ iff\ (G,*)$ is an abelian.

Unit – V

9. a) Explain breadth first search with example.
   b) State and prove Grinberg's theorem.

(OR)

10. a) Explain Kruskal's and Prim's algorithm for finding minimal spanning trees.
    b) When two graphs are said to be isomorphic explain with example?

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Code No. E – 15171/BL/CBCS

FACULTY OF INFORMATICS

M.C.A. (2 Years Course) I- Semester (CBCS) (Backlog) Examination, April/May 2023

Subject: Mathematical Foundation of Computer Science

Time: 3 Hours **Max. Marks: 70**

Note: I. Answer one question from each unit. All questions carry equal marks.
II. Missing data, if any, may be suitably assumed.

Unit – I

1. a) Define set. How is it denoted and what is are the two different ways of representing a set along with an example.
   b) Explain well-ordering principle with an example.

(OR)

2. a) Determine whether the following is a tautology or not $\big((p \to q) \wedge (r \to s) \wedge (p \vee r) \to (q \vee s)\big)$.
   b) State and explain division algorithm.

Unit – II

3. a) State and prove mathematical induction for 3 sets.
   b) Prove that $(n^3 - n)$ divisible by 3 for all positive integer $n,$ using mathematical induction.

(OR)

4. a) Define relation. Explain the properties of binary relations with examples.
   b) State and explain the properties of the pigeonhole principle.

Unit – III

5. a) Show that (i) $\frac{e^x+e^{-x}}{2} = 1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \cdots$ (ii) $\frac{e^x-e^{-x}}{2} = x + \frac{x^3}{3!} + \frac{x^5}{5!} + \cdots$
   b) Explain summation operator.

(OR)

6. a) Solve the recurrence relation $2a_{n+3} = a_{n+2} + 2a_{n+1} - a_n,\ n \geq 0,\ a_0 = 0,\ a_1 = 1,\ a_2 = 2.$
   b) Solve $a_n - 4a_{n-1} + 4a_{n-2} = (n+1)^2;\ a_0 = 0,\ a_1 = 1,$

Unit – IV

7. a) State and prove Lagranges theorem.
   b) Show that in a group $(G,*)$ for every $a, b\ \in G,\ (a * b)^2 = a^2 * b^2\ iff\ (G,*)$ is an abelian.

(OR)

8. a) Let $(G,*)$ be a group and let $a, b \in G,$ then $(a^{-1})^{-1} = a.$
   b) Let $S = \{1,3,7,9\}$ and $G = (S, multiplication\ mod\ 10)$ show that G is a group.

Unit – V

9. a) State and prove Euler's formula.
   b) When two graphs are said to be isomorphic? Explain with an example.

(OR)

10. a) Explain in detail about DFS and BFS search algorithms.
    b) State and Prove Grinberg's theorem.

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Code No: E-15111/NON-CBCS

FACULTY OF INFORMATICS

M.C.A. I-Year I-Semester (NON-CBCS) (Backlog) Examination, April/May 2023

Subject: Discrete Mathematics

Time: 3 Hours **Max. Marks: 80**

Note: I. Answer one question from each unit. All questions carry equal marks.
II. Missing data, if any, may be suitably assumed.

Unit – I

1. a) Prove that $[(P \to Q) \wedge (R \to S)] \wedge [(P \vee R)] \to (Q \vee S)$ is a tautology.
   b) Use Predicate logic to Prove the validity of following argument. “Every husband argues with his wife. “x” is a husband. Therefore “x” argues with his wife”.

(OR)

2. a) What is Hasse diagram?
   b) X={1,2,3,4,5,6,7} R = {(x, y) /x-y is divisible by 3} then show that R is an equivalence relation.

Unit – II

3. a) If $R = \{(1,2),(3,4)(4,2)\}$and $S = \{(1,3),(2,4)(4,2)(4,3)\}$ then compute ROS and SOR and also explain function mapping of R and S.
   b) Prove that function $f : A \to B$.

(OR)

4. Find the conjunctive normal form for the function.
   a) f(P,Q,R)=PQ+P’R.
   b) g(w,x,y,z)=(Wz+xyz) (x+x’y’z’).

Unit – III

5. Solve $a_n - 4a_{n-1} + 4a_{n-2} = (n+1)^2$, given $a_0 = 0$, $a_1 = 1$.

(OR)

6. a) Let (G,*) be a group and a, b, εG then $(a^{-1})^{-1} = a$.
   b) Show that if every element if a group is its own inverse, then the group is an abelian group.

Unit – IV

7. Compute how many integers between 1 and 100 are not divisible by 2,3,5 or 7.

(OR)

8. a) How many total number of integers can be formed with digits 1,2,3,4,5 if no digit is repeated. Explain.
   b) How many ways can a lady wear 5 rings on 4 fingers of her hand.

Unit – V

9. a) State and prove Eulers’ theorem.
   b) Prove that a complete bipartite graph $K_{m,,n}$ is planar iff $m \leq 2, n \leq 2$.

(OR)

10. a) A simple nondirected graph G is a tree iff G is a connected and contains no cycles.
    b) Write about Hamiltonian graphs and Eulerian graphs.

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