# Parvatibai Chowgule College of Arts & Science
# Autonomous

B.Sc. Semester End Examination, January 2022

Semester: I

Subject: Computer Science

Title: Mathematical Foundation of Computer Science-I (Core)

Duration: 2 Hours Max.Marks: 45

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**Instructions: Figures to the right indicate marks**

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**Q. 1. Answer <u>ANY THREE</u> of the following: (9)**

a. Consider the equation $(146)_b+(313)_{b-2}=(246)_8$. Find the value of b.
b. Add $(-49)_{10}+(-32)_{10}$ using Two's Complement.
c. Consider these functions from the set of students in a discrete mathematics class. Under what conditions is the function one-to-one if it assigns to a student his or her
   1) student identification number.
   2) final grade in the class.
   3) home town
d. In a class of 120 students numbered 1 to 120, all even numbered students opt for Physics, those whose numbers are divisible by 5 opt for Chemistry and those whose numbers are divisible by 7 opt for Maths.How many opt for none of the three subjects?

**Q. 2. Answer <u>ANY TWO</u> of the following: (12)**

a. Construct a K-Map and use it to find minimal expansion as Boolean sum of products.
   1) F (x, y, z) = xz + yz + xyz'
   2) F (x, y, z) = xz' + xyz + yz'
b. Which of these relations on {0, 1, 2, 3} are equivalence relations?
   1) {(0, 0), (0, 2), (2, 0), (2, 2), (2, 3), (3, 2), (3, 3)}
   2) {(0, 0), (1, 1), (1, 3), (2, 2), (2, 3), (3, 1), (3, 2),(3, 3)}
   3) {(0, 0), (0, 1), (0, 2), (1, 0), (1, 1), (1, 2), (2, 0),(2, 2), (3, 3)}
c. Give a recursive definition of
   a) the set of odd positive integers.
   b) the set of positive integer powers of 3.
   c) the set of positive integers not divisible by 5.

**P.T.O**

**Q. 3. Answer <u>ANY TWO</u> of the following:** **(12)**

a. Draw an FA accepting the indicated language over {a, b}.
   1) The language of all strings containing exactly two a's.
   2) The language of all strings containing at least two a's.

b. Convert $(153.125)_{10}$ into IEEE 754 floating point representation.

c. Find the DFA equivalent of NFA for which the state table is given below and final state is s2.

| States | Input=a | Input=b |
|---|---|---|
| s0 | - | s0,s1 |
| s1 | - | s2 |
| s2 | s0,s1,s2 | - |

**Q. 4. Answer <u>ANY ONE</u> of the following:** **(12)**

a. Let p and q be the propositions
   p : It is below freezing.
   q : It is snowing.
   Write these propositions using p and q and logical connectives (including negations).
   1) It is below freezing and snowing.
   2) It is below freezing but not snowing.
   3) It is not below freezing and it is not snowing.
   4) It is either snowing or below freezing (or both).
   5) If it is below freezing, it is also snowing.
   6) Either it is below freezing or it is snowing, but it is not snowing if it is below freezing.

**OR**

b. A committee of three individuals decides issues for an organization. Each individual votes either yes or no for each proposal that arises. A proposal is passed if it receives at least two yes votes. Design a Logic circuiT using gates that determines whether a proposal passes.

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