

[Time:2.30 Hrs]

[Marks:75]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Figures to the right indicate full marks.
 3. Students answering in the regional language should refer in case of doubt to the main text of the paper in English.

Q.1 Attempt **any three** of the following: 15

- a. Write notes on Russell's Paradox.
- b. Check whether the following statement is Tautology, Contradiction or Contingency:

$$[(P \rightarrow Q) \wedge (Q \rightarrow P)] \vee [P \wedge Q].$$

- c. Prove that if P set with n elements, then it has 2^n subsets.
- d. Define conjunction and Disjunction, construct its with truth table.
- e. Define power set of A, If Set $A = \{1,2,3,4\}$ write power set of A.
- f. If set $A = \{1,2,3\}$, $B = \{x, y, z\}$ and $C = \{m, n\}$ Write
i) $A \times B$ ii) $A \times C$ iii) $B \times C$

Q.2 Attempt **any three** of the following: 15

- a. Prove that the sum of any two even integers is even.
- b. Prove that $1+3\sqrt{2}$ is irrational.
- c. Suppose today is Tuesday, and neither this year nor next year is a leap year. What day of the week will it be 1 year from today?
- d. Prove or disprove There is a positive integer n such that $n^2 + 3n + 2$ is prime.
- e. Suppose m is an integer. If $m \bmod 11 = 6$, what is $4m \bmod 11$?
- f. Use a diagram to show the invalidity of the following argument:

All human beings are mortal.

Felix is mortal.

\therefore Felix is a human being

Q.3 Attempt **any three** of the following: 15

- a. Find an explicit formula for the sequence.
 $a_k = -4a_{k-1} - 4a_{k-2}$ for all integers $k \geq 2$, for $a_0 = 0, a_1 = -1$.
- b. Functions F and G are defined by formulas: $F(x) = x^3$ and $G(x) = x - 1$, for all real numbers x. Find $G \circ F$ and $F \circ G$ and determine whether $G \circ F$ equals $F \circ G$.
- c. Prove that, $2^n < 5 + (n+1)!$ for all integers $n \geq 2$.
- d. If function $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = 3x - 1$ then prove that f is bijective.
- e. What is recurrence relation? Write recurrence relation for Fibonacci Series and find the first 5 terms of its.

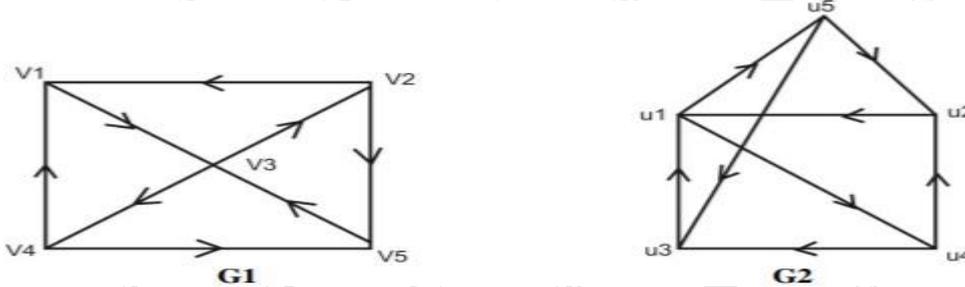
f. Define the following term with one example:

- i) Range of function ii) Boolean Function

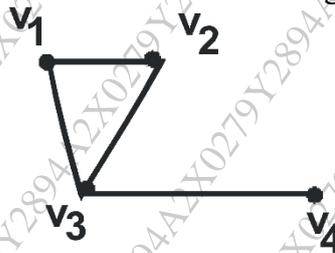
Q.4 Attempt **any three** of the following:

15

- a. Draw a tree with 7 vertices and count the pendent (leaf) vertices.
 b. Let $A = \{2, 3, 6, 12, 24, 36\}$. Check the relation divide on set A is linear or totally ordered relation and draw its Hasse diagram.
 c. Define isomorphism of graphs. Check whether G1 and G2 are isomorphic or not.



d. State “the Handshaking theorem” for an undirected graph also verify for given graph.



- e. Let Z be the set of all integers and let R be a relation in Z, defined by $R = \{(a, b) \mid (a - b) \text{ is even}\}$. Show that R is an equivalence relation in Z.
 f. Define the following terms with one example:

- i) Hamiltonian circuit ii) Elementary Path

Q.5 Attempt **any three** of the following:

15

- a. Show that if any five numbers from 1 to 8 are chosen, then two of that will add to 9.
 b. A license plate can be made by 2 letters followed by 3 digits. How many different license plates can be made if i) repetition is not allowed. ii) Repetition is allowed.
 c. State and Explain Bayes theorem.
 d. A box contains 5 white and 7 black balls. A person draws 3 balls at random. He gets Rs. 50 for every white ball and losses Rs. 10 every black ball. Find the expectation of him.
 e. If the probability is 0.45 that a program development job; 0.8 that a networking job applicant has a graduate degree and 0.35 that applied 210 for both. Find the probability that applied for at least one of jobs. If number of graduates are 500 then how many are not applied for jobs?
 f. A pair of fair dice is rolled. What is the probability that the sum of upper most face is 6, given that both of the numbers are odd?