MAY 2022 **P/ID 17604/PCAE1**

Time : Three hours Maximum : 80 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Define compound statements.

2. Define disjunctive normal form.

3. Form the conjunction of

   P : It is raining today

   Q : There are 20 tables in this room.

4. Write the following statement in symbolic form:

   IF either Jerry takes Calculus or Ken takes Sociology then Larry will take English.

5. Determine the minimum number of elements that one needs to take from the set $A = \{1,2,3,..,8\}$ to be sure that two of the numbers add up to 9.

6. Let $G = \{N, S, T, P\}$, $T = \{0,1\}$, $P = \{S \to 11S, S \to 0\}$. What is the language of this grammer?

7. How many ways can 3 persons are selected out of 15 persons so as to include always one particular person.

8. Define a semi group with example.

9. Define Gauss - Seidel method.

10. Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$.

11. Write the second order Runge-Kutta formula.

12. Define Adams-Bashforth formula.

PART B — (5 × 6 = 30 marks)

Answer any FIVE questions.

13. Prove that if $H_1, H_2, ...H_m$ and P imply Q, then $H_1, H_2, ...H_m$ imply $P \to Q$.

14. Express $P \uparrow Q$ in terms of $\downarrow$ only.

15. Convert the grammer $S \to aSb \mid bSa \mid a \mid b$ into GNF.

16. Let $(M,*)$ be a monoid. Then prove that there exists a subset $T \subseteq M^M$ such that $(M,*)$ is isomorphic to the Monoid (T, o).

17. Prove that if $f : A \to B, g : B \to C$ and $h : C \to D$ are functions, then $h \circ (g \circ f) = (h \circ g) \circ f$

18. Given the matrices $A = \begin{bmatrix} 2 & 5 & -2 \\ -1 & 0 & 0 \\ 3 & 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 5 \\ 1 & 0 \\ 2 & 0 \end{bmatrix}$ obtain AB.

19. Solve $y' = -y$ with the condition $y(0) = 1$, using Euler's method.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q, Q \to R, P \to M$ and ¬M.

21. Reduce the given grammer whose production $P = \{S \to AAC, A \to aAb / \varepsilon, C \to aC / a\}$ into CNF.

22. Prove that any permutation can be expressed as a product of transposition.

23. Find the inverse of the matrix $A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & 4 \\ 1 & 2 & 2 \end{bmatrix}$

using Gaussian Elimination method.

24. Solve, by Eulers method, the equation $\frac{dy}{dx} = x + y, y(0) = 0$, choosing $h = 0.2$ and Compute $y(0.4)$ and $y(0.6)$.
