

MAY 2016

P/ID 17451/RCA/
PCAA

Time : Three hours

Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) Construct the truth table for $\neg(P \vee Q) \wedge (P \vee R)$.

Or

(b) Prove $\binom{n+1}{r} = \binom{n}{r-1} + \binom{n}{r}$.

2. (a) Show that $a^n - b^n$ is divisible by $(a - b)$ for all $n \in \mathbb{N}$.

Or

- (b) Prove that $(a * b)' = b' * a'$, if a and b are the elements of a group $(G, *)$.

3. (a) Solve for a positive root of $x - \cos x = 0$ by Regula Falsi method.

Or

- (b) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton-Raphson method. Take $x_0 = 0.6$.

4. (a) Apply Gauss-Jordan method to solve the equations :

$$x + 3y + 3z = 16$$

$$x + 4y + 3z = 18$$

$$x + 3y + 4z = 19$$

Or

- (b) Using Gauss-Seidel method, solve the following system. Start with $x = 1$, $y = -2$, $z = 3$.

$$x + 3y + 52z = 173.61$$

$$x - 27y + 2z = 71.31$$

$$41x - 2y + 3z = 65.46$$

5. (a) Calculate $\int_{0.5}^{0.7} e^{-x} \sqrt{x} dx$ taking 5 ordinates by Simpson's $\frac{1}{3}$ rule.

Or

- (b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Romberg's method correct to 4 decimal places. Hence deduce an approximate value of π .

2 **P/ID 17451/RCA/
PCAA**

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

6. (a) Establish that $\neg(P \wedge Q) \rightarrow (\neg P \vee (\neg P \vee Q)) \Rightarrow (\neg P \vee Q)$.
- (b) Show that $((P \vee Q) \wedge \neg(\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg P \wedge \neg Q) \vee (\neg P \wedge \neg R)$.
7. (a) Prove that the intersection of any two subgroups of a group G is again a subgroup of G .
- (b) Let G be a group and $a \in G$. If $H = \{a^n : n \in \mathbb{Z}\}$, show that H is a subgroup of G .
8. Find a real root of the equation $\cos x = 3x - 1$ correct to 5 decimal places by fixed point iteration method.
9. By Newton Raphson method, find a non zero root of $x^2 + 4 \sin x = 0$.

