Instructions : (1)   All the questions are compulsory.

(2)   Q. 1 contains 20 short questions of one mark each.

(3)   Q. 2 and 3 carry 25 marks each with internal choices.

1. Answer all the Questions.   [20]

1) 'R is not reflexive means that R is irreflexive' (TRUE/FALSE) .
2) If $R = \{(1,1),(1,2),(1,3)\}$ is a relation on $A = \{1,2,3\}$ then find R^{-1}.
3) Define inverse relation.
4) Define Complemented lattice.
5) Define symmetric relation.
6) Define equivalence relation.
7) Define transitive relation.
8) Define sub Boolean Algebra.
9) Define complete lattice.
10) Find $\mathbb{P}(A)$ where $A = \{1,2,3,5\}$.
11) Define complex function.
12) Define Atom in Boolean Algebra.
13) Write entire function.
14) Define harmonic function.
15) Define analytic function.
16) Define Jordan arc.
17) Write Laplance equation.
18) Evaluate $\lim_{z \to \infty} \frac{2z-5}{z-2i}$.
19) Define smooth arc.
20) State Green's theorem.

2(a). Answer any three out of six.   [06]

1) Simplify the Boolean expression $[a * (b \oplus b')] * [a' \oplus (b * b')]$.
2) Give an example of a Bounded Lattice which is not Complemented Lattice.
3) Draw Hasse Diagram of (S_{12}, D).
4) Prove that (S_{30}, D) is Poset.

5) In usual notation prove that $A(x') = A - A(x)$.
6) For Boolean Algebra $(B,*,\oplus,',0,1)$ prove that
$(a \oplus b) * (b \oplus c) * (c \oplus a) = (a * b) \oplus (b * c) \oplus (c * a)$.

(b). Answer any three out of six. [09]

1) Define lattice and show that (S_6, D) is lattice.
2) State and Prove Modular Inequality.
3) In the lattice if $a \le b$ and $c \le d$, then prove that $a * c \le b * d$ and $a \oplus c \le b \oplus d$.
4) Show that similarity of Matrices on the set of $n \times n$ matrices is an equivalence relation.
5) If Boolean Algebra $(B, *, \oplus, ', 0, 1)$ and $x_1, x_2 \in B$ then prove that $A(x_1 * x_2) = A(x_1) \cap A(x_2)$
6) Obtain Cube array representation of Boolean function $f(x_1, x_2, x_3, x_4) = x_1(x_2 + x_3 x_4')$.

(c). Answer any two out of five. [10]

1) Prove that every chain is distributive lattice.
2) Prove that Direct product of Two lattice is also a lattice.
3) State and Prove De' Morgan's Law.
4) State and Prove Stone Representation Theorem.
5) If $A = \{a, b, c\}$ then show that (S_{30}, D) and $(P(A), \subseteq)$ are isomorphic lattice.

3(a). Answer any three out of six. [06]

1) Show that $f(z) = \bar{z}$ is not analytic.
2) Show that $f(z) = (3x + y) + i(3y - x)$ is entire function.
3) If $f = u + iv$ and it's complex conjugate $\overline{f} = u - iv$ is analytic then show that f is constant.
4) State Lioville's Theorem and Fundamental Theorem of Algebra.
5) Prove that $f(z) = (z^2 - 2)e^{-x}(cos y - i sin y)$ is analytic.
6) Find value of $\int_C z^2 dz$ where C is part of $y = x^2$ from $z = 0$ to $z = 1 + i$.

(b). Answer any three out of six. [09]

1) is Complex function $f(z) = \frac{1}{z}$ entire?. Justify your answer.
2) Prove Laplace equation in Polar Form.
3) Prove that $u = r^2 \sin 2\theta$ is harmonic function and find its conjugate.
4) Prove that $|\int_C \frac{1}{z^2} dz| < \sqrt{2}$, where C is the line segment joining points $z = 2$ and $z = 2i$.
5) State and Prove Cauchy's Inequality.
6) In usual notation prove that $|\int_c f(z)dz| \le ML$.

(c). Answer any two out of five. [10]

1) Prove that the analytic function of constant modulus is also constant in its domain.
2) State and Prove C–R Condition in Polar form.
3) State and prove Cauchy integral formula.
4) State and Prove Morera's Theorem.
5) Show that $|\int_C \frac{log Z}{z^2} dz| < \frac{2\pi(\pi + log R)}{R}$ where $C: |z| = R$ and $R > 1$.