647510 **BSc5MatC503x** **Seat No :________**

B.Sc. Semester - 5 (Remedial) (CBCS) Examination
March/April-2026 (NEW COURSE)
Boolean Algebra & Complex Analysis -1(Core)

Time: 2:30 Hours **Marks:70**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

Que.1(A) Answer any two. **(10)**

(1) R is an equivalence relation on set X then prove that

(i) $\cup_{x \in X}[x] = X$

(ii) $xRy \Leftrightarrow [x] = [y]$

(2) State and prove distributive inequalities.

(3) Let (L, ∗, ⊕) be a Lattice, a, b, c ∈ L then prove that

$a * (b \oplus c) = (a * b) \oplus (a * c) \Leftrightarrow a \oplus (b * c) = (a \oplus b) * (a \oplus c)$

Que.1(B) Answer any one. **(04)**

(1) In usual notations show that (S_n, D) is a poset.

(2) Define: Minimal member. Also find minimal member of (S, D) where S = {2, 3, 6, 12, 24, 36}.

Que.2(A) Answer any two. **(10)**

(1) If (B, ∗ , ⊕ , ', 0, 1) is Boolean algebra and a, b ∈ B then prove that

$a \leq b \Leftrightarrow a * b' = 0 \Leftrightarrow b' \leq a' \Leftrightarrow a' \oplus b = 1.$

(2) If S = {a, b, c}, B = {0, 1} then show that f: P(S) → B is Boolean homomorphism for (P(S), ∩, ∪, ^{c}, ϕ, S) and (B, ∗ , ⊕ , ', 0, 1) where

f(x) = 1, b ∈X

f(x) = 0, b ∉X

(3) If (B, ∗ , ⊕ , ', 0, 1) is a Boolean algebra and $x_1, x_2 \in B$ then prove that

$A(x_1 \oplus x_2) = A(x_1) \cup A(x_2)$.

Que.2(B) Answer any one. **(04)**

(1) In usual notation prove that $(a * b)' = a' \oplus b'$.

(2) Simplify following Boolean sentence.

$(a' * b' * c) \oplus (a * b' * c) \oplus (a * b' * c')$

Que.3(A) Answer any two. **(10)**

(1) In usual notations obtain Cauchy – Riemann conditions in Cartesian form.

(2) Find an analytic function f (z) = u + i v such that u – v = x + y.

(3) Prove that $f(z) = \frac{\overline{(z)}^2}{z}$, $z \neq 0$

& f (z) = 0 , z = 0 satisfies C – R conditions at origin however f(z) is not analytic at origin.

Que.3(B) Answer any one. **(04)**

(1) Prove that u = $r^2 \cos 2\theta$ is a harmonic function and find it's conjugate.

(2) Obtain Laplace equation in polar form.

Que.4(A) Answer any two. **(10)**

(1) State and prove Cauchy's integral formula.

(2) Find $\int_C \frac{z}{(9-z^2)(z+i)} dz$; where C: $|z| = 2$.

(3) Show that $\left|\int_C \frac{\log z}{z^2} dz\right| \leq 2\pi \frac{(\pi + \log R)}{R}$ Where C be the circle $|z|$ = R (R > 1) described in the counter clock wise direction.

Que.4(B) Answer any one. (04)

(1) In usual notations prove that $\left|\int_c f(z)dz\right| \leq$ ML.

(2) Find: $\int_c \frac{dz}{(z-3)}$ where C: | z - 2| = 5.

Que.5(A) Answer any two. (10)

(1) State and prove the fundamental theorem of algebra.

(2) State and prove Liouville's theorem.

(3) State and prove Morera's theorem.

Que.5(B) Answer any one. (04)

(1) Find: $\int_c \frac{5z^2-7z+3}{(z-1)^2}$ dz where C: |z| = 2

(2) If C: |z| = 3 is the closed contour and the integral is fallen in positive sense and g(z) = $\int_c \frac{2s^2-s-2}{s-z}$ ds then prove that g(2) = 8πi and find g(z) when |z| $>$ 3.

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