K26U 0850

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree (C.B.C.S.S.-OBE – Supplementary) Examination, April 2026
(2020 to 2023 Admissions)
CORE COURSE IN MATHEMATICS
2B02 MAT : Integral Calculus and Logic

Time : 3 Hours

Max. Marks : 48

SECTION – A

Short answer questions. Answer **any 4.**

1. Find the value of $\int_0^{\pi/2} \sin^8 x \, dx$.
2. Replace the polar equation $r \cos \theta = -4$ by equivalent cartesian equation.
3. What do we mean by Contradiction ?
4. What is the truth value of the proposition $(\exists n \in \mathbb{P})\ (n + 4 < 7)$ and justify.
5. Write the contrapositive of the implication "If I am in Chicago, then I am in Illinois". **(4×1=4)**

SECTION – B

Short essay questions. Answer **any 8.**

6. Show that $\cosh^2 x - \sinh^2 x = 1$.
7. Evaluate $\int_0^{\pi/2} \cos^3 x \cos 2x dx$.
8. Evaluate $\int \sec^3 x \, dx$.
9. Graph the sets of points whose polar coordinates satisfy the conditions $-3 \leq r \leq 2$ and $\theta = \frac{\pi}{4}$.

P.T.O.

10. Write the domination properties of double integrals.

11. Find the area of the region bounded by $y = x$ and $y = x^2$ in the first quadrant.

12. Find a spherical coordinate equation for the cone $z = \sqrt{x^2 + y^2}$.

13. Find the minimum number of intervals required to evaluate $\int_0^1 \ln(1+x)\,dx$ using Simpson's 1/3 rule with an accuracy of 10^{-6}.

14. If $a > 0$ is a real number then show that $\frac{1}{a} > 0$.

15. Find the truth set T_p of the propositional function p(x) given by "$x + 5 < 3$", defined on the set $P = \{1, 2, 3, ...\}$

16. Negate the statement "All Mathematics majors are males". **(8×2=16)**

SECTION – C

Essay questions. Answer **any 4**.

17. Evaluate $\int \frac{dx}{\sqrt{x^2 + 6x + 10}}$

18. Derive the reduction formula for $\int \cos^n x\,dx$.

19. Sketch the region of integration for the integral $\int_0^2 \int_{x^2}^{2x} (4x + 2)\,dy\,dx$ and write an equivalent integral with the order of integration reversed.

20. Find the area of the playing field described by

$R : -2 \le x \le 2, -1 - \sqrt{4 - x^2} \le y \le 1 + \sqrt{4 - x^2}$ using Fubini's theorem.

21. Use truth table to show that $\neg (p \vee q) \equiv \neg p \wedge \neg q$.

22. Evaluate $\int_0^1 \frac{dx}{3 + 2x}$ using Simpson's rule with $n = 2$.

23. Give a direct proof to the theorem "The square of an odd integer is also an odd integer". **(4×4=16)**

SECTION – D

Long essay questions. Answer **any 2**.

24. Obtain a reduction formula for $\int x^m (\log x)^n \, dx$ and apply it to evaluate $\int_0^1 x^4 (\log x)^3 \, dx$.

25. Find the volume of the solid region bounded above by the paraboloid $z = 9 - x^2 - y^2$ and below by the unit circle in the xy– plane.

26. Evaluate $\int_0^2 \frac{dx}{x^2 + 2x + 10}$ using trapezoidal rule with n = 4. Compare with the exact solution. Also find the bound on the error.

27. Prove that there are infinitely many prime numbers. **(2×6=12)**