



K25U 1319

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree (C.B.C.S.S. – OBE – Supplementary/  
Improvement) Examination, April 2025  
(2019 to 2023 Admissions)  
CORE COURSE IN MATHEMATICS  
2B02 MAT : Integral Calculus and Logic**

Time : 3 Hours

Max. Marks : 48

**Unit – I**Short answer type. Answer **any 4** questions. **Each** question carries **1** mark. **(4×1=4)**

1. Define hyperbolic sine of  $x$ .
2. Write the equation of the circle of radius  $|a|$  centered at  $O$  in polar co-ordinates.
3. Find the Cartesian equivalent of the Polar equation  $r^2 \cos \theta \sin \theta = 4$ .
4. Define a tautology.
5. Define the conjunction of  $p$  and  $q$ .

**Unit – II**Short essay type. Answer **any 8** questions. **Each** question carries **2** marks.

6. Prove that  $\sinh 2x = 2 \sinh x \cosh x$ . **(8×2=16)**
7. Evaluate  $\int x \sin 2x \, dx$ .
8. Find the Cartesian equivalent Polar equation of  $r \cos \theta = 2$ .
9. Evaluate  $I = \int_0^1 \int_1^2 (x^2 + y^2) \, dx \, dy$ .

P.T.O.



-3-

K25U 1319

**Unit – IV**Long essay type. Answer **any 2** questions. **Each** question carries **6** marks. **(2×6=12)**

24. Find reduction formulae for  $\int x \sin^n x \, dx$ .
25. Use cylindrical coordinates to evaluate  $\int_{-3}^3 \int_{\sqrt{9-x^2}}^{\sqrt{9-x^2}} \int_0^{9-x^2-y^2} x^2 \, dz \, dy \, dx$ .
26. Evaluate  $\int_0^1 \frac{dx}{3+2x}$ , using trapezoidal rule with  $n = 2, 4$ . Compare with the exact solution. Find the bound on the error. Also, find the number of sub-intervals required if the error is to be less than  $5 \times 10^{-4}$ .
27. Determine the validity of the following argument :  $p \rightarrow q, \neg q \vdash \neg p$ .

K25U 1319

-2-



10. Find the area enclosed between  $x = 5$ ,  $x = 10$  and  $y = x$  and  $y = 5 + x$ .
11. Define an integration rule of order  $p$ .
12. Write the composite trapezoidal rule of order 1.
13. What is the disjunction of the propositions  $p$  and  $q$  where  $p$  is the proposition "Today is Friday" and  $q$  is the proposition "It is raining today" ?
14. If  $m, n$  are natural numbers such that  $m + n \geq 20$ , then prove that either  $m \geq 10$  or  $n \geq 10$ .
15. Examine that the following argument is valid :  $p, p \rightarrow q \vdash q$ .
16. Check whether the proposition  $(\exists n \in \mathbb{P}) (n + 4 < 7)$  is true or false. Justify.

**Unit – III**Essay type. Answer **any 4** questions. **Each** question carries **4** marks. **(4×4=16)**

17. Evaluate  $\int 4 \cosh (3x - \ln 2) \, dx$ .
18. Evaluate  $I = \int \sin^3 x \cos^2 x \, dx$ .
19. Find the volume of the prism whose base is the triangle in the  $xy$ -plane bounded by the  $x$ -axis and the lines  $y = x$  and  $x = 1$  and whose top lies to the plane  $z = f(x, y) = 3 - x - y$ .
20. The upper half of the cardioid  $r = a(1 + \cos \theta)$  rotate about the polar axis. Find the volume generated.
21. Evaluate  $\int_0^1 \frac{dx}{3+2x}$ , using Simpson's rule with  $n = 2, 4$ . Compare with the exact solutions.
22. Show that the propositions  $p \rightarrow q$  and  $\neg p \vee q$  are logically equivalent.
23. Give a proof by contradiction of the theorem "if  $n^2$  is even, then  $n$  is even".