



Reg. No.: .....

Name : .....

**Second Semester B.Sc. Degree (CBCSS – OBE-Regular/Supplementary/  
Improvement) Examination, April 2024  
(2019 Admission Onwards)  
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 cosine 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  $r \cos \theta = 2$ .
4. Define a statement.
5. What you mean by a contingency ?

## UNIT – II

Short essay type. Answer **any 8** questions. **Each** question carries **2** marks. (8×2=16)

6. Prove that  $\cosh^2 x - \sinh^2 x = 1$ .
7. Integrate  $\log x$ .
8. Find the Cartesian equivalent to the polar equation  $r \cos\left(\theta - \frac{\pi}{4}\right) = \sqrt{2}$ .
9. Evaluate  $I = \int_0^1 \int_0^2 xy(x-y) dx dy$ .
10. Find the area bounded between the curve  $y = x^2$  above the  $x$ -axis and below the line  $y = 2$ .

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11. Define the error of approximation.
12. Write the formula using in Simpson's 1/3 rule of integration.
13. Find the conjunction of the propositions  $p$  and  $q$  where  $p$  is the proposition "Today is Friday" and  $q$  is the proposition "It is raining today".
14. Let  $a \geq 0$  be a real number. If for every  $\epsilon > 0$ , we have  $0 \leq a < \epsilon$ , then prove that  $a = 0$ .
15. Prove that the square of an odd integer is also an odd integer.
16. Examine that the following argument is valid :  $p, p \rightarrow q \vdash q$ .

## UNIT – III

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

17. Evaluate  $\int \coth 5x dx$ .
18. Show that  $\int \frac{\sin^4 x}{\cos^2 x} dx = \frac{\sin^3 x}{\cos x} + \frac{3}{2} \sin x \cos x - \frac{3}{2} x$ .
19. Evaluate  $\iint_S (x^2 + y^2) dx dy$  over the region  $S$  in which  $x \geq 0$ ;  $y \geq 0$  and  $x + y \leq 1$ .
20. Find the volume of  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ .
21. Evaluate  $\int_0^2 \frac{dx}{x^2 + 2x - 10}$ . Using Simpson's rule with  $n = 2, 4$ . Compare with the exact solutions.
22. Show that  $\neg(p \vee q)$  and  $\neg p \wedge \neg q$  are logically equivalent.
23. Show that the hypothesis "If you send me an e-mail message, then I will finish writing the program," "If you do not send me an e-mail message, then I will go to sleep early," and "If I go to sleep early, then I will wake up feeling refreshed" lead to the conclusion "If I do not finish writing the program, then I will wake up feeling refreshed."



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## UNIT – IV

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

24. If  $U_n = \int_0^{\pi/2} \sin^n \theta d\theta$  and  $n > 1$ , prove that  $U_n = \frac{1}{n^2} + \frac{n-1}{n} U_{n-2}$ . Deduce that  $U_5 = \frac{149}{225}$ .
25. Use triple integration in cylindrical coordinates to find the volume and the centroid of the solid  $G$  that is bounded above by the hemisphere  $z = \sqrt{25 - x^2 - y^2}$ , below by the  $xy$ -plane, and laterally by the cylinder  $x^2 + y^2 = 9$ .
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. Prove that the following argument is valid :  $p \rightarrow \neg q, r \rightarrow q, r \vdash p$ .