



K21U 3468

Reg. No. : .....

Name : .....

II Semester B.Sc. Degree (CBCSS – OBE – Reg./Sup./Imp.)  
Examination, April 2021  
(2019 Admission Onwards)  
CORE COURSE IN MATHEMATICS  
2B02 MAT : Integral Calculus and Logic

Time : 3 Hours

Max. Marks : 48

PART – A

Short answer questions. Answer any 4.

1. Find  $\int \frac{1}{\sqrt{4+x^2}} dx$  in terms of hyperbolic functions.
2. Convert the equation  $r = \sec \theta$  in to cartesian form.
3. State Fubini's theorem (first form).
4. Write the contrapositive of the statement :  $x > y \Rightarrow x^2 > y^2$ .
5. If P and Q are two statements, when will be the statement  $\neg(P \vee Q)$  true ? (4x1=4)

PART – B

Short essay questions – Answer any 3.

6. Evaluate  $\int_0^{\pi/2} x \cos^5(2x^2) dx$ .
7. Evaluate  $\int e^x \sinh 2x dx$ .
8. Express the Cartesian coordinates  $(x, y, z)$  in terms of the cylindrical coordinates  $(r, \theta, z)$ .
9. Evaluate  $\iint_R \cos \theta dr d\theta$ , where R is :  $0 \leq \theta \leq \frac{\pi}{2}; 0 \leq r \leq 3$ .

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10. Plot the domain of integration of the integral  $\int_0^1 \int_{1-x}^{1+x} f(x, y) dy dx$ .
11. Find  $\int_0^{\frac{\pi}{2}} \sin x dx$  using trapezoidal rule, taking two sub-intervals.
12. Find  $\int_0^4 f(x) dx$  using Simpson's 1/3 rule, where the function  $f(x)$  is given by

|      |   |   |   |    |    |
|------|---|---|---|----|----|
| x    | 0 | 1 | 2 | 3  | 4  |
| f(x) | 0 | 1 | 8 | 27 | 64 |

13. If  $x$  is an odd integer, prove that  $x^2 + 2$  is odd.
14. Define the terms :  
 i) tautology  
 ii) negation of a statement.
15. State the two De Morgan's laws for quantified statements.
16. If  $p(x) : x$  is an integer multiple of 2 and  $q(x) : x$  is an integer multiple of 3, what is the statement corresponding to  $\neg(p(x) \wedge q(x))$ ? (8x2=16)

## PART - C

Essay questions – Answer any 4.

17. Derive reduction formula for  $\int \sec^n x dx, n > 2$ .
18. Show that  $\frac{d}{dx} (\tanh^{-1} x) = \frac{d}{dx} (\coth^{-1} x)$ .
19. Express the integral in Cartesian form (no need to evaluate)  $\int_{\frac{\pi}{8}}^{\frac{\pi}{3}} \int_0^{\sec \theta} r^3 dr d\theta$ .



20. Evaluate  $\int \int_A dx dy$ , where A is the region in the first quadrant bounded by the curve  $xy = 16$  and the lines  $y = x$ ,  $y = 0$ ,  $x = 6$ .
21. Using trapezoidal rule, find the approximate area bounded between the parabola  $y = 4 - x^2$  and the X axis, using 8 sub-intervals.
22. Prove the following statement using the method of contradiction : "If n is an integer and  $n^2$  is even, then n must be even". Is the converse true ? Justify.
23. Write the negation of the statements using quantifiers :
- $(\forall x \in \mathbb{R}) (x^2 + 4x < 7)$
  - $(\exists x \in \mathbb{R}) (x^2 + 4x > 7)$ . (4x4=16)

## PART - D

Long Essay Questions - Answer any 2.

24. Find the following integrals :

i)  $\int_1^2 \frac{1}{x \sqrt{9 + (\ln x)^2}} dx$

ii)  $\int \frac{\cosh^{-1} x}{\sqrt{x^2 - 1}} dx$ .

25. Evaluate  $\int \int \int_V 2x dz dy dx$ , where V is the cylindrical solid  $x^2 + y^2 = 4$ , cut by the XY plane below and by the plane  $x + 2y + z = 9$  above.
26. Find  $\int_0^6 \frac{5}{x+2} dx$  using Simpson's 1/3 rule, taking six sub-intervals.
27. i) Explain the three methods of proof.  
ii) If  $x + a > 0$  for all  $a > 0$ , prove that  $x \geq 0$ . (2x6=12)