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.

(8×2=16)

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

P.T.O.

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 : $p, p \rightarrow q \; q$.

16. Check whether the proposition $(\exists n \in P)\ (n + 4 < 7)$ 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".

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 5×10^{-4}.

27. Determine the validity of the following argument : $p\rightarrow q, \neg q \neg p$.