K26U 1186

Reg. No. : .....

Name : .....

IV Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Supplementary/ Improvement) Examination, April 2026
(2020 to 2023 Admissions)
CORE COURSE IN MATHEMATICS
4B04 MAT : Number Theory and Applications of Integrals

Time : 3 Hours Max. Marks : 48

PART – A

Answer **any four** out of five questions. **Each** question carries **1** mark. **(4×1=4)**

1. Write first 10 prime numbers.
2. Find g.c.d of 10 and 9 using Euclidian algorithm.
3. Define Diophantine equation.
4. State Euler's theorem.
5. Show that if $a \equiv b \pmod{n}$, then $b \equiv a \pmod{n}$.

PART – B

(Short Essay Type)

Answer **any eight** out of eleven questions. **Each** question carries **2** marks. **(8×2=16)**

6. If $a|b$ and $a|c$, show that $a^2|bc$.
7. Find gcd(119,272) using Euclidian algorithm.
8. Find the *lcm* (143,227).
9. If a is an odd integer, then show that $a^2 \equiv 1 \pmod{8}$.
10. State Willson's theorem.

P.T.O.

11. Evaluate $\int_{-\frac{\pi}{4}}^{\frac{\pi}{2}} \cot\theta \operatorname{cosec}^2\theta d\theta$.

12. Find the area enclosed by the curves $y = x^2$, $y = \sqrt{x}, x = \frac{1}{4}$, and $x = 1$.

13. Define surface area problem.

14. Find the volume of the solid generated when the region between the graphs of the equations $f(x) = \frac{1}{2} + x^2$ and $g(x) = x$ over the interval [0, 2] is revolved about x-axis.

15. Find the arc length of the spiral $r = e^{2\theta}$, $0 \le \theta \le \pi$.

16. Find the area of the surface generated by $y = 7x$, $0 \le x \le 2$, revolving about x-axis.

PART – C

(Essay Type)

Answer **any four** out of seven questions. **Each** question carries **4** marks. **(4×4=16)**

17. Determine all solutions of $56x + 72y = 40$.

18. For any $k > 0$, show that $\gcd(ka, kb) = k \gcd(a, b)$.

19. Show that $11^{\phi(30)} \equiv 1 \pmod{30}$.

20. Find the area of the region enclosed by $x = y^2$ and $y = x - 2$, integrating with respect to y.

21. Find the area of the cardioid $r = 1 - \cos\theta$.

22. Find the length of the curve $y = \frac{4\sqrt{2}}{3} x^{\frac{3}{2}} - 1$, $0 \le x \le 1$.

23. Find the area of the surface that is generated by revolving the portion of the curve $y = x^2$ between $x = 1$ and $x = 2$ about the y-axis.

PART – D

(Long Essay Type)

Answer **any two** out of four questions. **Each** question carries **6** marks. **(2×6=12)**

24. For integers a, b, c show that

    i) If $a|b$ and $b \neq 0$, then $|a| \leq |b|$.

    ii) If $a|b$ and $a|c$, then $a|(bx + cy)$ for some arbitrary integers x and y.

25. Use Fermat's theorem to verify that 17 divides $11^{104} + 1$.

26. Find the area of the circle $x^2 + y^2 = a^2$ using integration.

27. Find the volume of the solid generated when the region under the curve $y = x^2$ over the interval [0, 2] is rotated about the line $y = -1$.