

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  $\text{lcm}$  (143, 227).
9. If  $a$  is an odd integer, then show that  $a^2 \equiv 1 \pmod{8}$ .
10. State Willson's theorem.

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

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  $r = e^{2\theta}$ ,  $0 \leq \theta \leq \pi$ .

16. Find the area of the surface generated by  $y = 7x$ ,  $0 \leq x \leq 2$ , 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  $y = \frac{4\sqrt{2}}{3} x^{3/2} - 1$ ,  $0 \leq x \leq 1$ .
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.

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**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  $y = -1$ .