Reg. No.

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.

UG DEGREE END SEMESTER EXAMINATIONS - APRIL 2025.
(For those admitted in June 2021 and later)

PROGRAMME AND BRANCH: B.Sc., MATHEMATICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
VI	PART-III	CORE ELECTIVE	U21MA6E2A	NUMBER THEORY

Date & Session:02.05.2025/FN   **Time : 3 hours**   **Maximum: 75 Marks**

Course Outcome	Bloom's K-level	Q. No.	SECTION – A (10 X 1 = 10 Marks) Answer ALL Questions.
CO1	K1	1.	What is the sequence 1, 3, 4, 7, 11, 18, 29, 47, 76, … called? a) Fibonacci sequence b) Lucas sequence c) Arithmetic sequence d) Geometric sequence
CO1	K2	2.	Which one of the following is related with Binomial theorem? a) Pascal's triangle b) Triangle inequality c) Division algorithm d) Euclidean Algorithm
CO2	K1	3.	Find the value of (5, 0). a) 0 b) 1 c) 5 d) Cannot determine
CO2	K2	4.	Which of the following method is used to find the G.C.D of any two positive integers? a) Division Algorithm b) Euclidean Algorithm c) Divisibility test d) Primality test
CO3	K1	5.	Identify the prime number among the following. a) 507 b) 509 c) 511 d) 513
CO3	K2	6.	If p and p+2 are both primes, then what are they called? a) relatively prime b) twin primes c) siamese twins d) coprimes
CO4	K1	7.	Which of the following is not true, if $a \equiv b \pmod{m}$? a) $a = M(m) - b$ b) $a - b \equiv 0 \pmod{m}$ c) $m / (b - a)$ d) $m / (a - b)$
CO4	K2	8.	If $a \equiv b \pmod{n}$, then which of the following is true? a) gcd(a, n) = gcd(b, n) b) gcd(a, b) = gcd(b, n) c) lcm(a, n) = gcd(b, n) d) lcm(a, b) = gcd(b, n)
CO5	K1	9.	If p is prime, which of the following is true? a) $a^p \equiv 1 \pmod{p}$ b) $a^p \equiv a \pmod{p}$ c) $a^p \equiv p \pmod{p}$ d) $a^p \equiv p - 1 \pmod{p}$
CO5	K2	10.	Name the composite number n such that $n \mid 2^n - 2$. a) relatively prime b) pseudoprime c) coprime d) residue

Course Outcome	Bloom's K-level	Q. No.	**SECTION – B (5 X 5 = 25 Marks)** Answer __ALL__ Questions choosing either (a) or (b)
CO1	K3	11a.	If a and b are any two positive integers, then prove that there exists a positive integer n such that na ≥ b. **(OR)**
CO1	K3	11b.	Write a short note on early number theory.
CO2	K3	12a.	Prove that if a|b and a|c, then a|(bx + cy), where x and y are integers. **(OR)**
CO2	K3	12b.	If a|bc, with gcd(a, b)=1, then show that a|c.
CO3	K4	13a.	If p is prime and p|ab, then prove that p|a or p|b. **(OR)**
CO3	K4	13b.	Prove that there are infinite number of primes.
CO4	K4	14a.	Show that for arbitrary integers a and b, $a \equiv b(mod\ n)$ if and only if a and b leave the same nonnegative remainder when divided by n. **(OR)**
CO4	K4	14b.	If $a \equiv b(mod\ n)$, then show that $a^k \equiv b^k\ (mod\ n)$ for any positive integer k.
CO5	K5	15a.	State and prove Femat's theorem. **(OR)**
CO5	K5	15b.	Prove that, If n is an odd pseudoprime, then $M_n = 2^n - 1$ is a larger one.

Course Outcome	Bloom's K-level	Q. No.	**SECTION – C (5 X 8 = 40 Marks)** Answer __ALL__ Questions choosing either (a) or (b)
CO1	K3	16a.	Prove that S is a set of all positive integers, if 1 belong to S and k+1 belongs to S whenever k belongs to S. **(OR)**
CO1	K3	16b.	Establish the Binomial theorem by mathematical induction.
CO2	K4	17a.	For any two positive integers a and b, prove that there exist a unique pair of integers q and r such that a = qb + r, where 0 ≤ r < b. **(OR)**
CO2	K4	17b.	For any two positive integers a and b, prove that gcd(a, b) lcm[a, b] = ab.
CO3	K4	18a.	State and prove the Fundamental theorem of arithmetic. **(OR)**
CO3	K4	18b.	Discuss the Goldbach conjecture.
CO4	K5	19a.	Calculate 5^{110} (mod 131). **(OR)**
CO4	K5	19b.	State and prove Chinese Remainder theorem.
CO5	K5	20a.	Prove that the quadratic congruence $x^2 + 1 \equiv 0\ (mod\ p)$, where p is an odd prime, has a solution if and only if $p \equiv 1\ (mod\ 4)$. **(OR)**
CO5	K5	20b.	State and prove Wilson's theorem.