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Question Paper Code	12458
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B.E./B.Tech - DEGREE EXAMINATIONS, NOV / DEC 2023

Third Semester

Computer Science and Engineering (Cyber Security)

20BSMA309 - NUMBER THEORY

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

- | | <i>Marks,
K-Level, CO</i> |
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| 1. Convert $(11100101)_2$ to octal digit. | <i>2,K1,CO1</i> |
| 2. Find gcd of 120 and 500. | <i>2,K1,CO1</i> |
| 3. Find 'q' and 'r' when 207 is divided by 15. | <i>2,K2,CO2</i> |
| 4. Define Congruence and incongruence solution. | <i>2,K2,CO2</i> |
| 5. Define Jacobi Symbol. | <i>2,K1,CO3</i> |
| 6. Calculate $\mu(10!)$. | <i>2,K1,CO3</i> |
| 7. Define linear Diophantine Equation in two variables. | <i>2,K1,CO4</i> |
| 8. Determine if the congruence $2x \equiv 3 \pmod{4}$ is solvable. | <i>2,K2,CO4</i> |
| 9. Define Sigma Function. | <i>2,K2,CO5</i> |
| 10. Find the inverse of 12 modulo 7. | <i>2,K2,CO5</i> |

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) Find the number of positive integers in the range 1976 through 3776 that are not divisible by 17. *8,K3,CO1*
(ii) Use the Euclidean algorithm to express the gcd of 4076 and 1024 as a linear combination of them. *8,K3,CO1*
- OR**
- b) (i) Given the pattern, find the formula for the n^{th} row and prove it. *8,K3,CO1*
 $9.9 + 7 = 88$
 $98.9 + 6 = 888$
 $987.9 + 5 = 8888$ and so on
(ii) Using the formula for $\pi(n)$ find the number of primes ≤ 100 . *8,K3,CO1*
12. a) Solve the linear system of congruences. *16,K3,CO2*
 $x+3y \equiv 3 \pmod{11}$
 $5x+y \equiv 5 \pmod{11}$.

OR

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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- b) Twenty-three weary travelers entered the outskirts of a lush and beautiful forest. They found 63 equal heaps of plantains and seven single fruits, and divided them equally. Find the number of fruits in each heap. *16,K3,CO2*

13. a) Prove that μ function is multiplicative. *16,K3,CO3*

OR

- b) (i) Find remainder when 193^{183} is divisible by 19. *8,K3,CO3*
(ii) Calculate $\mu(n)$ for each integer 'n' where $100 \leq n \leq 110$. *8,K3,CO3*

14. a) (i) Prove that the relation ' \equiv ' (congruence) is an equivalence relation. *8,K4,CO4*
(ii) Solve $x \equiv 1 \pmod{3}, x \equiv 3 \pmod{4}, x \equiv 4 \pmod{7}, x \equiv 7 \pmod{11}$. *8,K4,CO4*

OR

- b) State and prove Chinese remainder theorem. *16,K3,CO4*

15. a) (i) State and Prove Wilson's Theorem. *12,K3,CO5*
(ii) Find the remainder when 7^{1001} is divided by 17. *4,K3,CO5*

OR

- b) (i) State and Prove Euler's Theorem. *12,K3,CO5*
(ii) Evaluate the remainder when 199^{2020} is divided by 28. *4,K3,CO5*