

21U109

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Name: .....

Reg.No: .....

**FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2021**

(CBCSS - UG)

(Regular/Supplementary/Improvement)

**CC20U MTS1 B01 - BASIC LOGIC AND NUMBER THEORY**

(Mathematics - Core Course)

(2020 Admission onwards)

Time : 2.5 Hours

Maximum : 80 Marks

Credit : 4

**Part A** (Short answer questions)

Answer *all* questions. Each question carries 2 marks.

1. Define negation and give example.
2. Define inverse and give example.
3. Write distributive laws and De Morgan's laws of logic.
4. Define universe of discourse and give an example.
5. Test the validity of the argument  $p \vee q, q \vee r \sim r \therefore \overline{p}$
6. Prove by induction:  $1 + r + r^2 + \dots + r^{n-1} = \frac{1-r^n}{1-r}$
7. Find the quotient  $q$  and remainder  $r$  when  $-123$  is divided by 5.
8. State the prime number theorem.
9. Find the five consecutive composite numbers less than 100.
10. Write a linear combination of 12, 15, and 21
11. What you mean by prime factorization of  $n$ ?
12. State Dirichlet's Theorem
13. Find  $10^{-1}(\text{mod}11)$ .
14. Using divisibility test determine whether 800 and 816 are divisible by 8.
15. Define Euler's phi function and compute  $\phi(8)$ .

**(Ceiling: 25 Marks)**

**Part B** (Paragraph questions)

Answer *all* questions. Each question carries 5 marks.

16. There are  $n$  guests at a party. Each person shake hands with everybody else exactly once. Define recursively the number of handshakes  $h(n)$  made.
17. Using the Euclidean Algorithm, Find the gcd of 3076, 1976
18. Draw the factor tree for 2520
19. Find the lcm of 110, 210?
20. Find the remainder when  $3^{247}$  is divided by 17.
21. Show that  $f5 = 2^{2^5} + 1$  is divisible by 641.
22. Solve the congruence  $12x \equiv 48(mod18)$ .
23. Solve the linear congruence  $15x \equiv 7(mod13)$ .

**(Ceiling: 35 Marks)**

**Part C** (Essay questions)

Answer any *two* questions. Each question carries 10 marks.

24. a) Prove by contradiction; There is no largest prime number; that is, there are infinitely many prime numbers.  
b) Prove that  $\sqrt{2}$  is an irrational number.
25. If a cock is worth fivecoins, a hen three coins, and three chicks together one coin, how many cocks, hens, and chicks, totaling 100, can be bought for 100 coins?
26. a) Compute the remainder when  $7^{1001}$  is divided by 17.  
b) State and prove Fermat's Little Theorem.
27. a) Using Euler's theorem find the remainder when  $7^{1020}$  is divided by 15  
b) Solve the linear congruence  $25x \equiv 13(mod18)$ .

**(2 × 10 = 20 Marks)**

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