TB221340V **Reg. No :...............................**

Name :.................................

B.Sc. DEGREE (C.B.C.S.) EXAMINATION, NOVEMBER 2022

(2022 Admissions (regular) 2021 Admissions (Improvement / Supplementary), 2020, 2019, 2018, Admissions Supplementary)

SEMESTER I - CORE COURSE (MATHEMATICS) (Common For Mathematics and CA)

MT1B01B18 - DISCRETE MATHEMATICS AND TRIGONOMETRY

Time : 3 Hours **Maximum Marks : 80**

Part A

I. Answer any Ten questions. Each question carries 2 marks **(10x2=20)**

1. Define tautology and contradiction.
2. Calculate the bitwise AND and bitwise XOR of the bit strings 011 011 011 0 and 110 001 110 1
3. Write the negation of the statement $\exists x(x^2 = 2)$.
4. State Domination laws with regard to set operations
5. Examine whether the function f(x) = x^2 from the set of integers to the set of integers onto
6. Define Symmetric Difference of two sets A and B . Find the symmetric difference of A ={1, 3, 5} and B = {1, 2, 3}
7. Define a well ordered set. Determine whether the set of integers with usual less than or equal to relation is a well ordered set.
8. Explain the terms greatest lower bound and least upper bound relative to a partial order relation
9. Determine whether {1, 2, 5, 10, 30} is a chain under divisibility relation
10. Write the Gregory's series
11. Compute the period of sin x.
12. Write the infinite series expansion of e^x.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Write a direct proof for the theorem "If m and n are both perfect squares, then mn is also a perfect square"
14. Let p, q and r be the propositions

    p: You have the flu

    q: You miss the final exam

    r: You pass the course

    Express the proposition $(p \wedge q) \vee (\neg q \wedge r)$ as an English sentence.
15. Give examples of the following functions (a). one- one but not onto (b). Not one- one but onto (c). One- one and onto (d). neither one-one nor onto
16. Define floor and ceiling function and sketch the graph of these functions.
17. Let Z be the set of all integers. Define R = {(a, b)| b= a^r} for some positive integer r. Show that R is a partial ordering of Z.
18. Construct Hasse diagram for the poset ({1, 2, 3, 6, 12}, /) where '/' is the divided relation. Also determine whether the poset is totally ordered
19. Factorise $x^7 - 1$ into real factors

20. If $log\ \ sin(x+iy) = a+ib$, show that $2e^{2a} = cosh\,2y - cos2x$

21. Show that the sum of the series $sinh\alpha - \frac{1}{2}sinh2\alpha + \frac{1}{3}sinh3\alpha - \cdots = \frac{\alpha}{2}$

Part C

III. Answer any Two questions. Each question carries 15 marks **(2x15=30)**

22. (a). Show that $\sqrt{2}$ is irrational by giving a proof by contradiction

(b). Write a direct proof for the theorem "The sum of two rational numbers is rational"

23. (a). Show that if x is a real number $\lfloor 2x \rfloor = \lfloor x \rfloor + \left\lfloor x + \frac{1}{2} \right\rfloor$.

(b). Let f be a function from A to B and let S and T be subsets of A. Show that

$f^{-1}(SUT) = f^{-1}(S)U\,f^{-1}(T)$

24. (a)Let D_{24} be the set of all divisors of 24 and let R be the relation defined by aRb if and only if a divides b. List all elements in R.

(b).Construct the Hasse diagram of D_{24} and find out the greatest element and least element.

(b). Determine whether the poset is a lattice

25. (a) If -1< r<1, show that $\sum_{1}^{\infty} r^n sinnx = \frac{r\ sinx}{1-2rcosx+r^2}$

(b).Express x^8+1 as a product of real factors