# K22U 2320

Reg. No.: ...............................

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

2022 (odd sem)

**V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2022**
**(2019 Admission Onwards)**
**CORE COURSE IN MATHEMATICS**
**5B05MAT : Set Theory, Theory of Equations and Complex Numbers**

Time : 3 Hours Max. Marks : 48

## PART– A

Answer **any four** questions from this Part. **Each** question carries **one** mark.

1. Give an example of a countable set.
2. Explain Descartes rule of signs.
3. If $f(x) = 0$ is an equation of odd degree, then it has at least one ________ root.
4. Say true or false. "Zero is a complex number".
5. Find the conjugate of $6 - 5i$.

## PART– B

Answer **any eight** questions from this Part. **Each** question carries **two** marks.

6. Define a denumerable set, give an example.
7. If $\alpha, \beta, \gamma$ are the roots of $2x^3 + x^2 - 2x - 1 = 0$, find
   i) $\alpha + \beta + \gamma$
   ii) $\alpha\beta\gamma$
   iii) $\alpha\beta + \beta\gamma + \alpha\gamma$.

P.T.O.

8. Search for rational roots of $f(x) = 2x^3 - 5x^2 + 5x - 3 = 0$.

9. Show that $x^5 - 2x^2 + 7 = 0$ has at least two imaginary roots.

10. Transform the equation $x^3 - 6x^2 + 5x + 12 = 0$, into an equation lacking secon term.

11. Show that if $x = 1 + 2i$, then $x^2 - 2x + 5 = 0$.

12. Find the modulus and amplitude of $\sqrt{3} - i$.

13. Express $\frac{1+i}{2+3i}$ in the form of $X + iY$.

14. A) The solution of a reciprocal equation of first type depends on that of a reciprocal equation of first type and of __________ degree.

    B) The solution of a reciprocal equation of first type and of degree 2 m depen on that of an equation of degree __________.

15. Find the roots of $2x^3 + 3x^2 - 1 = 0$.

16. A) Write the standard form of a cubic equation.

    B) What is reciprocal equation ?

PART– C

Answer **any four** questions from this Part. **Each** question carries **four** marks.

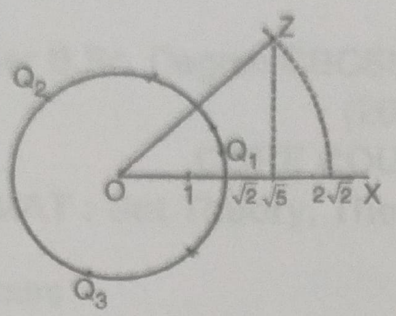
17. Show that the set $E_n = \{2n : n \in \mathbb{N}\}$ of even natural numbers is countal infinite.

18. If $\alpha, \beta, \gamma$ are the roots of $x^3 + P_1x^2 + P_2x + P_3 = 0$ then find the equation who roots are $\alpha^3, \beta^3, \gamma^3$.

19. Find an upper bound and lower bound for the limit to the roots of $f(x) = 3x^4 - 61x^3 + 127x^2 + 220x - 520 = 0$.

20. Solve the reciprocal equation, $x^4 - 8x^3 + 17x^2 - 8x + 1 = 0$.

21. Find the points of $Q_1$, $Q_2$, $Q_3$ representing the values of $\sqrt[3]{z}$ where $z = \sqrt{5} + i\sqrt{3}$.




22. A) Define $n^{th}$ root of unity.

    B) Define Principal $n^{th}$ root of unity.

23. Explain the behaviour of roots of the equation $ax^3 + 3bx^2 + 3cx + d = 0$, with respect to discriminant.

## PART– D

Answer **any two** questions from this Part. **Each** question carries **six** marks.

24. State and prove Cantor's theorem.

25. i) Find the condition that the sum of two roots of $\alpha$, $\beta$ of

    $x^4 + p_1x^3 + p_2x^2 + p_3x + P_4 = 0$, may be zero.

    ii) Use the result to find the roots of the equation, whose roots are the six values of $\frac{1}{2}(\alpha + \beta)$, where $\alpha$, $\beta$ are any roots of $ax^4 + 4bx^3 + 6cx^2 + 4dx + e = 0$.

26. If $\alpha$, $\beta$, $\gamma$ are the roots of $ax^3 + 3bx^2 + 3cx + d = 0$, then find the equation whose roots are squares of the difference of the roots.

27. Define multiplication and division of two complex numbers.

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