

SECOND SEMESTER UG DEGREE EXAMINATION, APRIL 2026

(FYUGP)

(Regular/Supplementary/Improvement)

CC24UMAT2MN103 - ANALYSIS AND SOME COUNTING PRINCIPLES

(Mathematics - Minor Course)

(2024 Admission onwards)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)Answer **all** questions. Each question carries 3 marks.

1. Describe the convergence of a p -Series. [Level:3] [CO2]
2. Check if the alternating series $\sum_{n=1}^{\infty} (-1)^n \frac{1}{\sqrt{n}}$ using the alternating series test. [Level:3] [CO2]
3. Write the first five terms of the sequence $\{a_n\} = \frac{n}{1-2n}$. [Level:2] [CO1]
4. Show that $|z|^2 = z\bar{z}$. [Level:2] [CO3]
5. If $z_1 = 2 - 3i$ and $z_2 = 4 + 6i$, find $\frac{z_1}{z_2}$. [Level:2] [CO3]
6. Give a formula to find out the n^{th} root of a complex number. [Level:1] [CO3]
7. State the criterion for analyticity. [Level:1] [CO4]
8. Define derivative of complex function at a point z_0 . [Level:1] [CO4]
9. A password consists of 2 letters followed by 3 digits. The letters can be any of the 26 alphabetic characters, and the digits can be any of the 10 digits (0-9). How many different possible passwords can be formed? [Level:3] [CO5]
10. Compute each of the following : (a) 5C_5 (b) 5C_2 (c) 3C_1 [Level:2] [CO5]

(Ceiling: 24 Marks)**Part B** (Paragraph questions/Problem)Answer **all** questions. Each question carries 6 marks.

11. Using the direct comparison test determine the convergence or divergence of $\sum_{n=1}^{\infty} \frac{1}{2n-1}$. [Level:3] [CO2]

12. Determine whether the following sequences are monotonic [Level:3] [CO1]
 (a) $\{a_n\} = 4(-1)^n$ (b) $\{a_n\} = \frac{2n}{1+n}$.
13. Find the principal argument, $Arg(z)$, for $z = i$. [Level:2] [CO3]
14. Find the values of the complex exponential function e^z at the following points. [Level:2] [CO3]
- $z = 0$
 - $z = i$
 - $z = 2 + \pi i$
15. Evaluate the following: [Level:2] [CO4]
 (i) $\lim_{z \rightarrow i} \frac{(3+i)z^4 - z^2 + 2z}{z+1}$ (ii) $\lim_{z \rightarrow 1+\sqrt{3}i} \frac{z^2 - 2z + 4}{z-1-\sqrt{3}i}$
16. Find out the singular points of the following functions: [Level:2] [CO4]
 (i) $f(z) = z^4 - 2iz^2 + 2$ (ii) $f(z) = \frac{z^2 + 2z}{z-1}$
17. Explain Pigeon hole principle. Show that if seven numbers from 1 to 12 are chosen, then two of them will add up to 13. [Level:2] [CO5]
18. A fair six-sided die is tossed three times and the resulting sequence of numbers is recorded. What is the probability of the event E that either all three numbers are equal or none of them is a 4? [Level:2] [CO5]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any **one** question. The question carries 10 marks.

19. (a) Find the sequence of partial sums S_1, S_2, S_3, S_4, S_5 for the series $\sum_{i=1}^{\infty} \frac{1}{2^n}$. [Level:3] [CO2]
 (b) Check whether the following geometric series converges. If so, find its sum.
 (i) $\sum_{n=0}^{\infty} \frac{3}{2^n}$
 (ii) $\sum_{n=0}^{\infty} \left(\frac{3}{2}\right)^n$.
20. Verify that the following functions are harmonic in an appropriate domain D: [Level:2] [CO4]
 1. $u(x, y) = -e^{-x} \sin y$
 2. $u(x, y) = \cos x \cosh y$
 3. $u(x, y) = \log_e(x^2 + y^2)$

(1 × 10 = 10 Marks)
