Reg. No. | | | | | | | |

**G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.**

**UG DEGREE END SEMESTER EXAMINATIONS - APRIL 2025.**
(For those admitted in June 2023 and later)

**PROGRAMME AND BRANCH: B.Sc., MATHEMATICS**

| SEM | CATEGORY | COMPONENT | COURSE CODE | COURSE TITLE |
|---|---|---|---|---|
| IV | PART-III | CORE-8 | U23MA408 | ELEMENTS OF MATHEMATICAL ANALYSIS |

**Date & Session: 30.04.2025/AN** **Time : 3 hours** **Maximum: 75 Marks**

| Course Outcome | Bloom's K-level | Q. No. | **SECTION – A (10 X 1 = 10 Marks)** Answer **ALL** Questions. |
|---|---|---|---|
| CO1 | K1 | 1. | What is the g.l.b of the sequence 1,2,3,4,.........<br>a) 0 b) 1<br>c) 4 d) -1 |
| CO1 | K2 | 2. | Write the limit of the sequence $1/2^n$?<br>a) 1 b) ∞<br>c) 1/2 d) 0 |
| CO2 | K1 | 3. | Identify the limit of the sequence $\left(\left(\frac{3n-4}{2n+7}\right)\right.$<br>a) 3/2 b) 0<br>c) 2/3 d) 4/7 |
| CO2 | K2 | 4. | If $\|r\|<1$ ,then $\lim_{n\to\infty} nr^n$ =______.<br>a) n b) 1<br>c) ∞ d) 0 |
| CO3 | K1 | 5. | Which theorem states that $\lim_{n\to\infty} a_n^{\frac{1}{n}} = \lim_{n\to\infty} \frac{a_{n+1}}{a_n}$?<br>a) Cauchy's Second limit theorem<br>b) Cauchy's first limit theorem<br>c) Cesaro's theorem<br>d) Role's theorem |
| CO3 | K2 | 6. | What will you say about the sequence 1,1/2,1,1/3,1,1/4.....1,1/n........ .<br>a) divergent b) convergent<br>c) Oscillating d) monotonic |
| CO4 | K1 | 7. | The geometric series $1+r+r^2+......+r^n+.....$ converges to<br>a) $\frac{r}{1-r}$ b) $\frac{1}{r-1}$<br>c) $\frac{1}{1+r}$ d) $\frac{1}{1-r}$ |
| CO4 | K2 | 8. | If $\sum a_n$is a series of positive terms,then $\sum a_n$ converges if $\lim_{n\to\infty} \frac{a_n}{a_{n+1}}$ >1 and diverges<br>if $\lim_{n\to\infty} \frac{a_n}{a_{n+1}}$ <1 this is which test?<br>a) Comparison test b) Kummer's test<br>c) D'Alembert's test d)Gauss's test |
| CO5 | K1 | 9. | What is the nature of this series $\sum \frac{(-1)^n}{n}$ ?<br>a) convergent b) conditionally convergent<br>c) absolutely convergent d) divergent |
| CO5 | K2 | 10. | Name the test which states that 'If $\sum a_n$is a convergent series and $(b_n)$ be a bounded monotonic sequence,then $\sum a_n b_n$ is convergent".<br>a) Leibnitz's test b)Dirichlet's test<br>c) Abel's tset d) Root test |

| Course Outcome | Bloom's K-level | Q. No. | **SECTION – B (5 X 5 = 25 Marks)**<br>**Answer ALL Questions choosing either (a) or (b)** |
|---|---|---|---|
| CO1 | K3 | 11a. | Prove that every convergent sequence is bounded.<br>**(OR)** |
| CO1 | K3 | 11b. | Prove that the sequence $((-1)^n)$ is not convergent. |
| CO2 | K3 | 12a. | If $(a_n)\to l$ ,$(b_n)\to l$ and $a_n \le c_n \le b_n$ for all n, then prove that $(c_n)\to l$ .<br>**(OR)** |
| CO2 | K3 | 12b. | Show that $\lim_{n\to\infty}\frac{3n^2+2n+5}{6n^2+4n+7}$=1/2. |
| CO3 | K4 | 13a. | State and prove Cesaro's theorem.<br>**(OR)** |
| CO3 | K4 | 13b. | Prove that $\frac{1}{n}\,[n(n+1)(n+2)\ldots.n+n]^{1/n}\to 4/e$. |
| CO4 | K4 | 14a. | Discuss the convergence of the series $\sum\frac{\sqrt{(n+1)}-\sqrt{n}}{n^p}$.<br>**(OR)** |
| CO4 | K4 | 14b. | Test the convergence of the series $1+\frac{x^2}{2}+\frac{x^4}{4}+\frac{x^6}{6}+\ldots$,where x is any positive real number. |
| CO5 | K5 | 15a. | Show that the series $\sum(-1)^n[\sqrt{(n^2+1)}-n]$ is conditionally convergent<br>**(OR)** |
| CO5 | K5 | 15b. | If $\sum\frac{1}{n^2}$=s, then show that $1+\frac{1}{3^2}+\frac{1}{5^2}+\ldots+\ldots = \frac{3}{4}$ s |

| Course Outcome | Bloom's K-level | Q. No. | **SECTION – C (5 X 8 = 40 Marks)**<br>**Answer ALL Questions choosing either (a) or (b)** |
|---|---|---|---|
| CO1 | K3 | 16a. | i) Show that a sequence cannot converge to two different limits .<br>ii) Prove that $\lim_{n\to\infty}\frac{1}{2^n}$ =0.<br>**(OR)** |
| CO1 | K3 | 16b. | i) Show that if $(a_n)$ is a monotonic sequence then prove that $\left(\frac{a_1+a_2+\ldots+a_n}{n}\right)$is also a monotonic sequence.<br>ii) Evaluate $\lim_{n\to\infty}\frac{n+1}{n}$. |
| CO2 | K4 | 17a. | If $(a_n)\to a$ and $(b_n)\to b$ , then prove that $(a_n+b_n)\to a+b$.<br>**(OR)** |
| CO2 | K4 | 17b. | Show that $\lim_{n\to\infty}\frac{\log n}{n^p}$ =0 if p>0 |
| CO3 | K4 | 18a. | State and prove Cauchy's first limit theorem.<br>**(OR)** |
| CO3 | K4 | 18b. | Let $(a_n)$ be a cauchy sequence .If $(a_n)$ has a subsequence $(a_{n_k})$ converges to l,then prove that $(a_n)\to l$. |
| CO4 | K5 | 19a. | State and prove Comparison test.<br>**(OR)** |
| CO4 | K5 | 19b. | State and prove Cauchy's root test. |
| CO5 | K5 | 20a. | Let $\sum(-1)^{n+1}a_n$ be an alternating series whose terms $a_n$ satisfy following conditions<br>(i) $(a_n)$ is a monotonic decreasing sequence.<br>(ii) $\lim_{n\to\infty} a_n$ =0.Then the given alternating series converges .Prove this statement.<br>**(OR)** |
| CO5 | K5 | 20b. | State and prove Abel's theorem. |