

PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2025  
(Fourth Semester)

Branch- MATHEMATICS WITH COMPUTER APPLICATIONS

SEQUENCE, SERIES AND TRIGONOMETRY

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (10 × 1 = 10)

| Module No. | Question No. | Question                                                                                                                                   | K Level | CO  |
|------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|
| 1          | 1            | A sequence of real Number is also called ____ sequence<br>a) Convergent b) divergent c) real d) none                                       | K1      | CO1 |
|            | 2            | If $a_n \leq a_{n+1}$ for all $n \in N$ . $(a_n)$ is monotonically ____<br>a) Increase b) decrease c) equal d) none                        | K2      | CO1 |
| 2          | 3            | For any $a > 0$ , $(\frac{1}{a^n})$ converges to ____<br>a) 1 b) 0 c) infinity d) none                                                     | K1      | CO2 |
|            | 4            | Every Cauchy sequence of real numbers ____<br>a) Divergent b) convergent c) bounded d) sequence                                            | K2      | CO2 |
| 3          | 5            | If $\sum_{n=1}^{\infty} a_n$ is convergent series. Then $\lim_{n \rightarrow \infty} a_n =$<br>a) 1 b) 0 c) $\infty$ d) none               | K1      | CO3 |
|            | 6            | If $\sum_{n=1}^{\infty} a_n$ converges absolutely, then $\sum_{n=1}^{\infty} a_n$ ____<br>a) Divergent b) sequence c) bounded d) converges | K2      | CO3 |
| 4          | 7            | The expansion of $\tan n\theta$ in powers of $\tan \theta =$<br>a) $1, n$ b) $0, 1$ c) $0, n$ d) $0, 2$                                    | K1      | CO4 |
|            | 8            | $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{\sin x} =$ ____<br>a) 0 b) 1 c) $\infty$ d) none                                            | K2      | CO4 |
| 5          | 9            | $\tanh^{-1}x = \frac{1}{2} \log$ ____<br>a) $\frac{1+x}{1-x}$ b) $\frac{1-x}{1+x}$ c) $x$ d) $\frac{1}{1-x}$                               | K1      | CO5 |
|            | 10           | $\cosh 2x =$ ____<br>a) $1 - 2 \sinh^2 x$ b) $2 \cosh^2 x - 1$<br>c) $\cosh^2 x - \sinh^2 x$ d) $\sinh^2 x - 1$                            | K2      | CO5 |

Cont...

**SECTION - B (35 Marks)**

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

| Module No. | Question No. | Question                                                                                                     | K Level | CO  |
|------------|--------------|--------------------------------------------------------------------------------------------------------------|---------|-----|
| 1          | 11.a.        | Prove that every subsequence of a subsequence of S is itself a subsequence of S.                             | K2      | CO1 |
|            |              | (OR)                                                                                                         |         |     |
|            | 11.b.        | Prove that $\lim_{n \rightarrow \infty} \frac{1}{\sqrt{n+1}} = 0$ .                                          |         |     |
| 2          | 12.a.        | State and prove Cauchy sequence.                                                                             | K3      | CO2 |
|            |              | (OR)                                                                                                         |         |     |
|            | 12.b.        | Evaluate $\lim_{n \rightarrow \infty} \sqrt{n}(\sqrt{n+1} - \sqrt{n})$ .                                     |         |     |
| 3          | 13.a.        | State and prove Leibniz theorem.                                                                             | K3      | CO3 |
|            |              | (OR)                                                                                                         |         |     |
|            | 13.b.        | Find the sum of the series $\frac{1}{123} + \frac{1}{2.3.4} + \dots + \frac{1}{n(n+1)(n+2)} + \dots$ .       |         |     |
| 4          | 14.a.        | Prove that $\frac{ah}{\cos \theta} - \frac{bk}{\sin \theta} = a^2 - b^2$ .                                   | K3      | CO4 |
|            |              | (OR)                                                                                                         |         |     |
|            | 14.b.        | Find $\lim_{\theta \rightarrow 0} \frac{n \sin \theta - \sin n\theta}{\theta(\cos \theta - \sin n\theta)}$ . |         |     |
| 5          | 15.a.        | If $\cos(x+iy) = \cos \theta + i \sin \theta$ . Prove that $\cos 2x + \cosh 2y = 2$ .                        | K2      | CO5 |
|            |              | (OR)                                                                                                         |         |     |
|            | 15.b.        | Find the sum of series $\cos^2 x + \cos^2(x+y) + \cos^2(x+2y)$ .. upto n terms                               |         |     |

**SECTION - C (30 Marks)**

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

| Module No. | Question No. | Question                                                                                                                                 | K Level | CO  |
|------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|
| 1          | 16           | State and prove limit of a convergent sequence is unique.                                                                                | K2      | CO1 |
| 2          | 17           | State and prove Bolzano – Weirstrass theorem.                                                                                            | K2      | CO2 |
| 3          | 18           | Prove that $\sum_{n=1}^{\infty} \frac{3n-2}{n(n+1)(n+2)} = 1$ .                                                                          | K3      | CO3 |
| 4          | 19           | Prove that $\tan \frac{\pi}{11} \cdot \tan \frac{2\pi}{11} \tan \frac{3\pi}{11} \tan \frac{4\pi}{11} \tan \frac{5\pi}{11} = \sqrt{11}$ . | K3      | CO4 |
| 5          | 20           | Separate into real and imaginary parts $\tan^{-1}(x + iy)$ .                                                                             | K3      | CO5 |

Z-Z-Z END