Government PG College, Ambala Cantt

Course File(Session 2023-24)

Name of Assistant Professor: Ms. Neha Rani

Class: B.A./B.Sc. II Year/4th semester

Section: Non Medical & Computer Science

Subject Code and Name: BM-241/Sequence and Series

SYALLBUS

B.Sc.	B.A.
External: 40 Internal: 10	External: 27 Internal: 06

Time: 3 Hours

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of objective type/short-answer type questions covering the entire syllabus. In addition to that eight more questions will be set, two questions from each Unit. A candidate will be required to answer five questions in all, selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

UNIT – I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed sets, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

UNIT – II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits.

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.

UNIT – III

Infinite series: D-Alembert's ratio test, Cauchy's nth root test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

UNIT – IV

Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re- arrangement of terms in a series, Dirichlet's theorem, Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only), Multiplication of series, Cauchy product of series, (definitions and examples only), Convergence and absolute convergence of infinite products.

Books Recommended:

1. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
2. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
3. Shanti Narayan : A Course in Mathematical Analysis, S. Chand and company, New Delhi Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York
4. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
5. Earl D. Rainville, Infinite Series, The Macmillan Co., New York

COURSE OBJECTIVES

The course objectives outlined are as follows:

1. Learn to work with logarithmic, exponential, and inverse trigonometric functions.
2. Learn to work with infinite sequences and series.
3. Learn to work with infinite sequence is bounded.
4. Learn to work with an infinite sequence is monotonic.
5. Learn to work with an infinite sequence is convergent or divergent.
6. Find the sequence of partial sums of an infinite series.
7. Determine if a geometric series is convergent or divergent.
8. Find the sum of a convergent geometric series.

COURSE OUTCOMES

After the successful completion of the course, students will be able to:

1. Determine if an infinite sequence is bounded.
2. Determine if an infinite sequence is monotonic.
3. Determine if an infinite sequence is convergent or divergent.
4. Find the sequence of partial sums of an infinite series.
5. Determine if a geometric series is convergent or divergent.
6. Find the sum of a convergent geometric series.
7. Determine if an infinite series is convergent or divergent by selecting the appropriate test from the following: (a) test for divergence; (b) integral test; (c) p-series test; (d) the comparison tests; (e) alternating series test; (f) absolute convergence test; (g) ratio test; and (h) root test.
8. Determine if an infinite series converges absolutely or conditionally.

Lesson Plan

From January 2024 to April 2024

Week No	Scheduled Dates	Topics to be covered
1.	**1-6 January**	Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points,
2.	**8-13 January**	Isolated points, limit points, open sets, closed sets
3.	**15-20 January**	Interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem,
4.	**22-27 January**	Open covers, Compact sets and Heine-Borel Theorem.
5.	**29-3 February**	Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences
6.	**5-10 February**	Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits
7.	**12-17 February**	Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series,
8.	**19-24 February**	Convergence and divergence of geometric series, Hyper Harmonic series or p-series.
9.	**26-2 March**	D-Alembert's ratio test, Cauchy's nth root test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test
10.	**4-9 March**	Gauss Test, Cauchy's integral test, Cauchy's condensation test.
11.	**11-16 March**	Alternating series, Leibnitz's test, absolute and conditional convergence
12.	**18-22 March**	Arbitrary series: abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re- arrangement of terms in a series, Dirichlet's theorem, Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only)
13.	**23-31 March**	**Holi Vacations**
14.	**1-6 April**	Multiplication of series, Cauchy product of series, (definitions and examples only),
15.	**8-13 April**	Convergence of infinite products
16.	**15-20 April**	Absolute convergence of infinite products
17.	**22-27 April**	Final Test, Assignments and REVISION of Contents
Exams Starts		