



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari science college
Semester-1 (M.Sc.)

Subject : Complex Analysis - MSC11505

Type of course : Minor

Prerequisite: Complex number system, Power series-convergence, Cauchy-Riemann equations

Rationale: Complex analysis, in particular the theory of conformal mappings, has many physical applications and is also used throughout analytic number theory. In modern times, it has become very popular through a new boost from complex dynamics and the pictures of fractals produced by iterating holomorphic functions.

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits | Examination Marks | | | | | Total Marks |
|-----------------|---|---|---------|-------------------|--------------|----|-----------------|-----|-------------|
| CI | T | P | | C | Theory Marks | | Practical Marks | | |
| | | | ESE | | MSE | V | P | ALA | |
| 3 | 0 | 0 | 3 | 60 | 30 | 10 | 00 | 50 | 150 |

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.



Continuous Assessment:

| Sr. No | Active Learning Activities | Marks |
|--------|---|-------|
| 1. | Assignment: Unit wise assignments will be given and students will prepare assignments and upload to Moodle. | 10 |
| 2. | Quiz : Faculty will assign Unit wise 10 MCQS and students need to solve mcqs and select the right answer in Moodle. | 10 |
| 3. | Puzzle : Various problems based on series, geometry, clock, calendar, etc.will be assigned to the students. Students need to submit Mathematical logic and Solution via moodle. | 10 |
| 4. | Analysis : Faculty will assign scientific pictures and students will analyze and prepare a report in 100 words and upload it to Moodle. | 10 |
| 5. | Concept mapping : Faculty will assign real time project / problem that Students map their Idea, Solution for real time project / problem and upload it to Moodle | 10 |
| Total | | 50 |



Course Content:

| Unit No. | Course content | Hrs | % Weightage |
|----------|---|-----|-------------|
| 1. | Chapter-1: <ul style="list-style-type: none"> ➤ A quick overview of complex number system, Polar representation and roots of complex numbers, ➤ The extended plane and its spherical representation, Metric spaces and the topology of C. | 15 | 25 |
| 2. | Chapter-2: <ul style="list-style-type: none"> ➤ Power series-convergence, Absolute convergence and radius of convergence, Analytic functions- their examples and elementary properties. ➤ Cauchy-Riemann equations, Harmonic functions, Power series as an analyticfunction, Branch of logarithm-its analyticity. ➤ Analytic function as mapping, Mobius transformation. | 15 | 25 |
| 3. | Chapter-3: <ul style="list-style-type: none"> ➤ Riemann-Stieljes integral, Line integral, Change of parameter, Fundamental theorem of calculus for the line integrals. ➤ Power series representation of analytic functions, Zeros of an analytic functions, The index of a closed curve, Cauchy's theorem and Cauchy integral formula, Cauchy inequality, Liouville's theorem. ➤ Fundamental theorem of algebra, Morera's theorem, The holomorphic version of Cauchy,s theorem and simple connectivity, Counting zeros, The open mapping theorem, Goursat's theorem.. | 15 | 25 |
| 4. | Chapter-4: <ul style="list-style-type: none"> ➤ Classification of singularities, Laurent series, Residue, Integrals with the help of residue, The argument principle. | 15 | 25 |



Suggested Specification table with Marks (Theory) : 60

| Distribution of Theory Marks (Revised Bloom's Taxonomy) | | | | | | |
|--|--------------------|----------------------|--------------------|----------------|-----------------|---------------|
| Level | Remembrance (R) | Understanding (U) | Application (A) | Analyze (N) | Evaluate (E) | Create (C) |
| Weightage | 10% | 40% | 20% | 10% | 20% | 0 |

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

| | |
|---|--|
| After learning the course the students should be able to: | |
| CO1 | Understand Polar representation and roots of complex numbers |
| CO2 | Know The Cauchy-Riemann equations, Harmonic functions |
| CO3 | Understand Riemann-Stieljes integral, Line integral, Change of parameter |
| CO4 | Learn Laurent series, Residue, Integrals with the help of residue, The argument principle. |

Instructional Method :

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.



Reference Books:

- [1] Conway, J. B., Functions of One Complex Variable, (Second Edition), Narosa Publ. House, New Delhi, 1994
- [2] Churchill, R. V., Brown, J. and Verle, R., Complex Variables and Applications, McGraw-Hill Publ. Co., 1974
- [3] Ponnusamy, S., Foundations of Complex Analysis, Narosa Publ. House, New Delhi, 1995.

