MTS 302 – Complex Analysis I

COURSE PARTICULARS

Course Code: MTS 302
Course Title: Complex Analysis I
No. of Units: 3
Course Duration: Two hours of Lecture and one hour of tutorial per week for 15 weeks.
Status: Compulsory
Course Email Address:
Course Webpage: http://www.mts.futa.edu.ng/courseschedule.php?coursecode=MTS%20302
Prerequisite: MTS 206

COURSE INSTRUCTORS

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COURSE DESCRIPTION

This course is an introductory course on Complex Analysis. It is designed for students in Mathematics and Physics disciplines. It may, however, be useful to students in engineering and other related fields. It introduces students to the complex numbers system and varieties of operations, analyses and problems that may arise within the context. It also equips the students with mathematical techniques and skills to handles such cases. Topics to be covered in this course includes: Introduction to complex number system, Limits and Continuity of Complex variable functions, Derivation of the Cauchy –Riemann"s Equation, Analytic functions. Harmonic functions, Bilinear transformation, Conformal mapping, Contour Integrals, Convergence of a sequences and series of function of Complex variable.

COURSE OBJECTIVES

The objectives of this course are to:

- introduce students to the Complex Number System
- equip students with necessary knowledge and skills to enable them handle mathematical operations, analyses and problems involving complex numbers..

COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of this course, the student will be able to:

- justify the need for a Complex Number System and explain how is related to other existing number systems
- define a function of complex variable and carry out basic mathematical operations with complex numbers.
- know the condition(s) for a complex variable function to be analytic and/or harmonic.
- State and prove the Cauchy Riemann Equation and use it to show that a function is analytic.
- define singularities of a function, know the different types of singularities, and be able to determine the points of singularities of a function.
- explain the concept of transformation in a complex space (linear and non-linear) and sketch associated diagrams.
- understand the concept of sequences and series with respect to the complex numbers system and establish whether a given series/ sequences is convergent/ divergent at a specified point or interval.

GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Assignments and/or Group works	10%
Test(s)	20%
Final Examination	70%
TOTAL	**100%**

GENERAL INSTRUCTIONS

Attendance: It is expected that every student will be in class for lectures and also participate in all practical exercises. Attendance records will be kept and used to determine each person's qualification to sit for the final examination. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with any of the instructors, indicating the reason for the absence.

Academic Integrity: Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person's work and submit it as your own; that is plagiarism. All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

Assignments and Group Work: Students are expected to submit assignments as scheduled. Failure to submit an assignment as at when due will earn you zero for that assignment. Only under extenuating circumstances, for which a student has notified any of the instructors in advance, will late submission of assignments be permitted.

Code of Conduct in Lecture Rooms and Laboratories: Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, *etc*.) during lectures. Food and drinks are not permitted in the lecture room.

READING LIST

[1,2] Spiegel, M.R. (1988). Schaum's Outline of Theory and Problems of Complex Variable. Mcgraw-Hill Book Company, Singapore. 313p.

[1,2]Stroud, K.A. (1996). Further Engineering Mathematics. 3rd Edition. The Bath Press, London, Great Britain. pp. 721- 824.

[4]Lang, S. (1976). *Complex Analysis*, Addison Wesley Publishing Company, Ontario, Canada. 321p.

[1]Priestley, H.A. (1990). Introduction to Complex *Analysis*. Oxford University Press, Oxford, U.K. 214p

Legend
1- Available in the University Library
2- Available in Departmental/School Libraries
3- Available on the Internet.
4- Available as Personal Collection
5- Available in local bookshops.

COURSE OUTLINE

Week	Topic	Remarks
1	Introduction and Course Overview • Brief introduction • Course outline • Introduction to complex number system.	During this first class, students are to be given an indication of what is to be covered and how the course will be assessed. Also, the students are to know the different number systems with emphasis on Complex number system and how these number systems are inter-related.
2 ,3 - 4	Working with Complex numbers • Introducing Complex Variables • Operations with Complex numbers • Conjugate and Absolute values of complex numbers, • Graphical Representation of Complex numbers • Polar form of complex numbers • De Moivres' theorem	Examples on each of the sub-topics will be solved. Questions will be entertained from students and answers will be given as appropriate. Exercises will be given to students practice.
5 - 8	More on Complex number • Definitions of some basic concepts. • Limits and continuity of functions of complex variables • Derivation of Cauchy-Riemann equations • Analytic and Harmonic functions • Function Singularities and its types.	Here, some of the definitions of basic concepts that will facilitate students understanding of the course will be given. Examples on each of the subtopics will be solved while exercises will be given for students to practice. MID-SEMESTER TEST
9- 11	Transformation • Linear and Non-linear Transformation • Inversion and Bilinear Transformation • Conformal Mapping and Contour Integral	Students will be made to understand the concept of Transformations of complex function starting from the simple linear ones to the complex bilinear mapping. Examples with associated diagrams will be used to illustrate the different transformations / mappings.

12 - 14	Sequence and Series • Sequences and series of Complex numbers • Limit of sequence and series • Sequences and series of Complex functions • Power and Taylors Series • Convergence of Sequences and Series of function of Complex variables	The students are to note the differences between Sequence/Series of functions and that of numbers. They should be able to give examples of each. Also, they are to be able to determine limit of a given Sequence/Series and establish whether Sequence/Series converges or not
15	Revision	This is the revision week for the students which will enable them prepare adequately for the examination.