DE LA SALLE UNIVERSITY
College of Science
Mathematics and Statistics Department

COMANAL – *Complex Analysis*
Prerequisite: ADVACAL

Prerequisite to:

Instructor: _____
Consultation Hours: _____

Contact details: _____
Class Schedule and Room: _____

Course Description

This course covers the definition of the complex number system. It discusses functions of a complex variable and their derivatives and integrals. Topics include the Cauchy-Riemann conditions, contour integrals, the Cauchy – Goursat Theorem, the Cauchy Integral theorem, Taylor and Laurent series, and the applications of residues.

Learning Outcomes

On completion of this course, the student is expected to present the following learning outcomes in line with the Expected Lasallian Graduate Attributes (ELGA) and the outcomes prescribed by the CHED Memorandum Order for the BS Mathematics program.

ELGA	Learning Outcome	Program Outcome								
	At the end of the course, the student will	1	2	3	4	5	6	7	8	9
Critical and Creative Thinker Effective Communicator Lifelong Learner	apply appropriate analysis concepts, thinking processes, tools, and technologies in the solution to various conceptual or real-world problems.	✓	✓	✓	✓	✓		✓		✓

Program Outcomes (BS Mathematics)

A graduate of the program should be able to

1. Apply analytical, critical and problem solving skills using the scientific method.
2. Carry out basic mathematical and/or statistical computations and use appropriate technologies in the analysis of data, and in pattern recognition, generalization, abstraction, critical analysis, and problem solving.
3. Demonstrate broad and coherent knowledge and understanding in the core areas of mathematics
4. Gain mastery in the core areas of mathematics: algebra, analysis and geometry
5. Demonstrate skills in pattern recognition, generalization, abstraction, critical analysis, problem-solving and rigorous argument.
6. Develop an enhanced perception of the vitality and importance of mathematics in the modern world, including the interrelationships within mathematics and its connection to other disciplines
7. Appreciate the concept and role of proof and reasoning and demonstrate knowledge in reading and writing mathematical proofs.
8. Make and evaluate mathematical conjectures and arguments and validate their own mathematical thinking
9. Communicate mathematical ideas orally and in writing using clear and precise language

Final Course Output

As evidence of attaining the above learning outcomes, the student is required to do and submit the following during the indicated dates of the term.

Learning Outcome	Required Output	Due Date
At the end of the course, the student will apply appropriate analysis concepts, thinking processes, tools, and technologies in the solution to various conceptual or real-world problems.	A written report based on regular weekly group discussions with classmates on the topics covered in class. These discussions should include how this course relates to other areas of mathematics.	Week 13

Rubric for assessment

CRITERIA	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Understanding of Mathematical Concepts (60%)	*Shows complete mastery of the concepts and processes studied in the course as well as their inter-relationships with one another*	*Shows an almost complete mastery of the concepts and processes studied in the course as well as their inter-relationships with one another.*	*Shows a moderate degree of under-standing of the concepts and processes studied in the course as well as their inter-relationships with one another.*	*Shows a limited degree of under-standing of the concepts and processes studied in the course as well as their inter-relationships with one another.*
Clarity of Presentation (30%)	*The ideas present-ed are easily understood and the existing inter-rela-tionships among the concepts and processes are clearly indicated.*	*Except for a few minor details, the ideas presented are easily under-stood and the existing inter-rela-tionships among the concepts and processes are clearly indicated.*	*Some ideas are not clearly presented and some inter-rela-tionships are either lacking or not correctly presented,*	*Many of the ideas presented and inter-relationships among concepts and processes are incorrect or lacking.*
Bibliography (10%)		*All resources cited*	*Some of the resources not cited*	*Majority of the resources not cited*

Grading System

	FOR EXEMPTED STUDENTS (w/out Final Exam)	**FOR STUDENTS with FINAL EXAM**	
		with no missed quizzes	*with one missed quiz*
Average of quizzes	95%	60%	50%
Other requirements	5%	10%	10%
Final exam	-	30 %	40%

Scale:

95-100%	4.0
89-94%	3.5
83-88%	3.0
78-82%	2.5
72-77%	2.0
66-71%	1.5
60-65%	1.0
<60%	0.0

Learning Plan

LEARNING OUTCOME	TOPIC	WEEK NO.	LEARNING ACTIVITIES
At the end of the course, the student will apply appropriate analysis concepts, thinking processes, tools, and technologies in the solution to various conceptual or real-world problems.	**I. THE COMPLEX NUMBER FIELD** 1.1. Complex Numbers as Ordered Pairs 1.2. The Rectangular Form of a Complex Number 1.3. The Polar and Exponential Forms 1.4. Powers and Roots of Complex Numbers 1.5. The Extended Complex Plane, Stereographic Projection	1-2	Recitation / Class Discussion Group discussions Library work
	QUIZ 1		
	II. FUNCTIONS OF A COMPLEX VARIABLE 1.1. Functions as Mappings 1.2. Limits of Functions	3-5	

	1.3. Continuous Functions 1.4. Differentiation of Functions 1.5. Cauchy-Riemann Conditions for Analyticity 1.6. Harmonic Functions		
	III. THE ELEMENTARY FUNCTIONS AND THEIR PROPERTIES 1.1. The Exponential Function 1.2. The Trigonometric Functions 1.3. The Hyperbolic Functions 1.4. Inverse Relations/ Functions 1.5. The Complex Logarithmic Function	5-7	
	QUIZ 2		
	V. INTEGRALS 1.1. Definition and General Properties of the Integral 1.2. Contour Integrals 1.3. The Cauchy-Goursat Integral Theorem 1.4. The Cauchy Integral Formula 1.5. Morera's Theorem	8-9	
	V. SEQUENCES AND SERIES 1.1. Definition and General Properties 1.2. Power Series, Region of Convergence 1.3. Functions as Power Series – Taylor's Series, Laurent's Series	10-12	
	VI. THEORY OF RESIDUES 1.1. Definition of Residues and Poles 1.2. The Residue Theorem	13	
	QUIZ 3		
	1.3. Residues at Poles 1.4. Improper Integrals		
	Final Examination		

The students will be instructed to form permanent groups of 3 – 5 students. These groups will have regular weekly meetings where the primary task is to discuss the material covered during the week. The results of their discussion will be documented since it will be their fourth hour activity. These written reports will be organized into a final report to be submitted at the end of the 13th week.

References

Pennisi L.L. (1976) Elements of Complex Variables (2nd Edition). Manila: National Bookstore
Ahlfors L.V. (1979) Complex Analysis (3rd Edition). NY: McGraw-Hill
Conway J.H. and Howell R.W. (2006) Complex Analysis for Mathematics and Engineering (5th Edition)
Andreescu, T.(2005) Complex Numbers from A to Z, Birkhauser
Cohen, H. (2008) Complex Analysis with Applications in Science & Engineering (2nd Edition). Springer
Eiderman, V.Y. and Samokhin, M.V.(2005). Selected Topics in Complex Analysis, Birkhauser
Gilman, J.P.(2008) Complex Analysis, Springer

Class Policies

1. The required minimum number of quizzes for a 3-unit course is 3, and 4 for 4-unit course. No part of the final exam may be considered as one quiz.
2. Cancellation of the lowest quiz is not allowed even if the number of quizzes exceeds the required minimum number of quizzes.
3. As a general policy, no special or make-up tests for missed exams other than the final examination will be given. However, a faculty member may give special exams for
   A. approved absences (where the student concerned officially represented the University at some function or activity).
   B. absences due to serious illness which require hospitalization, death in the family and other reasons which the faculty member deems meritorious.
4. If a student missed two (2) examinations, then he/she will be required to take a make up for the second missed examination.
5. If the student has no valid reason for missing an exam (for example, the student was not prepared to take the exam) then the student receives 0% for the missed quiz.
6. Students who get at least 89% in every quiz are exempted from taking the final examination. Their final grade will be based on the average of their quizzes and other prefinal course requirements. The final grade of exempted students who opt to take the final examination will be based on the prescribed computation of final grades inclusive of a final examination. Students who missed and/or took any special/make-up quiz will not be eligible for exemption.
7. Learning outputs are required and not optional to pass the course.
8. Mobile phones and other forms of communication devices should be on silent mode or turned off during class.
9. Students are expected to be attentive and exhibit the behavior of a mature and responsible individual during class. They are also expected to come to class on time and prepared.
10. Sleeping, bringing in food and drinks, and wearing a cap and sunglasses in class are not allowed.
11. Students who wish to go to the washroom must politely ask permission and, if given such, they should be back in class within 5 minutes. Only one student at a time may be allowed to leave the classroom for this purpose.
12. Students who are absent from the class for more than 5 meetings will get a final grade of 0.0 in the course.
13. Only students who are officially enrolled in the course are allowed to attend the class meetings.

Approved by:

DR. JOSE TRISTAN F. REYES
Chair, Mathematics and Statistics