هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Complex Analysis**
Course Code:	**2024102-3**
Program:	**Bachelor in Mathematics.**
Department:	**Mathematics and Statistics Department**
College:	**Faculty of sciences**
Institution:	**Taif university**

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A. Course Identification

1. Credit hours: 3	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	10^{th} level, 4^{th} year
4. Pre-requisites for this course (if any)**:**	Real Analysis (2) (2023202-4)
5. Co-requisites for this course (if any)**:**	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	4Hr/week	100
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	40
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	40

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides an introduction to the algebraic and geometric structure of the complex number system. We consider function of complex variables and develop the theory of differentiation for them and so we introduce analytic functions which play a central role in complex analysis. We consider various elementary functions of complex variables and study the analyticity of those functions such as:
Exponential, Trigonometric, Hyperbolic and the Logarithmic functions.
Integrals are extremely important in the study of functions of one complex variable.
The theory of integration, to develop theorems with proofs. We devoted to series representation of analytic functions, such as Taylor's and Maclaurin series as well as Laurent series. Integration, Differentiation multiplication and division of power series are also provided.
We develop also the theory of residues when the function fails to be analytic at a finite number of points interiors on a simple closed contour which each of those points contributes to the value of the integral.

2. Course Main Objective

In this course, the student should be taught as follows:

1-Introducing the algebraic and geometric structure of the complex number system with several forms, Demonstrating elementary functions of a complex variables with their limits, continuity, differentiability and analyticity
2-Studying analytic and harmonic functions, studying integrals for functions of one complex variable with main theorems and recognizing several tests for convergence of sequences and series as well as some series expansions in the complex plane.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and understanding:**	
1.1	Recognize the concept of analytic for elementary functions of complex variables.	K1
1.2	Define the Taylor series that represent the function of complex variable and its convergence.	K1
2	**Skills:**	
2.1	Calculate the roots of complex numbers.	S2
2.2	Explain the integrals of complex valued function of complex variable over simple & closed contour through several theorems and formulas.	S2
2.3	Demonstrate the importance of complex analysis in real life problems.	S5
3	**Values:**	
3.1	Demonstrate responsibility and ethically in conducting their work.	V3

C. Course Content

No	List of Topics	Contact Hours
1	Complex numbers; Sums & Products, Algebraic properties, Moduli , Conjugates, Polar coordinates and Euler's formula, Products and Quotients in exponential form.	4
2	Roots of complex numbers, Regions in the complex plane, Analytic functions; Functions of a complex variables.	4
3	mapping, limits, Theorems of limits, continuity, Derivatives, Differentiation formulas.	4
4	Cauchy – Riemann equations, Sufficient conditions for differentiability, Analytic functions, Harmonic functions, Hyperbolic functions.	4
5	Trigonometric functions, The logarithmic function and its branches.	4
6	**Midterm exam,** Some identities involving logarithms, Complex exponents, Integrals, Complex valued functions, Contours, Contour integrals.	4
7	Anti-derivatives, Cauchy – Goursat theorem Cauchy integral formula.	4
8	Derivatives of analytic functions, Liouville's theorem and the fundamental theorem of algebra, Sequences; Convergence of sequences &series.	4
9	Taylor series, Laurent series, Integration& Differentiation of power series, multiplication and division of power series.	4
10	Residues &poles & Residue theorems, The three types of isolated singular points, Residues at poles, zeroes &poles of order m.	4
Total		40

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding:**		
1.1	Recognize the concept of analytic for elementary functions of complex variables.	• Lectures • Group discussions	• Quizzes Assignments
1.2	Define the Taylor series that represent the function of complex variable and its convergence.	• Lectures • Group discussions	• Exams • Assignments
2.0	**Skills:**		
2.1	Calculate the roots of complex numbers.	• Interactive classes Group discussions	• Quizzes Assignments
2.2	Explain the integrals of complex valued function of complex variable over simple & closed contour through several theorems and formulas.	• Lectures • Group discussions	• Exams • Quizzes
2.3	Demonstrate the importance of complex analysis in real life problems.	• Lectures Self-learning through the website	• Exams • Quizzes Assignments
3.0	**Values:**		
3.1	Demonstrate responsibility and	Projects.	Through the oral presentation of the

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	ethically in conducting their work.		projects.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes + Home works	Continues	10 %
2	Midterm exam	5^{th}-6^{th}	30 %
3	Class Work (Homework- report- class test….)	8^{th}	10 %
4	Final exam	11^{th}	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

6 hours per week (as defined in the teaching schedule of the faculty member) for academic advice and consultations.
Teaching staff is also available using Blackboard web site and Taif University "Edugate" System.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	James Ward Brown and Ruel V. Churchill, Complex variables and applications, 8^{th} Ed McGraw-Hill international edition (2009).
Essential References Materials	Boas, Ralph P. Invitation to complex analysis, MAA Textbooks. Washington, DC: The Mathematical Association of America (MAA) (ISBN 978-0-88385-764-9/hbk). xiv, 2010.
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Lecture halls, containing white boards, and electronic monitors - The seats fit the number of students - Laboratories equipped with suitable numbers of computers**

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	**none**
Other Resources (Specify, e.g., if specific laboratory equipment is required, list requirements or attach a list)	**Wi-Fi internet connections**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Indirect
Quality of learning resources	Peer Reviewer Students	Direct Indirect
Extent of achieving the course learning outcomes	Peer Reviewer Students	Direct Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department of Mathematics and Statistics
Reference No.	11
Date	12-7-1443 H

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