2023
TP-153

Course Specification
(Bachelor)

Course Title:	Complex Analysis
Course Code:	2024102-3
Program:	Bachelor in Mathematics
Department:	Mathematics and Statistics Department
College:	Faculty of sciences
Institution:	Taif university
Version:	1
Last Revision Date:	20/5/2023

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒Department	☐Track	☐Others
B.	☒Required		☐Elective		
3. Level/year at which this course is offered: (Level 7/ Year 4)					
4. Course general 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.					
5. Pre-requirements for this course (if any)**:**					
Real Analysis (2) (2023202-3)					
6. Co-requirements for this course (if any)**:**					
None					
7. Course Main Objective(s):					
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.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3Hr/week	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	NA
3.	**Field**	NA
4.	**Tutorial**	NA
5.	**Others (specify)**	NA
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Recognize the concept of analytic for elementary functions of complex variables.	K1	• Lectures • Group discussions	• Quizzes • Assignments
1.2	Define the Taylor series that represent the function of complex variable and its convergence.	K1	• Lectures • Group discussions	• Exams • Assignments
...				
2.0	**Skills**			

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.1	Calculate the roots of complex numbers.	S2	• Interactive classes • Group discussions	
2.2	Explain the integrals of complex valued function of complex variable over simple & closed contour through several theorems and formulas.	S2	• Lectures • Group discussions	• Exams • Assignments
2.3	Demonstrate the importance of complex analysis in real life problems.	S5	• Lectures • Self-learning through the website	• Exams • Quizzes • Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate responsibility and ethically in conducting their work.	V3	• Projects	• Through the oral presentation of the projects

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.	3
2.	Roots of complex numbers, Regions in the complex plane, Analytic functions; Functions of a complex variables.	3
3.	mapping, limits, Theorems of limits, continuity, Derivatives, Differentiation formulas.	3
4.	Cauchy – Riemann equations, Sufficient conditions for differentiability, Analytic functions, Harmonic functions, Hyperbolic functions.	3
5.	Trigonometric functions, The logarithmic function and its branches.	6
6.	Some identities involving logarithms, Complex exponents, Integrals, Complex valued functions, Contours, Contour integrals.	6
7.	Anti-derivatives, Cauchy – Goursat theorem Cauchy integral formula.	6
8.	Derivatives of analytic functions, Liouville's theorem and the fundamental theorem of algebra, Sequences; Convergence of sequences &series.	6
9.	Taylor series, Laurent series, Integration& Differentiation of power series, multiplication and division of power series.	6
10.	Residues &poles & Residue theorems, The three types of isolated	3

	singular points, Residues at poles, zeroes &poles of order m.	
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Continuous Evaluation	10 %
2.	Assignments, report	Continuous Evaluation	10 %
3.	Midterm 1 Exam	8-9	15%
4.	Midterm 2 Exam	12-13	15%
5.	Final Exam	15-16	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	**James Ward Brown and Ruel V. Churchill, Complex variables and applications, 8th Ed McGraw-Hill international edition (2009).**
Supportive References	**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. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture halls, containing white boards, and electronic monitors - The seats fit the number of students - Laboratories equipped with suitable numbers of computers
Technology equipment (Projector, smart board, software)	Laptop and projector

Items	Resources
Other equipment (Depending on the nature of the specialty)	Wi-Fi internet connections

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty, Program Leader	Direct
Effectiveness of Students assessment	Students, Faculty	Indirect
Quality of learning resources	Faculty	Direct & Indirect
The extent to which CLOs have been achieved	Faculty	Direct & Indirect
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Department Council
REFERENCE NO.	4
DATE	OCTOBER 2023

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