اعتماد
NCAAA

T4
2020

Course Specifications

Course Title:	Complex Analysis
Course Code:	314 Math
Program:	B. Sc. in Mathematics
Department:	Mathematics
College:	Science
Institution:	Jazan University

Table of Contents

A. Course Identification

1. Credit hours: 03
2. Course type
a.   University ☐   College ☐   Department ☑   Others ☐
b.   Required ☑   Elective ☐
3. Level/year at which this course is offered: Level 6/Year 3
4. Pre-requisites for this course (if any)**: Math-313**
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**	45	100
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	42
2	**Laboratory/Studio**	
3	**Tutorial**	3
4	**Others** (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to provide students with

- **System of Complex Numbers**: Structure of complex numbers, algebraic properties, polar and exponential formula, powers and roots, De Moivre's theorem, geometrical representation.
- **Functions of Complex Variable**: Curves and regions in the complex plane, single valued and Multi-valued functions, limits and continuity.
- **Derivation**: Derivation conditions, Cauchy-Riemann equations, analytic function, harmonic function, simple functions (exponential, logarithmic, trigonometric and hyperbolic functions), derivation rules with applications.
- **Simple Transformations**: Translation, rotation, restricted dimension transformation, linear transformation, inverse transformation.
- **Integration of Function of Complex Variable**: Liner integration of complex functions, orbit, simple and multiple connected regions, Cauchy-Goursat theorem, Cauchy integral formula and its applications.
- **Series**: Series and sequences, convergence, Taylor's series, Laurent series, power series, zeros and singular points.
- **Residue Theory**: Residue theory, residue theorem, integration of trigonometric functions, improper integrals.

2. Course Main Objective

After finishing the course, the student is expected to be familiar with the following:

- Definition of complex numbers and operations on them
- Applications of the rules of real numbers field on field of complex numbers.
- The differences between the real and complex numbers.
- To distinguish between analytical characteristics and function differentiability.
- Transformation of simple regions.
- Applications of residue theory in the calculation of complex integrals.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding:**	
1.1	Distinguish mathematical concepts relevant to algebra of complex numbers, and the basic results in complex analysis knowledge.	K1
1.2	Identify background science, features and structure of mathematical problem in algebra of complex numbers, and the basic results in complex analysis problems.	K2
1.3	Explain notations and concepts required for the solution of Mathematical problem in algebra of complex numbers, and the basic results in complex analysis.	K3
2	**Skills:**	
2.1	Apply theoretical, computational or practical aspect relevant to algebra of complex numbers, and the basic results in complex analysis.	S1
2.2	Compute numerical quantities for various parameters to approximate the solution in complex numbers problems.	S2
2.3	Apply various mathematical rules, techniques and theorems in algebra of complex numbers, and the basic results in complex analysis.	S3
2.4	Solve mathematical problem using critical thinking in complex numbers problems.	S4
3	**Values:**	
3.1	Cultivate a mathematical attitude and nurture the interest.	V1
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	V2
3.3	Inculcating values and ethics in thought, expression and deed.	V3

C. Course Content

No	List of Topics	Contact Hours
1	Basics concepts related to the Complex numbers.	9
2	Analytic functions.	6
3	Elementary Functions.	6
4	Integrals.	6
5	Series.	6
6	Residues and poles.	6
7	Application of the Residues.	6
Total		45

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	Distinguish mathematical concepts relevant to algebra of complex numbers, and the basic results in complex analysis knowledge.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.2	Identify background science, features and structure of mathematical problem in algebra of complex numbers, and the basic results in complex analysis problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.3	Explain notations and concepts required for the solution of Mathematical problem in algebra of complex numbers, and the basic results in complex analysis.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.0	**Skills:**		
2.1	Apply theoretical, computational or practical aspect relevant to to algebra of complex numbers, and the basic results in complex analysis.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.2	Compute numerical quantities for various parameters to approximate the solution in complex numbers problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.3	Apply various mathematical rules, techniques and theorems in algebra of complex numbers, and the basic results in complex analysis.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.4	Solve mathematical problem using critical thinking in complex numbers problems.	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
3.0	**Values:**		
3.1	Cultivate a mathematical attitude and nurture the interest.	Group work, problem solving, web based work	Assignments
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	Group work, problem solving, web based work	Assignments
3.3	Inculcating values and ethics in thought, expression and deed.	Group work, problem solving, web based work	Assignments

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework	3	5%
2	First exam.	6	20%
3	Second exam.	12	20%
4	Homework	14	5%
5	Final exam.	16	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 :

Each group of students assigned to a teaching staff that will be available for help and academic guidance office hours at specific hours on daily basis. At least be available 8 hours per week.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Brown J.W. and Churchill R.W. Complex Variables and Applications, 7th Edition (2000) McGraw-Hill Company, New York.
Essential References Materials	- Dass H.K. (2008) Advanced Engineering Mathematics 18th Edition, S. Chand and. Company Ltd., New Delhi. - Kandasamy. P., Thilagavathy. K, and Gunavathy. K (2005) Engineering. Mathematics Vol. II. Chand & Co, New Delhi. - Erwin Kreyszing (2006) Advanced engineering mathematics Eighth Edition,JohnWiley and Sons, Inc. New York Chichester Brisbane Toronto Singapore. - Marsden J. E. and Hoffman M.J. (1987) Basic Complex Analysis, 2nd Edition, W. H. Freeman and Company, New York.
Electronic Materials	Websites and software dedicated to complex numbers.
Other Learning Materials	- Power point presentations and other handouts posted on the course website or on Blackboard.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms, Computer Lab.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show, Smart Board, Drawing Software
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	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	Board Of Mathematics Department
Reference No.	12th Meeting Of The Board Of Mathematics Department 1441-1442
Date	14/6/1442 A. H.; 27/1/2021 A. D.