Course Specification
(Bachelor)

Course Title:	**Complex Analysis**
Course Code:	**314MATH-3**
Program:	**B. Sc. in Mathematics**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan University**
Version:	**2024**
Last Revision Date:	9/2024

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A. General information about the course:

1. Course Identification

1. Credit hours:	03

2. Course type

A.	University ☐	College ☐	Department☒	Track☐	Others☐
B.	Required ☒	Elective☐			

3. Level/year at which this course is offered:

Level 6/ Year 3

4. Course general 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.

5. Pre-requirements for this course (if any): Math 313

6. Co- requirements for this course (if any): None

7. Course Main Objective(s)

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.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	45	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	42
2.	Laboratory/Studio	0
3.	Field	0
4.	Tutorial	3
5.	Others (specify)	0
	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	Distinguish mathematical concepts relevant to algebra of complex numbers, and the basic results in complex analysis knowledge.	K1	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.	K2	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.	K3	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
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.	S1	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.	S2	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.	S3	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.	S4	Lectures, Web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
3.0	Values, autonomy, and responsibility			
3.1	Cultivate a mathematical attitude and nurture the interest.	V1	Group work, problem solving, web based work	Assignments, Discussion
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.	V2	Group work, problem solving, web based work	Assignments, Discussion
3.3	Inculcating values and ethics in thought, expression and deed.	V3	Group work, problem solving, web based work	Assignments, Discussion

C. Course Content

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

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1	Homework and Quiz	3	5
2	First exam	6	20
3	Homework and Quiz	10	5
4	Second exam	12	20
5	Final exam	15	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	Brown J.W. and Churchill R.W. Complex Variables and Applications, 7th Edition (2000) McGraw-Hill Company, New York.
Supportive References	- 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. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms, Computer Lab.
Technology equipment (projector, smart board, software)	Data show, Smart Board, Drawing Software
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Effectiveness of students assessment	Students, Program assessment committee	Direct/ Indirect
Quality of learning resources	Instructor	Direct/Indirect
The extent to which CLOs have been achieved	Students, Faculty members	Indirect
Other	None	None

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	**Board Of Mathematics Department**
REFERENCE NO.	**2417**
DATE	**29/03/1446 A. H.; 2/10/2024 A. D.**