Pokhara University
Faculty of Science and Technology

Course code: MTH 250 (3 Credits) | Full marks: 100
Course title: Applied Mathematics (3-2-0) | Pass marks: 45
Nature of the course: Theory | Total lectures: 45 hrs.
Level: Bachelor | Program: BE

1. Course Description

This course is designed for developing competency of the students in the applications of various mathematical concepts they learned in courses in previous semesters. It is equipped with complex analysis, Z-transform, Partial differential Equations and Fourier Transform. The pre requisite for this course is Calculus I, II and Algebra and Geometry. The course will be delivered through lecture method, assignment on practically base engineering problems and class tests.

2. General Objectives

The course is designed with the general objective:

- To acquaint the students with applications of mathematical tools in engineering.

3. Methods of Instruction

Lecture, tutorials, discussions and assignments

4. Contents in Detail

Specific objectives	Contents
• Understand and apply function of complex variables, Calculus of functions of complex variables and their applications in Engineering problems.	**Unit I: Complex Analysis (17 hrs.)** **1.1 Complex numbers and functions (5 hrs.)** 1.1.1 Review on Complex number, their geometric representation, Polar form, power and roots**.** 1.1.2 Sets and functions in complex plane, Limits Continuity and derivatives of function of complex variables. (Definition and concepts only) 1.1.3 Analytic functions, Cauchy-Riemann(C-R) equations as necessary conditions for functions to be analytic, C-R equations as sufficient condition for analyticity (without proof), Polar form of C-R equations (No derivation). 1.1.4 Laplace equation, harmonic functions and harmonic conjugate 1.1.5 Related problems
	1.2 Integrals in complex plane (4 hrs.) 1.2.1 Line integrals in the complex plane, Evaluation of basic line integrals in complex plane 1.2.2 Cauchy's Integral theorem, Cauchy's integral formula

	and Cauchy integral formula of higher order (for analytic functions) without proof. 1.2.3 Related problems.
	1.3 Taylor and Laurent series for functions of complex variables. (6 hrs.) 1.3.1 Taylor series and Laurent series (Without Proof) and Related Problems 1.3.2 Singularities and zeros, Residues and integration, Cauchy Residue theorem (Without proof) and related Problems.
	1.4 Conformal mapping (2 hrs.): Special Linear fractional transformation (Bilinear fractional transformation) only.
• Understand and apply discrete transforms and solve difference equations.	**Unit II: Z-Transform and its Applications (10 hrs.)** 2.1 Z-transform, Z-transform of elementary functions, Properties of Z-transforms, Shifting theorems, initial value theorem, final value theorem. 2.2 Inverse z-transforms using division method, expansion method, Partial fraction method and residue method. 2.3 Application: Difference equations and solution by using Z-transform.
• Understand and apply higher dimensional systems and describe them by partial differential equations with solution techniques and interpretation of solutions.	**Unit III: Partial Differential Equations (12 hrs.)** 3.1 Partial differential equations and solutions by variable separation method. 3.2 One dimensional wave equation and its solutions and related problems. 3.3 One dimensional heat equation and it's solutions and related problems. 3.4 Two dimensional heat equation, Laplace equation (steady state heat equation) and its solution for rectangular boundaries. Laplace equation in polar form and its solution for circular boundaries, related problems.
• Evaluate Fourier integrals and Transforms.	**Unit IV Fourier integral and Transform (6 hrs.)** 4.1 Fourier integral, Fourier sine and cosine integrals and related problems. 4.2 Fourier integral in complex form and Fourier transform and inverse transform, Fourier sine and cosine transforms and their inverse transforms, Convolution theorem, Parseval's identity and related problems.

Note: The figures in the parentheses indicate the approximate periods for the respective units.

5. List of Tutorials

Tutorial work covers the work to be done in tutorial. This will enable the students to compute the mathematics problem under the supervision of the course leader. The major tutorial works are as follows:

Total : 30 Hours

Unit no.	Unit name	List of Tutorials	Tutorial hours
1	**Unit I: Complex Analysis (9 hrs.)**	1.1 Problems on differentiability 1.2 Problems on analyticity 1.3 Problems on Harmonic and conjugate harmonic functions. 1.4 Problems on Integrals using Cauchy integral theorem and formula. 1.5 Problems on Taylor's series and Laurent's series 1.6 Problems on singularities and residues.	1 hr. 1 hr. 1 hr. 2 hr. 2 hr. 2 hr.
2	**Unit II: Z-Transform and its Applications (7 hrs.)**	2.1 Problems on Z-transforms of elementary functions. 2.2 Problems on Z-transforms using different theorems. 2.3 Problems on inverse z-transforms. 2.4 Solution of difference equations.	1 hr. 2 hrs. 2 hrs. 2 hrs.
3	**Unit III: Partial Differential Equations (10 hrs.)**	3.1 Problems on separation of variables methods. 3.2 Problems related to one dimensional wave equation. 3.3 Problems on one dimensional heat equation. 3.4 Problems on two-dimensional heat equation rectangular boundaries 3.5 Problems on two-dimensional heat equation circular boundaries.	2 hrs. 2 hrs. 2 hrs. 2 hrs. 2 hrs.
4	**Unit IV Fourier integral and Transform (4 hrs.)**	4.1Problems on Fourier integrals. 4.2 Problems on Fourier Transforms and its inverse.	2 hrs. 2 hrs.

6. Evaluation System and Students' Responsibilities

Evaluation System

Internal evaluation is done as follows:

Internal Evaluation	Marks	External Evaluation	Weight	Marks
Attendance & Class Participation	10%	**Semester End Board Examination**	**50%**	50
Assignments	20%			
Presentations/Quizzes	10%			
Term exam	60%			
Total Internal	50			
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks in internal evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Book

1. Advanced Engineering Mathematics, Erwin Kreszig
2. Text Book of Engineering Mathematics, Debashis Dutta , NEW AGE International Publisher

References

1. Advanced Engineering Mathematics, Alan Jeffrey
2. Engineering Mathematics, S.S sastry Vol.1 and Vol.2