Ministry of Higher Education and Scientific Research

Erbil Polytechnic University

Technical Engineering College/Erbil

Highway Engineering Department

Subject: Advanced mathematics

Course Book for 2nd Academic Year

Lecturer's name: Grdamand J. Mohammed M.Sc.

Academic Year: 2023/2024

Course Book

1. Course name	Advanced mathematics
2. Lecturer in charge	Grdamand J. Mohammed
3. Department/ College	Highway Engineering Department.
4. Contact	e-mail: Grdamand.mohammed@epu.edu.iq
5. Time (in hours) per week	Theory: 4 Hours Practical: 0 Hours
6. Office hours	2 days per week (Tuesday and Tuesday) from 8:30 to 1:30
7. Course code	TTE601
8. Teacher's academic profile	BSc in civil Engineering at technical Engineering college/Erbil(2009) MSc in General civil engineering at Nottingham University-UK (2014)
9. Keywords	Calculus

10. Course overview:

The Advanced Mathematics II course is designed to continue to expand students' knowledge of functions and polynomials as they apply to real-world situations. The course includes a review of sequences and series as well as polynomial, rational, exponential, logistic, logarithmic, and trigonometric functions and their inverses. In the Advanced Mathematics II course, students are expected to engage in mathematical modeling with an emphasis on exploring and extending the ideas learned in Advanced Mathematics I.

11. Course objective:

Be able to apply problem-solving and logical skills. Have a deeper understanding of mathematical theory. Have a solid knowledge of elementary statistics. Be able to communicate mathematical/logical ideas in writing.

12. Student's obligation

a. To attend classes regularly with minimum absence.
b. To participate actively in the class discussion and Q&A session
c. Study on a daily basis to digest the class material
d. To write note off-handouts
e. Prepared for sudden Quizzes
f. Vet through the references provided by the lecturer and to solve as much as possible of homework and exercises for the subjective materials.
g. Prepare the assignment and the seminar as instructed by the lecturer.

13. Forms of teaching

1. A handout will be given to the students
2. All lectures by PowerPoint
3. Notes and questions are explained on whiteboard.
4. Videos will be played during the lectures.

14. Assessment scheme

1. Two exams will be held in the January and May.
2. Theoretical Exam each season.
3. Quiz and activities in class.

15. Student learning outcome:

Students who successfully complete this course will be able to:
early identified learning outcomes allow instructors to:

Make hard decisions about selecting course content
Design assessments that allow students to demonstrate their knowledge and skills
Design teaching strategies or learning activities that will help students develop their knowledge and skills
Measure student learning accurately and effectively
Having access to articulated learning outcomes (in a syllabus, for example) helps students:

Decide if the course is a good fit for their academic trajectory
Identify what they need to do to be successful in the course
Take ownership of their progress
Be mindful of what they are learning

16. Course Reading List and References:

- Key references:

1. **Real Analysis**:
    - "Principles of Mathematical Analysis" by Walter Rudin
    - "Real and Complex Analysis" by Walter Rudin
2. **Complex Analysis**:
    - "Complex Analysis" by Elias M. Stein and Rami Shakarchi
    - "Complex Analysis" by Elias M. Stein and Rami Shakarchi (Volumes 2 and 3)
3. **Abstract Algebra**:
    - "A First Course in Abstract Algebra" by John B. Fraleigh
    - "Abstract Algebra" by David S. Dummit and Richard M. Foote
4. **Linear Algebra**:
    - "Linear Algebra Done Right" by Sheldon Axler
    - "Introduction to Linear Algebra" by Gilbert Strang (available for free on MIT

OpenCourseWare)

5. **Differential Equations**:
   - "Elementary Differential Equations and Boundary Value Problems" by William E. Boyce and Richard C. DiPrima
   - "Partial Differential Equations for Scientists and Engineers" by Stanley J. Farlow
6. **Topology**:
   - "Topology" by James R. Munkres
   - "Topology" by James R. Munkres (Solutions Manual)
7. **Number Theory**:
   - "Elementary Number Theory" by Kenneth H. Rosen
   - "An Introduction to the Theory of Numbers" by G. H. Hardy and E. M. Wright
8. **Probability and Statistics**:
   - "Probability and Statistics" by Morris H. DeGroot and Mark J. Schervish
   - "Mathematical Statistics with Applications" by Dennis Wackerly, William Mendenhall, and Richard L. Scheaffer
9. **Differential Geometry**:
   - "Differential Geometry of Curves and Surfaces" by Manfredo P. do Carmo
   - "Differential Geometry" by Erwin Kreyszig
10. **Numerical Analysis**:
    - "Numerical Analysis" by Richard L. Burden and J. Douglas Faires
    - "Numerical Recipes: The Art of Scientific Computing" by William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery
11. **Optimization**:
    - "Introduction to Linear Optimization" by Dimitris Bertsimas and John N. Tsitsiklis
    - "Convex Optimization" by Stephen Boyd and Lieven Vandenberghe (available for free online)
12. **Combinatorics**:
    - "Principles and Techniques in Combinatorics" by Chen Chuan-Chong and Koh Khee-Meng
    - "Combinatorial Mathematics" by Douglas B. West

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17. The Topics:	Lecturer's name
Chapter 12: Sequences and Series • Convergence and divergence of sequences. • Convergence and divergence of series. • Integral test, comparison test, and ratio test. • Alternating series test.	

- Absolute and conditional convergence.
- Power series and their intervals of convergence.
- Taylor series and Maclaurin series.

Chapter 13: Parametric Equations and Polar Coordinates

- Parametric equations and curves.
- Calculus with parametric curves.
- Polar coordinates and polar curves.
- Area in polar coordinates.
- Conic sections in polar coordinates.

Chapter 14: Vectors and the Geometry of Space

- Three-dimensional coordinate systems.
- Vectors in space.
- The dot product and the cross product.
- Lines and planes in space.
- Vector-valued functions.
- Calculus of vector-valued functions.

Chapter 15: Vector Calculus

- Vector fields and vector operations.
- Line integrals and path independence.
- Green's theorem.
- Surface integrals and Stokes' theorem.
- Divergence theorem.
- Three fundamental theorems of vector calculus.

These chapters introduce more advanced concepts in calculus, particularly focusing on sequences, series, parametric equations, polar coordinates, vectors, and vector calculus. The material in these chapters is often considered to be part of the "multivariable calculus" or "calculus III" curriculum and provides a foundation for advanced courses in mathematics and physics.

18. Practical Topics (If there is any)	
no	
19. Examinations: **Theory:**	
20. Extra notes: no	