



Department of Mathematics-College of Science

Salahaddin University/Erbil

Subject: Mathematical Analysis II

Course Book – (3rd Class)

Lecturer's name: Ibrahim O. Hamad

Academic Year: 2023-2024 -- Second Semesters

له خوارهوه خشتهی ریژهی نههاتن رون دهکهینهوه له بابتهی Modern Geometry که پێویسته پابهند بن پێی:

ناگاداری کۆتایی	ناگاداری سهههتایی	وشیارکردنهوه	ژماره ی کاتژمیرهکان له ههفتهیهکدا (تیوری)
9	6	3	3

Course Book

1. Course name	Mathematical Analysis II
2. Lecturer in charge	Ibrahim Othman Hamad
3. Department/ College	Mathematics / Science
4. Contact	e-mail : ibrahim.hamad@su.edu.krd Tel: (optional) 07504630477
5. Time (in hours) per week	For example Theory: 3 Practical:
6. Office hours	Wednesday and Thursday G-A(8:30 – 10:30), G-B(10:30 – 12:30)
7. Course code	
8. Teacher's academic profile	<p>Education:</p> <p>PhD</p> <p><i>Date:</i> 25-5-2007</p> <p><i>Title:</i> Generalized Curvature and Torsion in Nonstandard Analysis</p> <p><i>Place of Attainments:</i> Mathematics Department, College of Science, University of Salahaddin\Erbil, Hawler (Erbil), Kurdistan Region, Iraqi.</p> <p><i>Supervisor:</i> Professor Dr. Tahir Hassan Ismail</p> <p><i>Supervisor Address:</i> Mathematics Department, College of Computer Science and Mathematics, University of Mosul, Mosul, Iraq. Email: tahir_hs@yahoo.com</p> <p>M. Sc.</p> <p><i>Date:</i> 2-8-2000</p> <p><i>Title:</i> A Nonstandard Study on The Taylor Series Development</p> <p><i>Place of Attainments:</i> Math. Dept.-College of Sci.-Univ. of Salahaddin\Erbil-Iraq.</p> <p><i>Supervisor:</i> Professor Dr. Tahir Hassan Ismail,</p> <p>B. Sc</p>

	<p>Date: 27-6-1992</p> <p>Place of Attainments: Math. Dept.-College of Sci.-Univ. of Salahaddin\Erbil-Iraq Title of the Graduation Project: Number of Limit Cycles of Nonlinear Autonomous Homogeneous System of Degree Three Academic records</p> <p>2009 – Present : Assistant (Associate) Professor, 2004 – 2007: PhD student, 2005 – 2009: Lecturer, 2000 – 2005: Assistant Lecturer 1998 – 2000: M.Sc Student, 1993 – 1998: Assistant Researcher in Math. Dept.</p> <p>Supervising 1 Ph.D + 2 M.Sc. +2 M.Sc.(under Supervision)</p> <p>Committees Membership and Positions</p> <ol style="list-style-type: none">1. Member of several scientific and other department and college committees.2. Member of the College Scientific Promotion committee.3. 2014 Organizer of CIMPA-KURDISTAN-IRAQ research school, Inverse problems: Theory and applications, University of Salahaddin, Erbil, Kurdistan-Iraq, May 5-14, 2014, http://www.cimpa-icpam.org/spip.php?article564 Visiting.4. 2011 Institute de Mathematiques de Jussieu - Paris, France; for a period one month.5. 2006 (INSPEM),University of Putra - Kuala Lumpur, Malaysia, for a period 6 month as a second part of PhD research. <p><i>unfortunately</i>, we were unable to in compliance with the above invitations because of the politic situation of Iraq at that time</p> <p>Conferences and Schools:</p> <ol style="list-style-type: none">1. Research School CIMPA UNESCO – EGYPT, Recent Development in the Theory of Elliptic Partial Differential Equations 25/1-3/2/2009. Alexandria, Egypt.2. CIMPA-UNESCO-IPM School, Repres. Theory of Algebras,15-25-6/, 2008.Tehran, Iran.3. First Iraq-French Mathematics Conferenc, Cooperation with College of Science 14 -18/11/2009. Hawler (Erbil) - Kurdistan Region, Iraq.
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	<p>4. The Second Conference on Mathematical Sciences (CMS'2008) 22-23/10/2008. Jordan, Zarqa.</p> <p>5. The Second International Conference of Mathematics 26-30/10/2008. Syria, Aleppo.</p> <p>6. International Congress "Nonstandard Methods and Applications in Mathematics- NSM" 25-31/5/ 2006, Pisa,Italy.</p> <p><i>unfortunately, we were unable to in compliance with the above invitations because of the politic situation of Iraq at that time</i></p> <p>Publications: Papers: 20 papers in local and international journals</p> <p>Books: Generalized Curvature and Torsion in Nonstandard Analysis, (Nonstandard Technical Treatment for Some Differential Geometry Concepts), LAP Lambert Academic Publishing ISBN 978-3-8443-0763-4, 140 Pages.</p> <p>Articles</p> <ul style="list-style-type: none"> • The Development Project of the Educational Program in Iraq (In Arabic), Journal of Afaq Al- Terbewiyha, Issued by the Ministry of Education – Iraqi Kurdistan Region, No.3(2004), pp 107-114. • Some Notes, About The Integration Subject in the Mathematics Book of 6th Secondary School (In Kurdish) Journal of Assoy Parwardayi, Issued by the Ministry of Education – Iraqi Kurdistan Region, No.38(2003), pp 58-63. <p>Courses Taught</p> <p>1. <i>1993-1998, as an Assistant Researcher:</i></p> <p><i>(Theoretical):</i> O.D.E, probability, & Statistics, Euclidean and Non Euclidean Geometry. <i>(Tutorial):</i> Euclidean and Non Euclidean Geometry y, Statistics, O.D.E, P.D.E, Topology. <i>(Computer Laboratory):</i> Basic, Fortran, and Pascal Language.</p>
<p>9. Keywords</p>	<p>Continuity, Differentiation, Sequences and Series of Functions, Convergency, Compactness, Darbox and Riemann Integral</p>
<p>10. Course overview:</p> <p>This course will differ from other math course you have taken because it emphasizes ideas and thinking skills. We don't ask that you memorizes formulas, statements, theorems and results, but rather that you learn to express yourself clearly and accurately; any one who has been in the least interested mathematics, or has even observed other people who are interested init, is aware that mathematics work is work with ideas, we know that a set of axioms and definitions is an attempt to describe the main properties of a mathematical idea. Don't just read it; fight it! Ask your own question look for your own examples discover your own proofs. Is the hypothesis necessary? Is the converse true? What happens in the special cases, what is the general case? What about the degenerate cases? Where does the proof</p>	

use the hypothesis?

This course offers a thorough introduction to the fundamental concepts of mathematical analysis, focusing on the rigorous development of sequences, series, limits, continuity, and metric spaces. The aim is to build a solid foundation for advanced mathematical thinking and proof construction, preparing students for further study in higher mathematics and its applications.

11. Course objective:

This course provides a rigorous introduction to the fundamental concepts of mathematical analysis. Topics include continuity, differentiation, compactness, sequences and series of functions, the Riemann integral, and an introduction to measure theory and zero sets. The course is designed to develop a deep understanding of these core areas, preparing students for advanced mathematical study and research

12. Student's obligation

Students and their obligations throughout the academic year, is the attendance and completion of all tests, exams, assignments.

13. Forms of teaching

Magic board and discussion and allow leg students to write some problems on the board and assignments and I give hard copy of my lecture notes to students before coming lecturer time.

14. Assessment scheme

The students are required to do two closed book exams during of the study year. The exam has 20 marks, attendance, classroom activities with quizzes 10 marks, workload and assignments 10 marks. There will be a final exam on 60 marks.

15. Student learning outcome:

By the end of this course, students will be able to:

- 1- Understand and apply the concepts of limits and continuity.
- 2- Differentiate functions rigorously and apply differentiation theorems.
- 3- Analyze compactness in metric spaces.
- 4- Study the convergence of sequences and series of functions.
- 5- Integrate functions using the Riemann integral.
- 6- Understand the basics of measure theory and the concept of zero sets.
- 7- Develop and present rigorous mathematical proofs effectively.

16. Course Reading List and References:

References

- [1] **Bartle R.G & Sherbert D., Introduction to Real Analysis.3^{ed}** John Wiley & Sons, **2000**
- [2] **Chen W. L., Fundamental of Analysis.** Lecture Notes-Internet, **2002**
- [3] **Hemen Dutta & P. N. Natarajan, Concise Introduction to Basic Real Analysis.** Taylor & Francis

Group, 2022

- [4] **Das G.**, *Mathematical Analysis*. 6^{ed}, McGraw-Hill Book Comp. 2003
- [5] **John B. Conway**, *A First Course in Analysis*. Cambridge University Press, 2018
- [6] **Pugh C. C.**, *Real Mathematical Analysis*. Sp0ringer-Verlag New York, 2002
- [7] **Themistocles M. Rassias & Panos M. Pardalos**, *Mathematical Analysis and its Applications*. Springer Nature Switzerland AG 2020
- [8] **Tom L. Lindstrom**, *An Introduction to Real Analysis*. American Mathematical Society 2017

17. The Topics:

Ch I Limits and Continuity in the Metric Spaces (Weeks 1-3)

(Continue from 1st Semester)

1. Definition of the Limit of the Functions.
2. Equivalent Definition of the Limit.
3. Continuity at a Point.
4. Continuous Functions on Compact Sets.
5. Uniform Continuity.
6. Discontinuities Points and their Types.
7. Compactness and Uniform Continuous.

Chapter II Sequence and Series of Functions (Weeks 1-2)

1. Sequence of Functions.
2. Pointwise Convergent and Uniform Convergent
2. Power Series and Series of Functions.
3. Uniform Convergence and Continuity.

Ch III Differentiation (Weeks 1-3)

1. A New Concept of Differentiation (Definitions and Examples).
2. Properties of Differentiation.
3. Differentiation and Continuity.
4. Intermediate Value Property.
5. Rolle's Theorem, Lagrange Mean Value Theorem, Cauchy Mean Value Theorem
6. Smooth Functions and Taylor Theorem.

Lecturer's name

<p>Ch IV Riemann Integral (Weeks 1-4)</p> <ol style="list-style-type: none"> 1. Riemann Partition. 2. Riemann Sum (Upper and Lower Riemann Sum). 3. Riemann Integral (Upper and Lower Riemann Integral). 4. Continuity and Integration. 5. Zero Sets. 6. Lebesgue Theorem for Riemann Integral. 7. Integration and Inverse Derivative. 8. Differentiation and Riemann Integration. (Fundamental Theorems) 	
<p>19. Examinations: Compositional: In this type of exam the questions usually starts with Explain how, furthermore it is like as lecture notes and contains some homework , so there will be continuing assignments of problem outside the lecture notes (note that this problem having small marks).</p>	<p>19. Examinations: Compositional: In this type of exam the questions usually starts with Explain how, furthermore it is like as lecture notes and contains some homework , so there will be continuing assignments of problem outside the lecture notes (note that this problem having small marks).</p>
<p>20. Extra notes:</p>	<p>20. Extra notes:</p>
<p>21. Peer review پیداچوونہوہی ھاوہل</p>	<p>21. Peer review پیداچوونہوہی ھاوہل</p>
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