Department of Mathematics-College of Science

Salahaddin University/Erbil

Subject: Modern Geometry

Course Book – (2nd Year)

Lecturer's name: Ibrahim O. Hamad

Academic Year: 2022-2023 -- Second Semesters

لە خوارەوە خشتەی ڕێژەی نەهاتن روون دەکەینەوە لە بابەتی Modern Geometry کە پێویستە پابەند بن پێ ی:

ژمارەی کاتژمێرەکان لە هەفتەیەکدا(تیۆری)	وشیارکردنەوە	ئاگاداری سەرەتایی	ئاگاداری کۆتایی
3	3	6	9

Course Book

1. Course name	**Modern Geometry**
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	Wensday and Thursday G-A(8:30 – 10:30), G-B(10:30 – 12:30)
7. Course code	
8. Teacher's academic profile	***Education***: **PhD** ***Date***: 25-5-2007 ***Title***: Generalized Curvature and Torsion in Nonstandard Analysis ***Place of Attainments***: Mathematics Department, College of Science, University of Salahaddin\Erbil, Hawler (Erbil), Kurdistan Region, Iraqi. ***Supervisor***: Professor Dr. Tahir Hassan Ismail ***Supervisor Address***: Mathematics Department, College of Computer Science and Mathematics, University of Mosul, Mosul, Iraq. Email: tahir_hs@yahoo.com **M. Sc.** ***Date***: 2-8-2000 ***Title***: A Nonstandard Study on The Taylor Series Development ***Place of Attainments***: Math. Dept.-College of Sci.-Univ. of Salahaddin\Erbil-Iraq. ***Supervisor***: Professor Dr. Tahir Hassan Ismail, **B. Sc**

Date: 27-6-1992

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

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.

Supervising 1 Ph.D + 2 M.Sc. +2 M.Sc.(under Supervision)

Committees Membership and Positions

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.

unfortunately, we were unable to in compliance with the above invitations because of the politic situation of Iraq at that time

Conferences and Schools:

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, Cooparation with College of Science 14 -18/11/2009. Hawler (Erbil) - Kurdistan Region, Iraq.

	4. The Second Conference on Mathematical Sciences (CMS'2008) 22-23/10/2008. Jordan, Zarqa. **5.** The Second International Conference of Mathematics 26-30/10/2008. Syria, Aleppo. **6.** International Congress "Nonstandard Methods and Applications in Mathematics- NSM" 25-31/5/ 2006, Pisa,Italy. *unfortunately*, we were unable to in compliance with the above invitations because of the politic situation of Iraq at that time **Publications**: Papers: 20 papers in local and international journals **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. **Articles** • 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. **Courses Taught** **1.** ***1993-1998, as an Assistant Researcher***: (***Theoretical***): O.D.E, probability, & Statistics, Euclidean and Non Euclidean Geometry. (***Tutorial***): Euclidean and Non Euclidean Geometry y, Statistics, O.D.E, P.D.E, Topology. (***Computer Laboratory***): Basic, Fortran, and Pascal Language.
9. Keywords	Euclids, 5th postulate, axiomatic systems, Hilbert construction, finite geometry, incidency, non Euclidean Geometry, projectivity, transformation geometry

10. Course overview:

"When will we ever use this?" This is a question that every teacher has heard at some point or at several points in time. But a better question would be, "Where has this been used this in the past?" It is important to not only look to the future, but to also look to the past. To fully understand a topic, whether it deals with science, social studies, or mathematics, its history should be explored. Specifically, to fully understand geometric

constructions the history is definitely important to learn. As the world progresses and evolves so too does geometry. In high school classrooms today the role of geometry constructions has dramatically changed.

In order to understand the role of geometry today, the history of geometry must be discussed. As Marshall and Rich state in the article, *The Role of History in a Mathematics Class.*

"... history has a vital role to play in today's mathematics classrooms. It allows students and teachers to think and talk about mathematics in meaningful ways. It demythologizes mathematics by showing that it is the creation of human beings. History enriches the mathematics curriculum. It deepens the values and broadens the knowledge that students construct in mathematics class."

This quote truly sums up the importance of relating the past to the present. Students will benefit from knowing about how mathematical topics arose and why they are still important today.

To thoroughly examine the history of geometry, we must go back to ancient Egyptian mathematics. A topic that often amazes people is the beautiful geometry in Egyptian pyramids. The mathematics and specifically geometry involved in the building of these pyramids is extensive. From Egypt, Thales brought geometric ideas and introduced them to Greece. This led to the important evolution of Greek deductive proofs.

Far back in history and to this present day, these problems are is cussed in detail. In early geometry, the tools of the trade were a ***compass*** and ***straightedge***. A *compass* was strictly used to make circles of a given radius. Greeks used collapsible compasses, which would automatically collapse. Nowadays, we use rigid compasses, which can hold a certain radius, but is has been shown that construction with rigid compass and straightedge is equivalent to construction with collapsible compass and straightedge. However, compasses have changed dramatically over the years. Some compasses have markings used to construct circles with a given radius.

After ***Euclid***, geometry continued to evolve led by Archimedes, Apollonius and others. However, the next mathematicians to make a dramatic shift in the nature of geometry were the French mathematicians, Rene Descartes and Pierre de Fermat, in the seventeenth century,

who introduced coordinate geometry. This advance of connecting algebra to geometry directly led to other great advances in many areas of mathematics.

Non-Euclidean geometry was the next major movement. Janos Bolyai, following the footsteps of his father, attempted to create a new axiom to replace Euclid's fifth axiom. Around 1824, this study led to development of a new geometry called non-Euclidean geometry. Another mathematician that made contributions to the formation of non-Euclidean geometry was Nikolai ***Ivanovich Lobachevsky***. In 1840, ***Lobachevsky*** published *Geometrie imaginaire*. Because of ***Bolyai*** and ***Lobachevsky's*** direct connection to Gauss, some believe that non-Euclidean geometry should in fact be credited to Gauss.

Even now, geometry continues to progress. In addition, how schools teach geometry has continued to change. In the past, compass and straightedge constructions were a part of the curriculum. However, in most recent years, constructions have faded out. In older textbooks, constructions were entire.

11. Course objective:

Geometry was first invented to meet the mathematical needs of scientists in two stage first 300BC and the second of seventeenth centuries, needs that mainly mechanical in nature. Nowadays it is a tool used almost everywhere in the modern world to describe any models and the relation inbetween objects in priciese axiomatized systems. Its use is widespread in science, engineering, medicine, business, industry, and many other fields. The objective of this course is to introduce the fundamental ideas of the classical and modern geometries. Important objectives of the geometry sequence are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics, and solved any problems in axiomatics sense . In particular, students learn how to apply the tools of geometry to a variety of problem situations. One of the primary objectives of any mathematics course is to help students learn to think about problems mathematically and to solve problems independently. Working in small groups, doing the lab activities, and talking about problems with other students are all strategies to assist the student in achieving these objectives.

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, assignments 5 marks, homwork 5 marks. There will be a final exam on 60 marks.

15. Student learning outcome:

On successful completion of the course, the students should be able to:

- recognise properties of geometry and their branches and derivations;
- recall and use properties of axiomatic systems, type of geometry, counstracting models for finit and incidence geometries;
- understand what is and how non-Euclidean Geometries arise;
- apply the procedures of model accurately,;
- perform accurately of the way of proving problems;
- understand and distinguishing between theorem, lemma, prposition, corollary, assumption,conjecturs.

16. Course Reading List and References:

References

[[1] Adler, C. F., ***Modern Geometry*** .2ed, McGraw-Hill Book Comp., **1967**

[2] Faber, R. L., ***Foundation of Euclidean and Non-Euclidean Geometry***, Marcel Dekker, Inc, **1983**

[3] Gemignant, M.C., ***Axiomatic Geometry,*** Addison-Wesley Pub. Comp. Inc. **1971**

[4] Leonard J. E. & Liu, G. W., ***Classical Geometry,*** John Wiley & Sons, Inc. **2014**

[5] Leonard M. B., ***A Modern View of Geometry,*** Leonard Pub., **1989**

[6] Marvin J. G., ***Euclidean and Non-Euclidean Geometries Development and History,*** Springer **2018**

[7] Meighan I. D., ***Modern Geometry through History***, Springer, **2018**

[8] Willim W. , ***Problems and Solutions in Euclidean Geometry***, Dover Pub., **2010**

[9] السراج ،ع. أ.، ***نظم البديهيات***

17. The Topics:	**Lecturer's name**

Chapter I Axiomatic Euclidean Geometry System (Week 1, 2, 3, 4, 5, 6)

1. Euclidean Geometry Foundation.
    a. Definitions.
    b. Axioms.
    c. Common Notions
    d. 48 Prpositions from Book I.
    e. Remarks about Contints of Book I.
        i. Definitions.
        ii. Postulates.
        iii. Common Notions.
        iv. Propositions.
2. Euclid's Propositions.

Chapter II Construction in Euclidean Geometry (Week 7, 8, 9)

1. Euclid’s Construction Axioms.
2. Euclid’s Construction Examples.
3. Impossible Constructions Examples.
4. HomeWorks.

Chapter III New Construction of Euclidean Geometry (Week 10, 11, 12)

1. Hilbert's Axiom.
2. The Distinguish of Hilbert's System.
3. Some Definitions and Theorems with Hilbert Axioms.
4. SMSG Postulates for Euclidean Geometry.
5. Birkhoff's Axiom (Postulates) for Euclidean Geometry.
6. HomeWorks.

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).	**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).
20. Extra notes:	**20. Extra notes:**
21. Peer review پێداچوونەوەی هاوەڵ	**21. Peer review پێداچوونەوەی هاوەڵ**

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).
20. Extra notes:
21. Peer review پێداچوونەوەی هاوەڵ