

Foundation of Mathematics II
Course Outline
Course 8996052 Section 01, Fall 2021
Tuesdays 10:00 - 12:50, Room: E1-1 #116
Chungbuk National University

Instructor: Dr. Byungdo Park

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Office hours: Thursdays 17:00–17:50 at E1-1 #110 or by appointment.

Class webpage: Announcements, homework, exam schedules and other relevant information will be posted on the following webpage: https://byungdo.github.io/teaching/f2021_fom2.html which is also accessible via instructor's webpage: <https://byungdo.github.io/>

References on geometry general:

- Claire F. Adler, *Modern Geometry : an integrated first course*, 2nd Edition (1967), McGraw-Hill, ISBN-13: 9780070004214
- Marvin J. Greenberg, *Euclidean and Non-Euclidean Geometries: Development and History*, 4th st Edition (2007), W. H. Freeman, ISBN-13: 9780716799481
- Robin Hartshone, *Geometry: Euclid and Beyond* (Undergraduate Texts in Mathematics), 1st Edition (2005), Springer New York, ISBN-13: 9780387986500
- Shoshichi Kobayashi, *From Euclid geometry to modern geometry*, translated in Korean by D. Won (1999), Cheongmoongak, ISBN-10: 8970881816

References on differential geometry:

- Martin M. Lipschutz, *Schaum's Outline of Differential Geometry*, 1st Edition (1969), McGraw-Hill Education, ISBN-13: 9780070379855
- Barrett O'Neill, *Elementary Differential Geometry*, Revised 2nd Edition (2006), Academic Press, ISBN-13: 9780120887354
- Manfredo P. do Carmo, *Differential Geometry of Curves and Surfaces: Revised and Updated Second Edition* (Dover Books on Mathematics) Updated, Revised Edition (2016), Dover Publications, ISBN-13: 9780486806990

Prerequisites: Differential Geometry I and II (7412005, 7412005). Geometry for teachers I and II (7412074, 7412075) are recommended. The instructor does not dissuade students without meeting the prerequisite criteria registering for this course at his/her own risk.

Course description: As a continuation of Foundation of Mathematics I (8996051), we look into applications of generalities and techniques we have learned to various problem, which include Euclidean, projective, and non-Euclidean geometries as well as Frenet's theory of curves and Gauss'

theory of surfaces. Seeking connections between differential geometry and classical geometry as well as a reflection to secondary school geometry curricula is of particular interest. While doing so, we shall train ourselves for an ability of lucidly explaining and communicating logical thoughts on given problems to amplify teaching skills.

Course objectives: At the end of the course students should be able to:

- Understand how to apply what we learned about Frenet's theory of curves and Gauss' theory of surfaces to specific problems.
- Clearly communicate ideas and logic for addressing given problems.
- Understand where to fit each topic learned in geometry courses (including this one) in historical timeline.
- Create an online learning contents such as YouTube videos for sharing knowledge with a broader audience.
- Think about topics learned in geometry courses (including this one) in connection to the curricula in secondary mathematics education.

Details on problem solving: Problems arising in this course will be requiring proofs and calculations based on the mathematical discourse in class and/or the subjects students are supposed to know already. Through dialogues and discussions during each lecture as well as the instructor's office hours, the instructor will guide students approaching to problems that they will have to address.

Details on class proceeding: On every Tuesday, there will be a 25-minute quiz and followed by a discussion on quiz problems. Students should be able to present their solutions and logically communicate. We shall exchange helpful feedback to improve teaching skills of all of us. In a situation that this course has to run online, then every class meeting will consist of the following components.

- An introductory lecture followed by an in-class problem session (Problem session: 25-minute long).
- Going over the problems from the problem session.
- An in-class quiz (25 minutes).
- Going over the quiz problems from the previous day.

Grading policies: 78% from final exam, 14% from in-class quiz, and 8% from attendance. Up to an additional 3% total score credit for your PBL project. Grading policies in the academic integrity policies are applied in higher priority than the above grading policies. Those who are in their final semester and have to show up to work during the semester, special rules applies in accordance with the university policies (cf. 충북대학교 학칙 제34조의2, 학사운영규정 제86조의3).

Assessment through in-class quizzes: There will be total fourteen 25-minute long in-class quizzes. Each quiz will consist of two problems and the style of questions will be similar to those of Public Secondary School Teacher Employment Exam. You will get 1% of total score if you hand-in a quiz showing your work and 0% if not.

Attendance policies: Attendance data will be collected in every class meeting and will be used for determining your final grade. You will get a grade F if you have missed more than 25% of class meeting hours. Up to 3-hour of absence the number of absent hours will be counted but there will be no penalty on your total score. After that, you lose 1% of total score for an absence of each 50-minute-long class meeting, with a maximum total loss 8% from your total score. If you have permissible reasons for your absence in accordance with the Regulation on Academic Management of the CBNU Article 52(1) (충북대학교 학사운영규정 제52조(공결승인) 제1항), you will need to contact the Department Assistant to follow the procedure for getting an approval on your absence bringing proper documentation as proof. That said, you have to fill out a form and submit it along with appropriate proofs before the absence or after seven days of the date of absence.

Assessment of Project-Based Learning (PBL): To submit your PBL project for an extra credit, you should record a 20-minute long video lecture about one of the following:

- A sample lecture on any topic listed on the syllabus of this course.
- A sample lecture on a concept from secondary school geometry curricular.

You should submit the video in a form of a YouTube video link by choosing the sharing option “unlisted(일부공개).” Your video will be disclosed to your classmates in this course as a part of a YouTube playlist. Registering to this course would mean that you accept sharing your video lecture with your classmates via YouTube. You may turn your video into “private” or even delete the video after your letter grade for this course is assigned. The assessment will be done as follows: 3/3 all in all good work. 2/3 lacking important examples, theorem, proofs or there are significant mathematical errors. 1/3 overall poor contents of the material. 0/3 no hand-in.

Assessment of learning: The assessment will be primarily done by the abovementioned grading policy. Nonetheless, the instructor will also take into account students’ devotions and efforts for this course as well as their enthusiasm as a future educator so that those qualitative elements are not going to be neglected.

Important dates:

- Tuesday September 21st: Chuseok holidays

Weekly lesson plan:

Week 1: Weekly quiz and review. Basics on smooth curves. Lengths.

Week 2: Weekly quiz and review. Frenet formulae I

Week 3: Weekly quiz and review. Frenet formulae II

Week 4: Weekly quiz and review. Congruence of curves.

Week 5: Weekly quiz and review. Additional topics on curves.

Week 6: Weekly quiz and review. Concept of surfaces.

Week 7: Weekly quiz and review. Local theory of surfaces I

Week 8: Weekly quiz and review. Local theory of surfaces II

Week 9: Weekly quiz and review. Local theory of surfaces III

Week 10: Weekly quiz and review. Local theory of surfaces IV

Week 11: Weekly quiz and review. Geodesic curvature, geodesics.

Week 12: Weekly quiz and review. Gauss-Bonnet theorem.

Week 13: Weekly quiz and review. Gauss-Bonnet Formula.

Week 14: Weekly quiz and review. Gauss map, The Gauss theorema Egregium.

Week 15: Weekly quiz and review. Weingarten map.

Accommodating disabilities in learning and assessment: The instructor is committed to providing access to all students. If you need accommodation in classroom or in assessment, you are encouraged to set up an appointment with the instructor at your soonest availability so that we can figure out the best way to accommodate you. Possible accommodations include, but not limited to, provision of materials from lectures, permission to hire an assistant for taking notes, audio-recording lectures, and aid/assistant devices, extension of due dates for assignments, alternative assessment for in-class presentations, extension of exam hours, and provision of an accommodating exam locations and exam sheets.

Academic integrity: It is expected that you will complete all exams without giving or receiving help from anyone. Electronic devices are not allowed in any in-class exam. You may talk to other students about the homework but you must then complete the homework yourself. The grader will trust students and will not apply any prejudice. However, if the grader has found an evidence that you have violated those policies, the grader reserves the right to investigate by summoning you to come in to his office, reproduce and explain your own solutions in front of the chalkboard. If you cannot provide a coherent and consistent explanation to your own solution to a problem or do not show up to the investigation without a documented official cause and/or an emergency, the minimum punishment would be score zero to that problem and lowering your letter grades by 2 letters. (For example, if you were to receive A+, it will become C+.) In addition to that, your other homework solutions may possibly be a subject of investigation. The investigation session will be both video and audio recorded, and the result of the investigation (including video/audio recording of the investigation) can be reported to the department or the university center. You **MUST** drop this course if you cannot comply with this policy.

General plans and outlook concerning the new Corona virus (SARS-CoV-2) outbreak:

The class will follow the instructions from the university center regarding class operation policies due to the current Corona virus pandemic situation. Based on [학사지원과-4977 (2021.06.21) 2021 학년도 2학기 수업운영 계획 송부] we shall **meet in-class** however if the class cannot meet in-class for any reasons, we will follow the following action plan.

- **Remote classes using Youtube videos:** We shall have remote classes using **video-recorded lectures** posted on Youtube. The **platform** will be CBNU e-Campus (Blackboard) wherein you will be able to find Youtube video links. By the class meeting time of each day, you will be provided video recordings of lectures for that day's class meeting. Your attendance will be collected by using the online system implemented on e-Campus, while you will be provided a google form to submit in case the e-Campus system does not recognize your watching activities correctly. The instructor recommends watching youtube videos while logged into your own google account so that youtube can record your history in your account. You must complete watching video lectures within the specified period, which normally ends on Saturday of the week each lecture belongs.
- **Collecting assignments:** Hand-in your homework via email to byungdo@g.cbnu.ac.kr by scanning it or using smart phone scanner apps. You have to hand-in your homework by the due date. A late submission will not be accepted for any reasons.