MATH418

Course Summary

Course : MATH418 **Title :** Topology
Length of Course : 8
Prerequisites : MATH419 **Credit Hours :** 3

Description

Course Description: Topics include definition of a topology, closed sets, relativizations, base and sub-bases of a topology, compact topological spaces, separation axioms, normal spaces, regular spaces, metric spaces, continuous mappings, product spaces, and function spaces. (Prerequisite: MATH419)

Course Scope:

This course broadens the foundation of modern mathematicians. Its purpose is to provide students with advanced mathematical skills, to promote their deeper knowledge, and to develop them as problem solvers as they face today's challenging issues. Topology is a cornerstone subject area within applied mathematics. This course is a portion of the Applied Mathematics concentration which is designed to focus on the knowledge of advanced mathematics, the critical thinking skills necessary to assess, evaluate, and apply practical solutions to complex problems, and the application of quantitative and qualitative methods in a wide variety of work disciplines.

Objectives

After successfully completing this course, you will be able to

CO-1 Determine whether a collection of subsets of a set is a topology and determine a basis for a topology.
CO-2 Use homeomorphisms and show two spaces are topologically equivalent.
CO-3 Explain and proof the basic properties of compactness and of connectedness.
CO-4 Determine if a topological space is a metric space and generate a topology from a metric.
CO-5 Use the subspace topology, the product topology, and the quotient topology.
CO-6 Explain and proof basic separation axioms and properties of Hausdorff spaces.

Outline

Week 1: Review of sets and functions. Introduction to topology on a set.

Learning Objectives

LO-1: Review the properties for finite and infinite sets.
LO-2: Apply the definitions for relations, equivalence relations, and functions.
LO-3: Create topologies using the definition for a topology on a set.

Readings

Text Readings:
Adams/Franzosa

- Chapter 0: § 0.0-0.6
- Chapter 1: § 1.1 Morris
- Chapter 1: § 1.1-1.2
- Appendix 2

Assignments

Forums:
1) Introduce Yourself
2) Definition of a Topology
Homework: Problems in Adams/Franzosa
Required: 1.1, 1.2, 1.6
Optional: 1.3, 1.5, 1.9, and all definitions and theorems in Chapter 0

Week 2: Introduction to topological basis and Hausdorff spaces. Learn the definitions for interior, closure, and boundary.

Learning Objectives

LO-4: Apply the ideas of a topological basis and sub-basis.
LO-5: Identify the structure and qualities of a Hausdorff space.
LO-6: Understand the definitions for interior, closure, and boundary of a set.
LO-7: Apply the definitions for limit points, convergence, and neighborhoods.

Readings

Text Readings:
Adams/Franzosa

- Chapter 1: § 1.2-1.3
- Chapter 2: § 2.1-2.3 Morris
- Chapter 1: § 2.1-2.3
- Appendix 2

Assignments

Forums:
1) Basis for a Topology
Homework:
Problems in Adams/Franzosa
Required: 1.10, 1.11(a,c,d), 1.14, 1.31, 1.34, 2.1, 2.13(a,c,d,e,f), 2.24(a,c,d,e,f) Optional: 1.13, 1.25, 1.28, 1.33, 2.2(c), 2.6, 2.8(a), 2.18, 2.26(b,d)
Writing Assignment 1

Week 3: Various derived topologies.

Learning Objectives

LO-8: Derive a subspace topology from a set and topology.
LO-9: Derive a product topology from a finite number of sets and topologies.
LO-10: Derive a quotient topology using a quotient map and existing topology.

Readings

Text Readings:
Adams/Franzosa

- Chapter 3: § 3.1-3.3Morris
- Chapter 4: § 4.1
- Chapter 8: § 8.1-8.2
- Appendix 5

Assignments

Forums:
1) Product Topologies
Homework:
Problems in Adams/Franzosa
Required: 3.1, 3.2, 3.4(f,g,h,i,j), 3.18, 3.23, 3.27 Optional: 3.5(f,g,h,i,j), 3.14, 3.19, 3.24, 3.28
Quiz 1

Week 4: Learn about homeomorphisms and topological equivalence.

Learning Objectives

LO-2: Apply the definitions for relations, equivalence relations, and functions.
LO-11: Define relevant continuous functions and homeomorphisms.
LO-12: Establish topological equivalence between spaces and topologies.

Readings

Text Readings:
Adams/Franzosa

- Chapter 0: § 0.5-0.6
- Chapter 4: § 4.1-4.2Morris
- Chapter 4: § 4.2-4.3
- Chapter 5: § 5.1-5.2

Assignments

Forums:
1) Topological Equivalence
Homework:
Problems in Adams/Franzosa
Required: 4.1, 4.3, 4.8, 4.23, 4.24, 4.25(b), 4.32(a) Optional: 4.6(a), 4.7, 4.26(a), 4.32(b,c)
Writing Assignment 2

Week 5: Introduction to metrics, metric spaces, and metrization.

Learning Objectives

LO-7: Apply the definitions for limit points, convergence, and neighborhoods.
LO-13: Understand the definitions of a metric and metric space.
LO-14: Develop a topology from a metric.
LO-17: Demonstrate the basic separation axioms.

Readings

Text Readings:
Adams/Franzosa

- Chapter 5: § 5.1-5.4 Morris
- Chapter 6: § 6.1-6.6

Assignments

Forums:
1) Regular and Normal spaces
Homework:
Problems in Adams/Franzosa
Required: 5.1, 5.3, 5.5, 5.26, 5.33, 5.36 Optional: 5.2, 5.15, 5.27, 5.28, 5.37
Quiz 2

Week 6: Introduction to connectedness and separation. Cover separation of topological spaces.

Learning Objectives

LO-15: Apply the definitions for connected, path connected, and disconnected.
LO-16: Synergize the concept of connectedness with separable sets and spaces.
LO-17: Demonstrate the basic separation axioms.

Readings

Text Readings:
Adams/Franzosa

- Chapter 6: § 6.1-6.4 Morris
- Chapter 1: § 1.4
- Chapter 3: § 3.1-3.3
- Appendix 4

Assignments

Forums:
1) Connectedness
Homework:
Problems in Adams/Franzosa
Required: 6.1, 6.4, 6.7(a), 6.18, 6.20(a,b), 6.33, 6.39 Optional: 6.5, 6.10, 6.21, 6.35, 6.40
Multimedia Presentation

Week 7: Introduction to compactness and complete spaces.

Learning Objectives

LO-5: Identify the structure and qualities of a Hausdorff space.
LO-18: Demonstrate compactness using covers, open covers, and subcovers.
LO-19: Verify the definition of a complete space using real numbers.

Readings

Text Readings:
Adams/Franzosa

- Chapter 7: § 7.1-7.4 Morris
- Chapter 1: § 7.1-7.2 N/A

Assignments

Forums:
1) Compactness
Homework:
Problems in Adams/Franzosa
Required: 7.1, 7.4, 7.5, 7.15, 7.19, 7.35 Optional: 7.9, 7.12, 7.23, 7.24, 7.36
Quiz 3

Week 8: Comprehensive Final Exam

Learning Objectives

LO-1 through **LO-19**
Comprehensive Final Exam

Assignments

Forums:
1) Feedback

Final Exam

Evaluation

Reading Assignments: Reading assignments are provided each week. These assignments flow into the Forum discussions and homework problems. Reading assignments are not graded directly; however, required homework problems must be submitted via the Messages by Sunday at midnight. Optional homework problems are for your benefit and are not required for submission. Your conceptual understanding, ability to solve problems, and ability to synthesize material will be evaluated using quizzes, projects, and a final exam.

Forum Assignments: Mathematics is not a spectator sport. In order to learn the language of Mathematics, you must be engaged with the material. It is critical that you spend time thinking, considering examples, working problems, and discussing ideas with others. The Forums are evaluated in three areas: quantity of posts, quality of posts, and value of interactions.

> Quantity – The initial post for each Forum includes at least 250 words, and a minimum of two interaction posts are required per Forum using at least 100 words each.
> Quality – High quality posts are critical to the development of everyone in the course. The overall quality of your posts is evaluated.
> Value – Banal posts such as “Good work” and “Nice conclusion” provide no value to the Forum conversations. The key to the Forums is quality interaction. Superior posts promote a valuable conversation and meaningful interaction.

Evaluation criteria	Descriptive adjectives	Scoring
Quantity	First post (>250 words) Two interaction posts (>100 words each)	33%
Quality	Accuracy, logical presentation, organization, clarity, completeness, proper terminology	34%
Value	Contributing to the conversation, useful to your colleagues, valuable feedback	33%

Forum Note: you cannot score points for the quality and value of a post if you fail to meet the minimum quantity.

Writing Assignments: Written communication is a key piece of modern mathematics. The Forums as well as many of the homework problems ask you to develop an argument and write it clearly. In addition to the Forums and homework, you are required to write two formal proofs as writing assignments. These assignments are evaluated according to their validity, readability, and fluency. The definitions for those concepts are given here.

Validity – Validity corresponds to the validity of your arguments. It addresses the extent to which your method is appropriate, your calculations are correct, and your deductions follow the rules of logic.
Readability – If your written work is not readable it cannot be assessed. Since the ability to communicate Mathematics is a focal point for this class, special attention will be paid to the readability of your work.
Fluency – Mathematics is a concise and precise language, and I wish to enhance your fluency. Therefore, part of every assessment will focus on your ability to incorporate correct, established notation and terminology into your written work.

Evaluation criteria	Descriptive adjectives	Scoring
Validity	logical arguments, deductive reasoning, proper conclusions, complete reasoning	43%
Readability	organization, presentation, format, clarity, effectiveness	35%

Fluency	proper notation, proper terminology, appropriate definitions, conciseness	22%

Quizzes: These are the core assessment tools for the assigned readings and homework. Your work will be graded for correctness, completeness, and clarity.

Multimedia Presentation: As with the writing assignments, the multimedia presentation provides you with an opportunity to improve your Mathematical communication. For the presentation you will need to effectively communicate your ideas in a slideshow presentation that includes an audio track. Using audio files you will explain your work with clarity and precision. This assignment will be evaluated in a manner similar to the writing assignments. However, an additional criteria will be evaluated.

> Multimedia – A completely integrated presentation incorporating written work with emphases and accompanying audio. The total effect of the presentation is evaluated.

Evaluation criteria	Descriptive adjectives	Scoring
Validity	logical arguments, deductive reasoning, proper conclusions, complete reasoning	34%
Readability	organization, presentation, format, clarity, effectiveness	27%
Multimedia	incorporated audio, highlights, emphases, audience engagement, integration	22%
Fluency	proper notation, proper terminology, appropriate definitions, conciseness	17%

Final Exam: As with the quizzes, the final exam is a core assessment tools for the assigned readings and homework. The final exam is comprehensive, and your work will be graded for correctness, completeness, and clarity.

Please see the Student Handbook to reference the University's grading scale.

Grading:

Name	Grade %
Forums	23.00 %
Honor Pledge	0.96 %

Introduction Forum	0.96 %
Week 1 Forum & Homework	2.88 %
Week 2 Forum & Homework	2.88 %
Week 3 Forum & Homework	2.88 %
Week 4 Forum & Homework	2.88 %
Week 5 Forum & Homework	2.88 %
Week 6 Forum & Homework	2.88 %
Week 7 Forum & Homework	2.88 %
Week 8 Feedback	0.96 %
Writing	26.00 %
Writing 1	8.00 %
Writing 2	8.00 %
Presentation	10.00 %
Quizzes	30.00 %
Quiz 1	10.00 %
Quiz 2	10.00 %
Quiz 3	10.00 %
Final Exam	21.00 %
Final Exam	21.00 %

Materials

Book Title: Introduction to Topology: Pure and Applied - The VitalSource e-book is provided via the APUS Bookstore

Author: Adams, Colin

Publication Info: Pearson

ISBN: 9780131848696

Book Title: You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available here - http://apus.libguides.com/bookstore/undergraduate

Author: N/A

Publication Info: N/A

ISBN: N/A

Additional Resource
Topology Without Tears by Sidney A. Morris
Version of 3 March 2013
Online textbook: http://www.topologywithouttears.net/topbook.pdf

Web Sites
In addition to the required course texts, many public domain web sites are useful. Here are a few sites to consider if you want to view topology and modern mathematics from a different perspective. Please abide by the university's academic honesty policy when using Internet sources. Note web site addresses are subject to change.

Site Name … youtube.com	Web Site URL/Address
Intro to Topology by Franzosa	http://www.youtube.com/watch?v=zsN_guq Ac
Topology basics	http://www.youtube.com/watch?v=tWIoUZNYj1g
Topology basics	http://www.youtube.com/watch?v=cBMtwB8xoTE
Intro to Topology	http://www.youtube.com/watch?v=Z-4Uo1pv0mU
Neighborhoods	http://www.youtube.com/watch?v=6F3iJ1utuG0
Int, Cl, Bdry part 1	http://www.youtube.com/watch?v=4N-DS2xxZAY
Int, Cl, Bdry part 2	http://www.youtube.com/watch?v=7e4zC-PLZxI
Higher Math – Infinity	http://www.youtube.com/watch?v=RZL5bKk9lHs
Higher Math – Real numbers	http://www.youtube.com/watch?v=YW3EDsmj9bo
Higher Math – Topology	http://www.youtube.com/watch?v=FHL4udeLf9Q
Higher Math – Sequences	http://www.youtube.com/watch?v=rMe8YaoyDBA
Metrics	http://www.youtube.com/watch?v=QDz_D2BPVG0

Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- Tutor.com offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 15% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not

copy/paste, and always cite.

Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.
- "Substantive" means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says "I agree" is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

University Policies

Student Handbook

- Drop/Withdrawal policy
- Extension Requests
- Academic Probation
- Appeals
- Disability Accommodations

The mission of American Public University System is to provide high quality higher education with emphasis on educating the nation's military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.