

# Marshall University Syllabus

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| Course Title/Number | <b>Math 431: Topology 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Semester/Year       | Spring 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Days/Time           | Tuesday and Thursday 8:00am – 9:15am                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Location            | Weisberg Applied Engineering Center 3119                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Instructor          | Carl Mummert                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Email               | mummertc@marshall.edu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Phone               | 304 696-6156                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Office              | Morrow Library 110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Office Hours        | I have an open door policy – you are welcome to stop by my office any time. My scheduled office hours are:<br>Monday, Tuesday, Wednesday, and Thursday 9:30am – 11:00am                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Prerequisites       | Math 430 and Math 450                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| University Policies | By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to <a href="http://www.marshall.edu/academic-affairs">www.marshall.edu/academic-affairs</a> and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to <a href="http://www.marshall.edu/academic-affairs/policies/">http://www.marshall.edu/academic-affairs/policies/</a> .<br><i>Policies:</i> Academic Dishonesty / Excused Absence Policy for Undergraduates / Computing Services Acceptable Use / Inclement Weather / Students with Disabilities / Academic Dismissal / Academic Probation and Suspension / Academic Rights and Responsibilities of Students / Affirmative Action / Sexual Harassment. |

## Course Description From Catalog

First course in algebraic topology. Homotopy, fundamental group, simplicial homology.

## Required Texts

- *A Taste of Topology* by Volker Runde, Springer, 2007.  
Paperback, ISBN 038725790X.
- *Topology*, second edition, by James Munkres, Prentice-Hall, 2000.  
Paperback, ISBN 8-1203-2046-8.  
A more expensive hardcover version is also available, ISBN 0-131-81629-2.  
Please do not buy the first edition, which is very different.

## Course Student Learning Outcomes

The table below shows how each student learning outcome will be practiced and assessed in the course.

| Student Learning Outcome                                                                                                 | How students will practice this outcome | How student achievement of this outcome will be assessed |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------|
| Students <b>will be able to recall and state the key definitions and theorems of topology</b>                            | In-class discussion, homework           | Exams                                                    |
| Students <b>will be able to produce both routine and novel proofs</b> of topological results                             | In-class discussion, homework           | Exams, portfolio                                         |
| Students <b>will be able to recall, synthesize, and create examples</b> of topological spaces with specific properties   | In-class discussion, homework           | Exams, portfolio                                         |
| Students <b>will be able to apply problem solving skills</b> at a level appropriate for undergraduate mathematics majors | In-class discussion, homework           | Exams, portfolio                                         |

## Attendance Policy

Attendance at all class meetings is expected, with the same general standards as absences at a place of employment. If you cannot be present at a class, please email me to let me know. Attendance will be taken at the start of class. Make-up exams will be given only for excused absences, and late homework will be accepted only for excused absences.

## Anti-plagiarism policy

Plagiarism of any kind is not permitted. Students who plagiarize on an assignment will in most cases receive a zero for that assignment, and the university-wide plagiarism policy will be followed. The expectation is that all work you submit is your own, and that all uses of reference material are attributed appropriately. The university policy on academic dishonesty has additional details about the definition of plagiarism.

## Audio/visual recording policy

You are permitted to make audio recordings of this class, provided that you notify me in advance. I will notify the class so they are also aware. Recordings must be deleted after the semester ends. If you have an accommodation from the Office of Disability services that relates to audio/visual recording, it will be honored; please contact me.

## MU Online

It is important to visit MU Online regularly for up-to-date information about the course. All course materials including assignments, handouts, lecture notes, and reading materials will be posted there. MU Online is the official source for all assignments.

## Assignments and Due Dates

- **Weekly homework** will be due on Thursday each week.
- **Exams** will be given during class on March 3, 2016 and April 21, 2016.
- A **proof portfolio** will take the place of the final exam. A rough draft will be due during the semester at a date to be announced. The final version is due on May 5, 2016.

The exams and proof portfolio are the **major assignments**, and have extra weight in the overall grade.

## Grading Policy

This course will have a **nonquantitative** grading system. This means that, rather than giving feedback as an opaque number, I will give feedback that is more directly meaningful. The grading system is based on three detailed rubrics: the **mastery rubric**, the **proof grading rubric**, and the **grade combining rubric**.

**Mastery rubric** I will use this to assess the level of mastery that is demonstrated on all assignments. The mastery rubric is on pages M-1 and M-2 of this syllabus. It has detailed definitions of the following *levels of mastery*:

- Graduate mastery (GM): the level of mastery expected for an A in a graduate course.
- Undergraduate mastery (UM): the level of mastery expected for an A in an upper-level undergraduate course.
- Partial mastery (PM): a beginning level of mastery that does not reach the level of undergraduate mastery.
- Not meeting expectations (NE): this level is assigned to assignments that are incomplete or contain significant errors.
- No submission (NS): this level is assigned when an assignment was not submitted, or was extremely incomplete.

**Proof grading rubric** The proof grading rubric shows the grading levels for proofs that you submit in the class. The rubric is on page P-1 of this syllabus.

**Grade combining rubric** This rubric shows how the grades from different assignments are combined to give an overall course grade. The rubric is on page C-1 of this syllabus.

**Homework resubmission policy** Homework assignments that are graded NE or NS may be resubmitted *one time* for re-grading, provided that you meet with me during office hours to discuss the assignment before re-submitting it. The second grade will replace the original grade. Re-submissions must be submitted with the next weekly homework after the re-submitted assignment was returned to you.

**Letter grades** The following table shows the letter grade associated with each level of mastery.

| Level                         | Grade<br>for undergraduate | Grade<br>for graduate |
|-------------------------------|----------------------------|-----------------------|
| GM / Graduate mastery         | A                          | A                     |
| UM / Undergraduate mastery    | A                          | B                     |
| PM / Partial mastery          | B                          | C                     |
| NE / Not meeting expectations | C                          | D                     |
| NS / No submission            | F                          | F                     |

### Course Expectations

- Keep up with the course. The difficulty of the course increases greatly if you fall behind. You need to be conversant with the definitions and theorems we have already covered, which will require studying between classes.
- Engage with the material during class and ask questions about topics you do not understand. You can ask questions during class, or after class in person or by email.
- Make use of my office hours to discuss any material you find difficult. You should plan to come to my office at least once before each exam.
- Arrive at class on time and remain in the class for the entire duration of the class, unless there are unavoidable conflicts.
- You are welcome to step out of class to take phone calls when necessary, except during exams. Please put all phones and other noisemakers in silent mode during class.

## Mastery Rubric

|                                          | <b>GM: Graduate Mastery</b>                                                                                                                                                                                                                                                  | <b>UM: Undergraduate Mastery</b>                                                                                                                                                                                                                                                      |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Writing and clarity of expression</b> | Writing displays extreme clarity of thought through the use of precise, non-verbose prose and appropriate use of mathematical symbolism. Proper mathematical terminology is used fluently throughout, in a manner demonstrating mastery of the meanings.                     | Writing displays clarity of thought through the use of clear prose and appropriate use of mathematical symbolism. Some paragraphs or sentences may be slightly unclear, verbose, or clunky. Rarely uses incorrect or clunky terminology; some use of terminology may not seem fluent. |
| <b>Definitions</b>                       | Able to recall all definitions from this course and previous courses. Able to state definitions clearly and precisely, and rephrase definitions for the problem at hand.                                                                                                     | Able to recall all definitions from this course, and state the definitions clearly and precisely, with rare errors of limited significance. Can restate some definitions for the problem at hand, but may rely on rote memorization for stating some definitions.                     |
| <b>Proofs</b>                            | Proofs are correct and straightforward to follow, with clear organization. There are no logical or quantifier errors. All variables are clearly introduced. All proofs are at level 9 or 10 on the proof rubric. Straightforward proofs are at level 10 of the proof rubric. | Proofs are almost entirely correct, and are straightforward to follow, with clear organization. All variables are clearly introduced. Most proofs are at level 9 or 10 on the proof rubric; few are at level 7 or below.                                                              |
| <b>Examples</b>                          | Able to recall all examples seen in class, and determine additional properties of the examples. Able to construct new examples, some of which may be challenging.                                                                                                            | Able to recall all examples seen in class, and to determine simple additional properties of the examples. Able to construct simple new examples by analogy with known examples.                                                                                                       |
| <b>Problem solving</b>                   | Able to construct solutions to some challenging problems that have not yet been encountered. Able to solve all problems that have previously been encountered. Able to apply techniques in novel ways.                                                                       | Able to construct solutions for problems that have already been encountered, with infrequent minor errors. Able to solve some novel problems that apply techniques similarly to previously encountered problems.                                                                      |

**Mastery Rubric (continued)**

|                                          | <b>PM: Partial Mastery</b>                                                                                                                                                                                                                                                      | <b>NE: Not meeting expectations</b>                                                                                                                                                                                                                                                |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Writing and clarity of expression</b> | Writing sometimes shows clarity of thought, but at other times may be hard to follow or go off on tangents. Writing sometimes uses too little prose (too much symbolism). Occasional misuses of mathematical terminology, but not in ways that seriously jeopardize the answer. | Writing is unclear so that the main argument is difficult to follow. A large number of proofs may have minimal prose (symbolic derivation only), or excessively verbose prose. Significant errors in mathematical terminology, or excessive avoidance of mathematical terminology. |
| <b>Definitions</b>                       | Able to recall all definitions from the course, with occasional minor errors, and to state the definitions clearly and precisely. May rely on rote memorization. May struggle to apply definitions in proofs.                                                                   | Unable to recall definitions from the course. Some definitions are stated with significant errors.                                                                                                                                                                                 |
| <b>Proofs</b>                            | Proofs have occasional errors, but generally not insurmountable ones. Proofs may appear to be rushed or unrevised. Many proofs are at level 8 or higher on the proof rubric; few are at level 6 or below.                                                                       | Many proofs have significant errors. Majority of proofs at level 6 to 8 of the proof rubric, although a few proofs may be higher.                                                                                                                                                  |
| <b>Examples</b>                          | Able to recall most examples from class, although perhaps with minor errors. Unable to determine some simple properties of these examples. Unable to construct new examples.                                                                                                    | Unable to recall many examples seen in class. Examples may be recalled with significant errors. Unable to determine new properties of already-seen examples.                                                                                                                       |
| <b>Problem solving</b>                   | Able to solve most straightforward exercises, but may struggle to solve novel problems. Occasional errors in applying basic proof strategies.                                                                                                                                   | Unable to solve straightforward exercises that apply practiced techniques. Frequent errors applying basic proof strategies.                                                                                                                                                        |

## Proof Grading Rubric

|                                          | Surface features                                                                                                                                                     | Mathematical writing                                                                                                                                                             | Logical reasoning                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>10</b><br>Mastery                     | The problem is clearly stated. Grammar and spelling errors are rare. The formatting matches the submission guideline.                                                | Variables are properly introduced before they are used. The use of quantifiers is clear. Symbols and terminology are used appropriately. The proof is written in polished prose. | The logical reasoning is correct and clearly explained. The proof is complete: all cases have been examined, all significant steps have been justified, and all assumptions have been clearly stated. The proof is clearly organized and the argument is easy to follow.                                                                                            |
| <b>8</b><br>Partial<br>Mastery<br>(High) | The problem is clearly stated. Grammar and spelling errors, if present, do not distract from the content. The formatting matches the submission guideline.           | Some variables are used without being introduced. Symbols and terminology are used appropriately. The proof is written in prose.                                                 | The logical reasoning is essentially correct, although some parts are not clearly explained. Only minimal revision would be needed to correct the reasoning. All cases have been examined, all significant steps have been justified, and all assumptions have been clearly stated. The proof is organized well enough that the structure of the argument is clear. |
| <b>6</b><br>Partial<br>Mastery<br>(Low)  | The problem is clearly stated. Grammar and/or spelling errors distract from the content. The formatting does not meet the submission guideline.                      | Some variables are used without being introduced. Some symbols or terminology are used incorrectly. The bulk of the proof is written in prose.                                   | The logical reasoning has a flaw that requires rewriting part of the argument. The proof is not complete: some case has not been examined, a significant step has not been justified, or an unspoken assumption has been made. Some parts of the argument are not clearly explained. The organization makes it difficult to discern the structure of the argument.  |
| <b>5</b><br>Not Meeting<br>Expectations  | The statement of the problem is missing or unclear. Grammar and/or spelling errors distract from the content. The formatting does not meet the submission guideline. | Some variable are written without being introduced. Some symbols are used inappropriately, or some terminology is used incorrectly. The proof is not written in prose form.      | The logical reasoning has a serious flaw or multiple minor flaws. Significant revision is required to correct the argument. The proof is not complete: some case has not been examined, a significant step has not been justified, or an unspoken assumption has been made. Some parts of the argument are not clearly explained. The proof is not well organized.  |
| <b>0</b><br>No Submission                | No solution is submitted, or the solution does not make progress on the assigned problem.                                                                            |                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                     |

## Grade Combining Rubric

| Overall Grade | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GM            | <p>Grades satisfy all the following requirements:</p> <ul style="list-style-type: none"> <li>• At least 50% of homework grades at level GM, and at least two major assignment grades are GM; or all major assignment grades are GM</li> <li>• There are no more than two PM homework grades</li> <li>• There are no PM grades on major assignments</li> <li>• There are no NE or NS grades</li> </ul>                                                                                                                |
| UM            | <p>Grades satisfy all the following requirements:</p> <ul style="list-style-type: none"> <li>• At least 50% of homework grades are at level UM or higher, and at least two major assignment grades are UM or higher; or all major assignment grades are UM or higher</li> <li>• There are no more than two NE homework grades</li> <li>• There are no NE grades on major assignments</li> <li>• There are no NS grades</li> <li>• There may be some GM grades, but the overall standard for GM is not met</li> </ul> |
| PM            | <p>Grades satisfy all the following requirements:</p> <ul style="list-style-type: none"> <li>• At least 50% of homework grades are at level PM or higher, and at least two major assignment grades are PM or higher</li> <li>• There are no NS grades on major assignments</li> <li>• There are no more than two NS grades on homework</li> <li>• Note: There may be some grades higher than PM, but the grades do not meet the overall standard for GM or UM</li> </ul>                                             |
| NE            | <p>Grades satisfy all the following requirements:</p> <ul style="list-style-type: none"> <li>• The grades do not meet the standard for GM, UM, or PM</li> <li>• There are no NS grades on exams</li> <li>• There are not more than two NS grades on homework</li> </ul>                                                                                                                                                                                                                                              |
| NS            | The grades do not meet the overall standard for GM, UM, PM, or NE                                                                                                                                                                                                                                                                                                                                                                                                                                                    |