

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

About the Instructor:

Contact Information:

Name: Dr. Shakiba Enayati

Email address: senayati@umsl.edu

Campus office: #209-ESH

Class Time: **Tuesdays 6 pm to 7:15 pm, Hybrid (meeting about twice per month- The schedule for in-person classes: in the course outline below).**

- The in-person classes will be at **Express Script Hall-104**
- The online classes will be synchronous Zoom meetings (link on Canvas)

Office Hours: always virtual, **Tuesdays 12 pm-2 pm** or by appointment **via Zoom** (<https://umssystem.zoom.us/my/shakiba>).



Welcome: In this course, you will learn one of the most exciting and interesting subjects in the integrated world of APPLIED math and business: Operations Research or Management Science field of study. Some people approach this course with a certain amount of anxiety and skepticism. The main source of anxiety is the reputation of the field as being highly mathematical. This reputation then generates skepticism that such a theoretical approach can have much relevance for dealing with practical managerial problems. Good news is that we are not going to have a traditional class. We will learn this field to become successful managers not mathematicians! This means including a little mathematics here and there and focusing more on many different interesting applications. *Office hours are important in supporting you throughout this course. Even if you don't have specific questions, needs, and concerns, I would love to meet up with you at least once during this semester. Just virtually stop by and say hi!*

Instructor Bio: I joined Supply Chain and Analytics Department at UMSL in the fall 2020 and before that I was teaching at SUNY- Plattsburgh. I do research on analytical modeling and optimization of complex systems as applied to healthcare and service systems. For example, I've recently worked on the optimal distribution of a limited supply of influenza vaccine in an equitable manner to contain an outbreak. I also work on a few ongoing projects for vaccine delivery using drones in less-developed countries. I enjoy finding the best course of action for difficult strategic and tactical problems for which there are no immediate and obvious solutions. In my spare time, I enjoy hiking with my husband, watching movies, and reading classic novels.

Teaching Philosophy: My teaching techniques and strategies have evolved around three essential principles:

- (1) *interactive learning*: my primary responsibility as a teacher is to design learning processes and environments in which students continually interact with me and their peers
- (2) *goal orientation*: I link my lectures to several bigger-picture learning objectives,
- (3) *incentivizing via rewards*: I reward students' achievements on different levels.

I endeavor to provide a strong foundation of business analytics and to foster enhanced critical thinking skills that will build students' confidence in their ability to apply quantitative methods in practice and to learn new techniques as needed. To reach these goals, I will ask questions that require you to think through problems and consider how different concepts are related to each other. I will also encourage you to make connections between the class material and your everyday lives.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

Distance learning for me is like understanding and connecting to the world for someone who has lost their sight; that is, they are not able to use every “normal” tool to connect to the world. It is the role of the instructor, student’s collaboration and their consistent hard work that would help sharpen other senses for making the best possible experience! What does it mean? it means we are going to work **harder together** to make that happen.

Communication Plan:

All email from the instructor will be sent to each student’s UMSL email address. Check this email address regularly. Treat all email as professional correspondence with an appropriate salutation and closing.

During the week (Monday-Friday), all students’ emails sent by 5 pm will be responded by the end of the day. Emails sent after 5 pm will be replied within 24 hours. Be advised that questions posed over the weekend (i.e., after 5 p.m. Friday) may not be answered until the following Monday afternoon.

About this course:

Course Overview: Prescriptive Analytics and Optimization is one of the three pillars (Descriptive-Predictive-Prescriptive) of Business Analytics. It seeks to prescribe the best (or better) course of decision that optimizes a decision-maker’s objective (e.g., minimizes cost or maximize return), while satisfying various constraints in terms of requirements and limits. It belongs to a skill set in the field of Management Science (a.k.a. Decision Science and Operations Research).

Complementary to Descriptive Analytics for describing what happened with descriptive statistics and various data visualization techniques in business intelligence (BI), and Predictive Analytics for predicting/forecast what will happen in the future using regression, Bayesian inference in statistics, along with the other predictive techniques in machine learning and neural network, Prescriptive Analytics provides data-driven solutions to address *what to do and/or how to react*. Its data-driven nature enables the decision-maker to effectively and quickly react to the changing business environment, or to plan for proactive decision that is robust against potential risk and uncertainty.

Optimization-based analytical models and algorithms are being widely applied in various sectors and business domains. To name a few, logistics network design in supply chain, vehicle routing in transportation, production planning and scheduling in manufacturing, resource allocation and planning in service systems (e.g. public health agencies), product design in marketing, and portfolio optimization in finance. Optimization-based “engine” serves the core of many state-of-the-art decision-support systems (DSS) and tools, including sales & operations planning (S&OP) in state-of-the-art ERP (Enterprise Resource Planning), rate and lane optimization module in TMS (Transportation Management System), JDA and Llamasoft for supply chain optimization, and the route optimizer in ArcGIS. The role and use of Prescriptive Analytics and Optimization will be further boosted by the fast advancement of information technology (IT) and growing availability of data.

Course Description: This is an introductory course to Prescriptive Analytics and Optimization, as an important component in the three-pillar of Analytics: Descriptive-Predictive-Prescriptive. It covers fundamental optimization topics such as linear programming, integer/binary programming, network optimization, project scheduling, decision analysis and simulation. As supplements, special topics are

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

covered on exact and heuristic algorithms for solving large-scale integer programs, and other combinatorial optimization problems.

This course is application oriented. Various examples and applications in manufacturing, service systems, finance and marketing are provided to motivate and facilitate the understanding of each topic. Application examples include but are not limited to resource allocation and production planning in manufacturing, capital budgeting and portfolio optimization in finance, advertising in marketing, and transportation, minimum cost flow and facility location problems in logistics and supply chain.

Microsoft Excel Solver will be used as the modeling and solution tool for this class. Hands-on experience will be provided on how to formulate an optimization model, implement the model in Excel, and use the Solver to obtain optimal solutions and perform sensitivity analysis (answer what-if questions).

Students in this class will also be guided by the instructor to work on case studies in groups, to implement the optimization methodologies learned on real world applications.

Course Objectives: Your attainment of the following goals will be assessed based on homework scores, quiz scores, exams, (and a project for graduate students).

- Formulate business decision problems as abstract mathematical models
- Apply optimization software packages such as Excel to solve the mathematical models and conduct analysis of real-world business problems
- Analyze and interpret the solutions and perform sensitivity analysis
- Apply critical and creative thinking skills in the process of solving business problems or addressing business questions

Schedule:

The tentative schedule of in-person classes are included in the course outline. You will have the option to attend via Zoom for those sessions that are scheduled to be in-person. **The first two weeks of the semester is online.** Our online sessions are synchronous classes and meetings will occur via zoom **every Tuesday at 6 pm.** **There is no penalty for not attending the in-person classes or synchronous classes live. However, in every session (in-person or via Zoom), there will be a short quiz on the presented lecture which will count as bonus points towards your quiz grades. You may not take these offline.** A portion of each class time (both at the beginning and the end) will be reserved for unrecorded Q&A to encourage students to ask questions. The remainder of the session will be recorded and posted, but due to video processing times, there will be a delay between the end of the session and the posting of the recording. *I ask that students keep their video on during the synchronous sessions, if possible, to enhance the learning experience through increased interactions.*

Asynchronous content will be available on Canvas and will take the place of the other class meeting for the week. The asynchronous content is generally intended to follow the content presented in the synchronous session for that week.

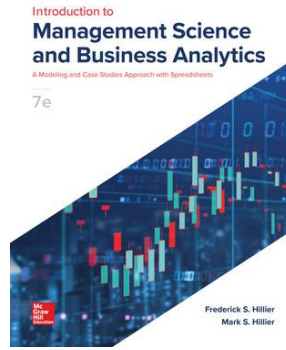
UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

Required Text:

Introduction to Management Science: A Modeling and Case Studies Approach with Spreadsheets, by Frederick S. Hillier and Mark S. Hillier, McGraw-Hill, 7th Edition, 2023.



This class participates in the auto access program for the text book. Online access to “Connect” is necessary to complete the online assignments which includes helpful supplemental material for many of the problems.

[Watch this video on how to access Connect through Canvas.](#)

Hard copies of the book are available separately through the Triton Store and various online sellers. However, if you prefer to study from a hard copy, you can often save money by purchasing or renting a used copy of the book.

Auto Access (UMSL Digital Content Solution):

This course is part of our AutoAccess program designed to reduce the cost of course materials for students. You will be able to access the digital content for this course through Canvas on the first day of class automatically.

Your student account will be charged for the cost of the digital course material. We have helped save students over \$58 million by providing digital content over the last 9 years.

The lowest cost content has been sourced. If you choose to opt out of the content, please do so by January 30, 2024 to receive a refund. You will be sent an AutoAccess Welcome Email that will provide charge amounts, the opt-out DEADLINE DATE and any additional information needed for your AutoAccess course(s) beginning January 3, 2024.

Your AutoAccess course may have a Print Upgrade available as an additional purchase. This is a low-cost version of the printed text made available by the publisher at a reduced cost. It is the publisher’s requirement that in order to purchase the additional print, you must be opted in for the AutoAccess digital required material. If you have questions about Print Upgrades and opting out, please contact us at autoaccess.umsltritonstore.com.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

If you have any questions please contact the Triton Store 314-516-5763, email autoaccess@umsl.edu or visit autoaccess.umsltritonstore.com.

Recommended Textbook for Optional Supplemental Readings:

An Introduction to Management Science: Quantitative Approaches to Decision Making – Edition 15th.
Anderson, Sweeney, Williams, Camm and Martin; Publisher: South-Western Cengage Learning,

Time Requirements:

In-person versions of this course include 2.5 hours/week of time in class plus time outside of class for studying the material and completing assignments. The time requirements of the hybrid version are no different in terms of the expectations for your involvement.

This is an active hybrid course that requires 2.5 hours/week of your time for both the synchronous and asynchronous contents, in addition to the time it takes you to read the required materials and complete assignments. You should plan to spend a minimum of 6 hours a week (up to 9-10 hours a week) on activities related to this course.

Technology Requirements:

As a student in a hybrid course, you are expected to have reliable internet access almost every day. If you have computing problems, it is your responsibility to address these or to use campus computing labs. Problems with your computer or other technology issues are not an excuse for delays in meeting expectations and missed deadlines for the course. If you have a problem, get help in solving it immediately. At a minimum, you will need the following software/hardware to participate in this course:

1. Computer with an updated operating system (e.g. Windows, Mac, Linux)
2. Updated Internet browser of your choice
3. Ability to navigate Canvas (Learning Management System)
4. Minimum Processor Speed of 1 GHz, 2 or more GHz recommended.
5. DSL or Cable Internet connection or a connection speed no less than 10 MB/s
6. Media player such as Windows Media Player to open course media. Flash player may be required by some aspects of the course and is available as a free download (<http://get.adobe.com/flashplayer/>)
7. Adobe Acrobat to open PDF files throughout the course – available as a free download (<http://get.adobe.com/reader/>)
8. A webcam and/or microphone is highly recommended.
9. Access to a full copy Microsoft Excel **that includes the data analysis add-in and the solver add-in.** Students can get a version for free (<http://products.office.com/en-us/student/office-in-education>)

Prerequisite: A minimum campus GPA of 3.0 and SCMA 3301.

Succeeding in This Course: This course will include a mix of lectures, example problems, small discussions during synchronous/in-person sessions and offline, group assignments, and small case studies as computer lab assignments. Success requires your active and ongoing participation (both synchronous and asynchronous ways), including:

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

1. The main (and perhaps the most challenging) learning objective of this course is expanding your critical thinking. This does not happen unless you do not give up when you are challenged and struggle with example problems provided in the lectures, homework assignments, and quizzes.
2. Due to the quantitative nature of the course, it is highly recommended that the students read and review materials before and after class. In addition, working on an adequate number of exercises (examples, solved problems, homework assignments) is essential to succeed in this class.
3. Accessing and completing all assignments in a timely manner.
4. Ensure that you understand the homework problems that you model and solve rather than blindly plugging-in numbers or reading through expressions in a model following an example. If you see a similar but different problem in the future (such as a quiz or exam), make sure you would know how to approach it and solve it.
5. Staying up-to-date on the material. If you fall behind, it is very difficult to catch up.
6. Asking questions when you do not understand something.
7. Taking advantage of office hours.
8. Checking your email regularly for any class updates.

If this is your first online course, it is recommended that you log into Canvas and complete the Online Course Overview listed in your Canvas course list. If you've already completed the orientation, you do not have to retake it but you can refer to it for helpful videos and tutorials about the technologies used in this course.

Class Rules:

1. You are expected to regularly (*at least once a day*) check the Canvas course website as it will be the main channel of our communication. Please double check your notification setting on Canvas to make sure you are properly receiving updates.
 - a. Due dates for all assignments and exams will be posted on Canvas. Tentative dates are provided at the beginning of semester but they are subject to change.
2. There will be a homework assignment (individually or in group) each week, which is due in a week before the next class meeting. Assignments and their due dates will be given in class and posted on Canvas. **No late assignment will be accepted.**
3. There will be a weekly quiz, also due in a week before the next class meeting. No make-up quiz is given, except for unusual circumstances.
4. Group assignments will be given in the form of case studies/problems. Detailed instructions will be given on every case study/problem.
5. There are three exams (exams are not cumulative, except for the optional final exam). It is the student's responsibility to attend each exam. **NO MAKE-UP, LATE OR EARLY EXAMS WILL BE GIVEN** in general, except for unusual circumstances or documented medical emergencies. Signed documents with official letterhead are required for a makeup exam.
6. It is expected that all assigned reading material will be done prior to the class meeting for which it is assigned.
7. Cheating (including plagiarism) is **not tolerated** and it will lead to the student expulsion from the course.

Honor Code: It is expected that all students enrolled in this class support the letter and the spirit of the Academic Honesty Policy as stated in the college catalog.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

Tentative Course Outline:

Week	Mode	Date	Lecture Topic	Chapter
1	ZOOM Synchronous	16-Jan	Introduction to MS/OR	Chapter 1
2	ZOOM Synchronous	23-Jan	Linear Programming (I)- Formulation	Chapter 5 (ONLY LP Formulation)
3	IN-PERSON	30-Jan	Linear Programming (II)- Graphical Methods	Chapter 5 (Graphical Methods)
4	IN-PERSON	6-Feb	Linear Programming (III)- Applications and Excel Solver	Chapter 6 (Both Algebraic formulations and & Excel Solver Solutions)
5	ZOOM Synchronous	13-Feb	Linear Programming (IV)- Sensitivity Analysis	Chapter 8
6	ZOOM Synchronous	20-Feb	Transportation & Assignment Problems	Chapter 17
7	IN-PERSON	27-Feb	Review and Practice For Exam 1	
8	IN-PERSON	5-Mar	Exam 1	
9	IN-PERSON for projects**	12-Mar	Network Optimizaition	Chapter 9
10	ZOOM Synchronous for projects**	19-Mar	Integer & Binary Programming Formulation and Application	Chapter 10 (Both Algebraic formulations and & Excel Solver Solutions)
		26-Mar	Spring Break	
11	ZOOM Synchronous for projects**	2-Apr	Decision Analysis	Chapter 12
12	IN-PERSON	9-Apr	Exam 2	
13	IN-PERSON for projects**	16-Apr	CPM/PERT for Project Management	Chapter 18
14	IN-PERSON for projects**	23-Apr	Simulation 1- Static	Chapter 14
15	ZOOM Synchronous for projects**	30-Apr	Simulation 2- Dynamic Discrete-Event Simulation	Chapter 14+ Supplement
16		7-May	Final Week	

****All lectures following the first exam will be available in an asynchronous format.**

The graduate students are required to meet synchronously or in-person as specified above to work on their projects.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

Assessment/Grading:

Grading at a Glance:

For undergraduate students		
	Date	Weight
Exam # 1	March 5	15%
Exam # 2	April 9	15%
Final Exam #3	May 7	15%
Quizzes	~Weekly	15%
Homework Assignments	~bi-Weekly	20%
Group Assignments /Case studies	~bi-Weekly	20%

For graduate students			
		Date	Weight
Exam # 1		March 5	15%
One Exam (the student's choice from Exams 2 or 3)		April 9 or May 7	15%
Real-World Project	Proposal :5%	Feb 27	25%
	intermediate report:5%	March 19	
	Final report:50%	April 30	
	Final presentation:40%	April 30	
Quizzes		~Weekly	15%
Homework Assignments		~bi-Weekly	15%
Group Assignments /Case studies		~bi-Weekly	15%

- **All exams must be taken in person.**

- The exams 1-3 are not cumulative. However, some concepts from the beginning of the course will reappear throughout the course and will therefore also reappear on later exams. There is a strict time limit of 90 minutes on each exam. Exams will be administered through Canvas. The exams must be completed individually, but you may use your notes. However, **to succeed on the exams, it is imperative that you know the material without the notes.** Students who attempt to look everything up during the exam will run out of time and will have a high likelihood of failing the exam.

- Many extra credit opportunities are included in assignments, quizzes, and exams. Try to take advantage of them as they would enhance your learning experience as well as improve your overall grade at the end.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

Assignments in Greater Detail:

Individual Homework

- Assigned almost bi-weekly corresponding to the weekly material (alternating with the group assignments). Homework assignments are submitted online either directly on Canvas or through the Connect platform which is also accessible through Canvas.
- Unlimited number of attempts allowed on all homework problems.
- All homework needed to be completed individually, but discussing the concepts with other students are allowed.
- Homework numbering will correspond with the week number on which it is assigned. Some weeks may have more than one homework assignment. In these cases, the assignments will be numbered HW 1.1, HW 1.2, HW 1.3, etc.

Quizzes

- Weekly quizzes that correspond to the weekly material and assigned homework. For example, Quiz 1 covers the content from HW 1.
- Quizzes are administered online either directly on Canvas or through the Connect platform which is also accessible through Canvas. The quizzes are open-note but have to be taken individually.
- Quizzes are short, multiple choice/short-answer questions. The quizzes are open-note.
- The best way to prepare for the quiz is to ensure that you understand all the concepts and problems in the weekly lecture and homework.

Computer Lab or Modeling Group Assignments

- Assigned almost bi-weekly corresponding to the weekly material (alternating with the individual homework). Group assignments are relatively more challenging and include solving business problems, case studies, modeling assignments, and/or working with Excel. Students have the option to work in a group of two. Considering different learning styles and other limitations, students are allowed to work individually on the group assignments as well.

Midterm Exams (1-3)

three non-cumulative exams covering three units of the course (I. Linear Programming, II. Network Optimization, Integer Programming, and Decision Analysis and III. Simulation). Exams are administered through Canvas. The exams have to be completed individually, but are open-note.

Real-world Project

- This is the grading component only for graduate students (enrolled in SCMA 6350 or ACCTNG 4450). Students should work in **groups of 2 or 3** for the final term project to define a real-life business problem of their choice, **develop an optimization model**, and **solve, analyze and recommend optimal solutions**. Individual projects are NOT allowed. This project is a critical part of the course, and a significant factor in determining your grade. Teams are required to (1) write a one-page proposal (5%), (2) hand in an Intermediate report on the term project (5%), (3) submit a final report (20-25 pages) (50%), and (4) prepare a short class presentation (15-20 minutes) for their work (40%). More detailed guidelines will be provided for every step.
- Every group should coordinate among themselves for a regular 30-min meeting time with the instructor during an extended office hours as needed.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

- There may be a few real-world projects from local industries available that will be assigned based on team members' backgrounds, interests, and technical skillsets.
- Alternatively, potential project topics include (but not limited to):
 - service systems (e.g., banks, gyms, call centers, supermarkets, restaurants),
 - health care (e.g., hospitals, clinics),
 - communication and social networks (e.g., facebook, twitter),
 - manufacturing systems (e.g., machine workshops, production lines),
 - transportation systems (e.g., trains, airports, highways),
 - financial processes (e.g., stock prices),
 - sports, etc.
- All team members, by default, will receive the same score for their project. If a team feels that this is unfair, perhaps due to HIGHLY imbalanced contributions, then every team member needs to provide a detailed feedback on the contribution of each of the other team members via email to me by the last day of class. After that, I will need to have a meeting with all members together to mediate.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

Course Plan for the Unexpected:

Please stay informed about university policies, instructions and resources as they relate to the COVID-19 pandemic: <https://www.umsl.edu/hcdas/coronaupdates.html>

It is important to me that you stay on track toward your degree completion. This section presents our course continuity plans for how we will handle situations to avoid disruption to your learning.

- In the event of having to switch to 100% online, all our Tuesday sessions will be synchronous Zoom sessions.
- If you are unable to attend the in-person or Zoom sessions due to illness, please communicate it with me as soon as possible so I can provide enough help and support needed to ensure your success after you get well.

COVID Related Issues:

Please follow all in-person safety procedures when attending in-person sessions and feel free to skip the in-person sessions and join via Zoom instead, if you are sick or have been in contact with someone who is sick. Accordingly, all office hours will be held via zoom to maintain the safety that we obtain by meeting online.

Should you become ill during the semester, please contact the instructor. Leniency on due dates will be extended for up to two consecutive weeks of assignments for students who become ill. Should an illness affect coursework beyond two weeks, the student will be referred to the UMSL CARE team that supports faculty with gathering medical documentation. It is strongly advised that students do not request an illness-related extension unless it is actually necessary given the difficulty of getting back on track with the course material. If it becomes evident that students might be abusing this policy, the leniency on due dates may be reduced to one week of assignments prior to referral to the UMSL CARE team.

Online Class Netiquette/Behavior:

Use effective communication.

- Be polite, understate rather than overstate your point, and use positive language.
- If you are using acronyms, jargon or uncommon terms, be sure to explain them so everyone can understand and participate in the discussion.
- Avoid the use of all caps or multiple punctuation elements (!!!, ??? etc).

Be self-reflective. Before you post an emotional response and reread what you have written to be sure it is positive. Think of your comments as printed in the newspaper. Your online comments will be seen, heard and remembered by others in the class.

Keep the conversation on topic. By responding to questions, adding thoughtful comments about the topics at hand. Online dialogue is like conversation. If there is a certain dialogue going on, please add to it, but if you have something new to say, please post it in another thread.

Foster community. Share your great ideas and contribute to ongoing discussions. Consider each comment you make as one that is adding to, or detracting from, a positive learning environment for you and your classmates.

Be constructive. You can challenge ideas and the course content, but avoid becoming negative online. When you disagree politely, you stimulate and encourage great discussion. You also maintain positive relationships with others with whom you may disagree on a certain point.

UMSL Hybrid- (In person ~2x/month)

Syllabus: SCMA 4350/6350 & ACCTNG 4450, Spring 2024

Prescriptive Analytics, Optimization, Management Science Methods

Do not forget to sign your name. It is easier to build a classroom community when you know to whom you are responding.

We will follow all policies in the UMSL *Student Conduct Policy*:

<http://www.ums.edu/~studentconduct/Student%20Conduct%20Policy/index.html>

Also, please refer to the Support & Policies section on Canvas for additional info.