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## Course Syllabus: CT Physics

Robert D. & Carol Gunn College of Health Sciences & Human Services

Shimadzu School of Radiologic Sciences

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### Course Information

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<b>Name</b>	RADS 4723x20 - Computed Tomography Physics (online)
<b>Credit</b>	3 hours
<b>Term</b>	Spring 2021
<b>Dates</b>	January 11, 2021 – April 27, 2021
<b>Time Commitment</b>	Students should expect to spend at least 9 hours per week on course material in a 15 week term or 12 hours per week in a 10 week term
<b>Prerequisites</b>	RADS 4703, Principles of CT or 100 documented hours of CT experience

### Professor

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**Kimberly Onstott, EdD, RT (R)(CT)(MR), MRSO**

**Assistant Professor, Radiologic Sciences**

**E-mail:** [Kimberly.Onstott@msutexas.edu](mailto:Kimberly.Onstott@msutexas.edu)

Use this format in the subject line: 4723\_your last name\_topic of the message

E-mail is the best way to me. If I haven't responded within 72 hours, please email me again.

**Phone:** (940) 397-4332      **Fax:** (940) 397-4845

**Office:**      Midwestern State University  
                  3410 Taft Blvd, Centennial Hall 430Q  
                  Wichita Falls, TX 76309

**Office hours:** Tuesday 11am-1:00pm, Wednesdays 1:00-3:00pm Thursday 12pm-1:00pm, Additional hours by request. Due to the pandemic in-office visits will be carried out by phone or virtually using Zoom. Please make an appointment by e-mail.

### Communicating with the Professor

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I prefer email so there is a record of the communication and often I am away from my desk. Phone calls may be answered by email when appropriate. I will respond or at least acknowledge all student communications

within five (5) business days. If this time period will be longer because I am out of town or for another reason, a news item will be posted online in D2L for the class. Please always give me the time asked for to respond before repeating your request.

## Course Description

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This internet-based course explores the basic physical and technical principles of computed tomography (CT) scanning. Computer technology, system components, image characteristics, and quality control methods are introduced. This course is designed to aid the student in preparation for the A.R.R.T.'s CT registry. This course is not meet the ARRT structured education requirements for sitting for the CT registry by itself. It can be part of a certificate program which does meet the ARRT structured education requirements. Please visit the MSU website for more details.

## Course Objectives

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Upon completion of this course, the student will:

- Describe the principles of CT.
- Identify the functions and operating parameters for major CT system components.
- Define and describe the different types of CT reconstruction.
- Identify the factors that affect image quality in CT.
- Discuss several methods for reducing patient dose in CT scanning.

## Teaching Methodology

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Independent reading assignments, study guide, unit exams, CT assignments, and closed book D2L final examination.

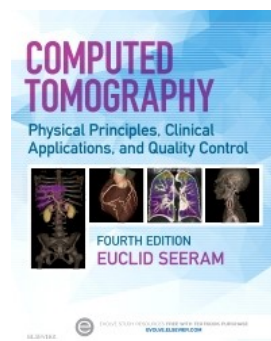
## Course Materials

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### Textbooks

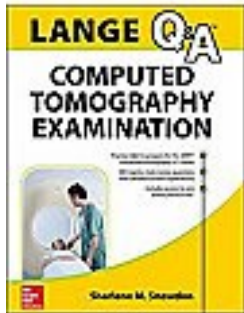
#### Required

Seeram, E. (2016). *Computed tomography: physical principles, clinical applications, and quality control* (4th ed.). St. Louis, MO: Elsevier. [ISBN: 9780323312882]



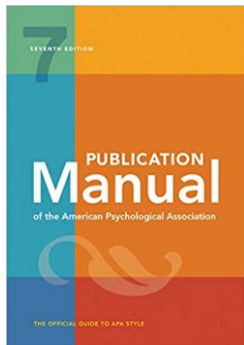
### Recommended

Snowdon, S.M. (2016). *LANGE review: Computed Tomography Examination*. New York, NY: McGraw-Hill Education. (ISBN 9780071843867)



### Recommended

American Psychological Association. (2020). *Publication manual of the American Psychological Association* (7<sup>th</sup> Ed.). Washington, DC: Author. [ISBN: 978-1-4338-3216-1]



### Computer Requirements

You need access to an up-to-date computer with an internet connection in this course. D2L does not work well with Internet Explorer. Use a different browser when working in D2L.

### ProctorU Specifications:

Type	Minimum	Recommended
Webcam	640x480 resolution	1280x720 resolution
PC Users	Windows Vista	Windows 10 (10 S not supported)
Mac Users	Mac OS X 10.5 or higher	Mac OS x 10.13 High Sierra
Internet Download Speed	.768 Mbps	1.5 Mbps
Internet Upload Speed	.384 Mbps	1 Mbps
RAM	1024 MB	2 GB
Connectivity Ports	1935, 843, 80, 443, 61613, UDP/TCP	1935, 843, 80, 443, 61613, UDP/TCP

Detailed instructions for ProctorU are in the RADS 4723 D2L course shell under the section labeled Final Examination.

## Assignments

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There will be six exams, one project, one presentation, and one final examination. See more detailed descriptions of each at the end of this syllabus.

## Important Dates

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All times are MSU campus time

Date	Assignment
<b>January 11</b>	Class opens All exams open Review course syllabus
<b>January 26</b>	Unit 1 Exam due 11:59 pm
<b>February 9</b>	Unit 2 Exam due 11:59 pm
<b>February 23</b>	Unit 3 Exam due 11:59 pm
<b>March 9</b>	Unit 4 Exam due 11:59 pm
<b>March 23</b>	Unit 5 Exam due 11:59 pm
<b>April 6</b>	Unit 6 Exam due 11:59 pm
<b>April 13</b>	<b>CT Trends Presentation for BSRS students due 11:59 pm in the dropbox (Note: CT Trends Presentation for BSRT students due during on campus seminar days-TBA)</b>
<b>April 20</b>	Unit 7 Exam due 11:59 pm <b>Course project (scanning or alternate) due 11:59 pm in the dropbox</b>
<b>April 23</b>	Last day to withdraw with a “W” grade by 4:00 pm campus time
<b>April 1-27</b>	<b><i>Final Exam Available</i></b> <b><i>Final Examination closes at 11:59 pm on the 27<sup>th</sup> of April, 2021</i></b>

## Course Units

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Unit 1: Introduction to CT

Unit 2: Introduction to Computers and Digital Image Processing

Unit 3: Data Acquisition in CT and Basic Instrumentation

Unit 4: Image Reconstruction, Manipulation, and 3-D CT

Unit 5: Image Quality

Unit 6: Patient Dose and Essentials of Radiobiology

Unit 7: Quality Control for CT Scanners

Final Examination

## Evaluation

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### Grade Distribution

- 40% Unit Exams (7)
- 20% CT Course Project
- 10% CT Trends Presentation
- 30% Comprehensive Final Examination

### Grade Scale

A=100-90

B=89-80

C=79-70

D=69-60

F=59 and below

### Grading Cycle

All assignments are graded together as a group to maintain a higher level of consistency. Grading begins on the first business day after a due date, outside of university holidays and professional meetings, and is typically completed before the next due date. You may track your progress through the Gradebook in D2L.

### Feedback

Feedback varies throughout the course. The News section of the course is where I will send messages to the entire class. It is best to set up your D2L account to receive an email notification (to the email of your choice) when News items are posted, so you do not miss important updates.

1. Click the down arrow in the News section on the 4723 course home page
2. Select Notifications
3. Check the box next to “News - new item available” and then check any other boxes you wish to receive an email notification from.
4. Check the email address you wish to send email notifications. If you need to change this, select “change your email settings” and enter the new email address. This email address should be an email address you check frequently.

You are welcome to email questions to clarify concepts or look for further explanations. If I come across repeated questions I will provide feedback or supplementary resources in the News section of the course so that everyone can benefit from it. You might look there first, because your question may be located there.

## Late Work

### Due Dates

Most assignments are due on Tuesdays. Assignments must be submitted by 23:59 (11:59 pm) campus time, on scheduled due dates in the course schedule. If a student fails to meet a deadline the student will receive no credit for the assignment not submitted on time.

### Emergency Extension

If you have a major event such as a death in the family, illness, hospitalization, or other extenuating circumstances, email the professor at [kimberly.onstott@msutexas.edu](mailto:kimberly.onstott@msutexas.edu) as soon as possible and on or before the scheduled due date. I may grant extensions on an individual basis. If an extension is granted, typically the following guidelines will be followed.

1. The assignment may be up to one week late and still qualify for full credit. After the one-week extension has passed, ten percent per day can be deducted until the assignment is no longer worth any credit.
2. When the assignment is completed, you must send a follow-up email to let the professor know it is ready to grade. Failure to notify the professor could lead to a grade of zero.
3. **Avoid End of Course Late Work:** Please note there are University deadlines for submitting grades at the end of the semester. All work must be turned in at least a week before grades must be posted.
4. If a course includes interaction between students in the discussion board, and if extenuating circumstances will prevent you from participating, an alternate assignment may be considered at the discretion of the professor.

## Final Course Grade

A final course score of 70% is required to pass this course. Letter grades of “D” or “F” cannot be used for graduation and will require the course be repeated according to the current radiology program policies.

## Technical Difficulties

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On occasion, you may experience problems with accessing D2L, accessing class files located within D2L, connecting with your internet service, or you may encounter other computer related problems. Make the professor aware of a technical problem as soon as possible. If a problem occurs on our end, such as D2L failure, then a due date extension will typically be granted. **However, keep in mind it is your responsibility to have (or have access to) a working computer in this class. Assignments and tests are due by the due date, and personal computer technical difficulties will not be considered reason for the instructor to allow students extra time to submit assignments, tests, or discussion postings.**

Dropbox assignments that can be attached in an email should be emailed to the professor as soon as a problem is encountered. Failure to do so may result in points being lost, regardless of connection issues.

For help options:

- For D2L issues go online go to the [Distance Education Helpdesk](#)
- By phone call the Distance Education office at 940-397-4868 between 8am and 5pm.
- Use the D2L help link in D2L.
- Contact your professor.
- For other computer access issues, go online to the MSU [Information Technology Website](#).

## Attendance

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This is an online course and there are no mandatory sessions. However, the student should be vigilant in logging in to D2L. The student should expect to log in at least 3 times per week. Regular checks will ensure that messages from the professor are received in a timely manner. This course is on a schedule that will be strictly adhered to. See the Important Dates section above for specific due dates.

## Requesting a Withdrawal

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The last opportunity to drop this course with a grade of “W” is 4:00pm on April 23, 2021. All withdrawals **must be initiated by the student**. After this date dropping the course results in a grade of “F”.

In an emergency or extenuating circumstance, a student may request a grade of “Incomplete” before grades are submitted. If the professor grants the “Incomplete,” the student has until thirty (30) days after the beginning of the next long semester to complete the course requirements. If the student does not complete the course requirements within the deadline, the grade of “Incomplete” will automatically convert into a grade of “F”.

## Special Needs

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In accordance with Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, Midwestern State University endeavors to make reasonable adjustments in its policies, practices, services, and facilities to ensure equal opportunity for qualified persons with disabilities to participate in all educational programs and activities.

The Office of Disability Services (ODS) provides information and assistance, arranges accommodations, and serves as a liaison for students, professors, and staff. The ODS has assistive devices such as books on tape, recorders, and adaptive software which can be loaned to qualified individuals. A student/employee who seeks accommodations based on disability must register with the Office of Disability Services in the Counseling Center; Clark Student Center Room 108. Documentation of disability from a competent professional is required.

Individuals with grievances related to discrimination or lack of accommodation based on a disability are encouraged to resolve the problem directly with the area involved. If the matter remains unresolved, the Office of Disability Services for resolution will provide advice and/or assistance. The grievance procedure may be found in the Student Handbook and Activities Calendar.

The Director of the Counseling Center serves as the ADA Coordinator and may be contacted at (940)397-4618, TDD (940)397-4515, or 3410 Taft Blvd., Clark Student Center Room 108.

## Administrative Process

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Unresolved issues related to this course should be first addressed between the student and the course professor. If there is no resolution, students must follow this sequence:

1. Department Chair – Dr. Beth Vealé (940-397-4611)
2. College Dean - Dr. Jeff Killion (940-397-4679)
3. Dean of Students – Matthew Park (940-397-7500)

## Honor System

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RADS 4723 adheres to the [MSU Code of Conduct](#).

In particular, academic dishonesty, however small, creates a breach in academic integrity. A student's participation in this course comes with the expectation that his or her work will be completed in full observance of the MSU Code of Student Conduct. A student should consult the current Student Handbook for answers to any questions about the code.

All components of RADS 4723 are designed to represent the efforts of each student individually and are NOT to be shared, copied, or plagiarized from other sources. When students submit their efforts for grading, they are attesting they abided by this rule.

An online plagiarism service may be used in this course. Student assignments may be uploaded to the service for identification of similarities to other student papers and published works.

Cheating includes, but is not limited to

- Use of any unauthorized assistance in taking exams, tests, or examinations;
- Dependence upon the aid of sources beyond those authorized by the professor in writing papers, preparing reports, solving problems, or completing other assignments; or
- The acquisition of tests or other academic materials belonging to the university faculty or staff without permission.

Plagiarism includes, but is not limited to

- The use of, by paraphrase or direct quotation without correct citation in the text and in the reference list,
- The published or unpublished works of another person.
- Students may NOT submit papers and assignments that they have previously submitted for this or other courses.
- The use of materials generated by agencies engaged in "selling" term papers is also plagiarism.
- Collaboration between students on individual projects

Academic dishonesty (cheating, plagiarism, etc.) will not be tolerated in this class. Whenever a student is unsure of whether a particular situation will be interpreted as academic dishonesty, he/she should ask the professor for clarification. If students are guilty of academic dishonesty, a grade of zero (0) will be given for the exam, assignment, etc. Based upon the severity of the case, a grade of "F" may be given. Cases will be referred to the department disciplinary committee which may result in dismissal from the program. Cases may also be referred to the Dean of Students for possible dismissal from the university.

Students are encouraged to review the tutorials and suggested websites for more information about plagiarism. If you have any questions about what constitutes plagiarism, please consult:

- The [University Academic Dishonesty Policy](#)
- The website [Plagiarism.Org](#), or
- The professor

### **Please Note**

By enrolling in this course, the student expressly grants MSU a "limited right" in all intellectual property created by the student for the purpose of this course. The "limited right" shall include, but shall not be limited to the right to reproduce the student's work/ project in order to verify originality and authenticity, and for educational purposes. Specifically, faculty may submit student papers and assignments to an external agency to verify originality and authenticity, and to detect for plagiarism.



## Senate Bill 11

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Senate Bill 11 Senate Bill 11 passed by the 84th Texas Legislature allows licensed handgun holders to carry concealed handguns on campus, effective August 1, 2016. Areas excluded from concealed carry are appropriately marked, in accordance with state law. For more information regarding campus carry, please refer to the [University's campus carry webpage](#). If you have questions or concerns, please contact MSU Chief of Police [Patrick Coggins](#) by email at [mpatrick.coggins@msutexas.edu](mailto:mpatrick.coggins@msutexas.edu).

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## Computed Tomography Physics Assignment Details

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There are six units, six exams, one project, and one final examination in this course.

- 40% Unit Exams (7)
- 20% CT Course Project
- 10% CT Trends Presentation
- 30% Comprehensive Final Examination

### Unit Exams (7) - 40%

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Students should complete the reading assignments, answer the chapter objectives, and review the questions at the end of the chapter before attempting the unit exams.

When a student has reviewed a unit and is ready for the exam, he/she will log into D2L and receive a customized timed unit exam consisting of randomized multiple choice questions. It is important to know the unit content before attempting the unit exams since the exams are timed. Exam scores will be available immediately after a student submits for grading.

If students have technical difficulties during an exam, they should use the 'Help' link located on the top toolbar within D2L to contact the MSU Information Systems Support Staff and send an email to the course professor explaining what happened.

If a student finds a faulty exam item or believes an exam question has been scored incorrectly, he/she should send an email to the course professor that includes the following:

- Unit Exam Number (1-7)
- Question Stem
- Rationale Supporting Why the Student's Answer is Correct
- Include Page Numbers When Referencing the Textbook

For example, a student cannot send the message: "I think question number ten is wrong on exam four" because each student gets an exam of randomly generated test items. The professor has to know the question stem to find the question in the database. After reviewing the situation, if the course professor thinks a revision is justified, the student's exam score will be revised to reflect the additional points, and the test bank will be updated.

**All exams must be completed by the due date listed in this syllabus and on d2l at 11:59 pm. You must take the exams in order and cannot skip any. If you receive a zero for not completing an exam, you must still**

**take it to progress to the next exam. You may not take the final examination until all exams are completed. No exceptions.**

## **CT Course Project - 20%**

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You are required to complete the Course Project or the Alternate Project. This will help reinforce learning. The course project consists of CT scans and a short paper describing various CT QC tests. The alternate project does not require any CT scanning and consists of a narrated PowerPoint describing various CT QC tests. All projects are individual projects and are not group projects. Students are expected to do their own work and any collaboration will be considered plagiarism.

### **ASSIGNMENT 1 (IF YOU HAVE ACCESS TO A CT SCANNER) DUE APRIL 23:**

#### Part I: CT Scanning:

Use the provided log sheet to complete 25 scans. You may perform any scans with the following requirements:

- You must have 3 – 5 scans of each exam type for any of the scans to count. (i.e. 3-5 head without contrast scans, 3-5 abdomen scans)
- You must have 3 – 5 scans from the following QC tests:
  - Calibration check
  - CT number and standard deviation (water phantom)
- None of the above scans can be scans you turned in for credit in RADS 4703, Principles of CT.

#### Part II: Quality Control Paper

Write a short paragraph or two describing each of the following tests:

- Average CT Number of Water
- Standard Deviation CT Number of Water
- High Contrast Resolution
- Low Contrast Resolution
- Bed Indexing
- Pitch and Slice Width
- Noise Characteristics
- Radiation Scatter and Leakage

Your one to two paragraph description of each test should include:

- Why was the test done?
- How is the test done?
- What are acceptable and unacceptable results?
- What are possible causes of failure?

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### **ALTERNATE CT LAB ASSIGNMENT (IF YOU DO NOT HAVE ACCESS TO A CT SCANNER) DUE APRIL 23:**

If you are unable or would prefer not to complete the course project requiring scans with a CT, you can create a PowerPoint about CT Quality Control:

- The PowerPoint should contain:
  - Images of phantoms used and test results
  - Text describing the highlights of what will be discussed
  - A 5 – 7 minute recorded narration as if you were giving the presentation to a group.
- The following should be discussed for each QC test:
  - Why the test is done?
  - What is the phantom equipment that is used?
  - What are the expected results?
  - What are the acceptable and unacceptable results?
  - What are any possible causes of any failure?
- The following tests must be discussed:
  - Average CT Number of Water
  - Standard Deviation CT Number of Water
  - High Contrast Resolution
  - Low Contrast Resolution
  - Bed Indexing
  - Pitch and Slice Width
  - Noise Characteristics
  - Radiation Scatter and Leakage

### **CT Trends Presentation - 20%**

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- Each student will prepare a 7 – 10 minute PowerPoint presentation about a current trend in computed tomography. This presentation may be about new procedures, new equipment, or other noteworthy events currently happening in the field. All presentations must be directly related to computed tomography and the topic must be approved beforehand.
  - BSRT (entry-level) students will be presenting these during their seminar days on campus at times which will be announced later. The PowerPoints must be uploaded to the provided dropbox 48 hours before the presentation date.
  - BSRS (registered technologists) students will be recording their presentation with an audio soundtrack within PowerPoint as if they were presenting to a class. BSRS presentations are due April 13, 2021 by 11:59 pm in the provided dropbox.
- Each presentation should have a minimum of the following four slides:
  1. Introduction
  2. Description of the advancement or new technology
  3. How this new trend will benefit patients, technologists, and/or radiology departments
  4. APA formatted reference slide
- More slides may be used as long as the 10 minute time limit is not exceeded.
- To sign-up for your presentation, make a post in the appropriate discussion board. All topics are on a first-come, first-served basis. Please check the board to make sure your topic has not been already chosen before you post. I will make a post to let you know if your topic is approved or if I have any questions or concerns.
- BSRT students may work either as individuals, or as a pair. If you have a topic which requires more than 10 minutes to present, you may team-up with another BSRT student and make a joint presentation.
  - Joint presentations must be 15 – 20 minutes long.

- Each student must cover approximately one half of the material.
- Only groups of two are allowed.
- If you want to pair up, note this in your discussion board post.
- The two students will share the same grade.
- BSRS students may only do their presentations as individuals.

## Comprehensive Final Exam - 30%

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All exams and projects must be completed before the Final Exam is taken.

The final examination must be completed by April 27, 2021 11:59 pm campus time. Incomplete final exams will be scored a zero and the student will most likely fail the course. Students who know they will miss a due date because of extenuating circumstances should contact the professor so their situations can be dealt with on an individual basis. Acceptance of an extenuating circumstance is at the discretion of the professor. Since the final examination is open for one month, only the most extraordinary of circumstances will be considered.

All students are required to have a webcam and microphone for the Final Exam. The appointment with ProctorU should be scheduled by April 1, 2021 in order to avoid late fees and ensure you get the appointment time you want.

### Exam Format

- The proctored comprehensive final examination is closed book, and consists of 100 random multiple-choice questions.
- The exam is a timed, 2 hour (120 min) test.
- The final exam will be administered using Desire2Learn (D2L) and ProctorU online proctoring service.
- To prepare for this exam: The final has been derived from the entire content of this course. Review all of your exams and your textbook chapters. Reinforcing study materials include the PowerPoint presentations.

### What to Bring

- The student may bring scratch paper with only ProctorU's phone number on it.
- A non-programmable scientific calculator is allowed.
- No smart watches or any other electronic devices will be allowed.
- Students are not allowed to print the final exam.
- No textbooks or notes may be used.

### ProctorU Scheduling

- You may schedule your exam for any time within the testing dates in the course schedule. You must have ALL of your course work complete when you take your final or the final will not be accessible in D2L.
- For ProctorU instructions, please read the ProctorU Student Instruction Guide in the course and visit the [MSU ProctorU Webpage](#).
- Be aware certain equipment is required. Review the ProctorU instructions as soon as possible.
- Contact a ProctorU representative to check your equipment and bandwidth real time before your test date. If anything changes after this check (new computer, updates, ISP changes, etc.), REPEAT the check.
- All appointments should be made at least three days in advance. To make an appointment, simply create an account by visiting the [MSU ProctorU Webpage](#). Once logged in, click on the new exam link

and select the exam, date, and time you desire. You must submit payment (based on the length of the exam) at that time - usually about \$25.00. You will receive an email confirming your reservation at the email address you provided to ProctorU.

- Late registrations and *Take it Now* features are subject to availability. Note: If a proctor is not available because you did not schedule your exam in advance, the final is considered missed and a grade of zero will be given.
- Be mindful when you schedule your final exam. If you schedule the exam outside of the 5-day work week (M-F), there may be no one at MSU available to help if you have technical problems.

### Technical Problems

- If you are disconnected during your exam, you must immediately send an email to your professor, and immediately contact ProctorU by phone. All exams are monitored and a log is created by the proctor and by D2L.
- \*All times will be documented\*
- The exam must be taken within the scheduled test dates, regardless of any technical issues that may arise. This is the student's responsibility.
- Late submissions will not be accepted.
- My suggestion is to take the exam before the last 48 hours it is available (listed below) to avoid receiving a zero due to technical issues. If you have to reschedule, it must be within the scheduled dates and times.
- See the [Technical Difficulties](#) section above for help options.

**All course requirements must be completed before a grade is awarded.** Students must complete the final and all course work by the dates published in the course schedule (below).

**Note:** All assignments received are considered complete and will be graded as such. Any decision of the professor is final and there will be no further changes made.

Scroll down to view the Course Schedule.

### Course Schedule

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All times are MSU campus time

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Date	Assignment
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