

DMS-102 & DMS-102L Sonographic Physics and Instrumentation 2
Summer 2026

Professor:	Eun Soo Lee, M.Ed., R.D.M.S.
Office location:	Office: 20/302E (413.755.4915), Lab: 20/328
Email Address:	elee@stcc.edu
Semester Credits:	3
Meeting days and times:	Wednesdays 8 am –12 pm
Credit Hour Distribution:	Lecture: 2, Lab: 2
Office Hours:	Mondays and Tuesdays 12 pm – 1 pm

Required Textbook

Sonography Principles and Instruments by Frederick W. Kremkau (2020)
ISBN: 0323597084

Reference Websites

www.ARDMS.org
www.SDMS.org
www.AIUM.org

Course Description:

A continuation of DMS-101 presenting both theoretical and practical aspects of ultrasonic physics and instrumentation. It focuses on the areas of advanced Doppler principles, basic arterial and venous hemodynamics, artifact generation and recognition, biologic effects, ergonomics, quality control methods, statistics, basic scan plane orientation, and correct transducer manipulation. This is considered a critical course in which the student must learn to integrate the knowledge of physics with instrumentation theory and application. Understanding the production of, and being able to actually create quality diagnostic images will be stressed. Upon successful completion of this class, students will meet ARDMS eligibility requirements for the Sonography Principles and Instruments exam.

Prerequisites: DMS-101&101L, Sonographic Physics and Instrumentation and lab 1

Teaching methods

A variety of teaching methods will be used that may include, but not be limited to, the following: Class discussion, lectures, student presentations, demonstrations, laboratory exercises, scan lab, and homework assignments.

Student Learning Outcomes

At the successful completion of this course, the student will be able to define, explain, and/or use:

1. Artifact
 - a) Basic anatomic orientations, directions, and positions
 - b) Scan planes
 - c) Transducer manipulation
2. Pulse-echo instrumentation
 - a) Pulse-echo imaging artifacts
3. Basic Doppler principles
 - a) The Doppler effect/shift
 - b) Doppler and blood-flow measurements
 - c) Spectral Doppler waveform components
 - d) Uses of medical Doppler instrumentation
4. Basic arterial and venous hemodynamics
 - a) Bernoulli's Principle
 - b) Poiseuille's Law
 - c) Arterial hemodynamics
 - I. Normal flow patterns
 - II. Flow patterns in disease states
 - d) Venous hemodynamics
 - I. Normal flow patterns
 - II. Flow patterns in disease states
5. Biologic effects
 - a) Define biologic effects
 - b) Types of biologic effects
 - c) Mechanisms of biologic effects
 - d) Mechanical and thermal index
 - e) Current research and findings
 - f) FDA and AIUM regulations, guidelines, and positions
6. Ergonomics of scanning
 - a) Define terminology
 - b) Industry standards
 - c) Risk factors
 - d) Mechanisms of injury
 - e) Types of injury
 - f) Minimizing injuries through workplace controls
 - g) Minimizing injuries through professional controls
 - h) Incident reporting
7. Quality control
 - a) Define quality control
 - b) Factors that affect quality in medical ultrasound
 - c) Quality control devices
 - d) Developing a quality control strategy
8. Advanced signal processing

- a) Mechanisms of harmonic generation
 - b) Harmonic signal extraction and processing algorithms
 - c) Pulse encoding algorithms
 - d) Frequency compounding
 - e) Elastography and its applications
9. Research statistics
- a) Positive predictive value, negative predictive value
 - b) False positive, false negative, true positive, true negative
 - c) Sensitivity, specificity
 - d) Likelihood ratio and risk adjustment
10. History/Scars/Labwork
- a) Patient relations
 - b) Ethics
 - c) Preparation
 - d) History-taking
 - e) Scar identification
 - f) Labwork

Course Expectations

Each student is expected to participate in and contribute to all activities related to the course. In particular, each assignment, exam, and presentation must be completed by the announced date. All material handed in (i.e. Lab Reports) must be typed (Computers are available at multiple sites on campus for students who don't have access to one elsewhere). Graphs and diagrams may be handwritten. *Consistent with the College's Writing across the Curriculum initiative, points will be taken off for spelling, grammar, and punctuation errors on all submitted materials.*

Attendance/Tardiness

Because of the importance of this course and the volume of material covered, students are expected to follow the course schedule and attend every class and be on time. The student is required to contact the Professor in the event of an unavoidable absence at least one hour prior to the scheduled class start time.

Tardy

- Arrival 10 minutes or more after the designated start time for a lecture or laboratory Student will be allowed into the classroom.
- 3 events of tardiness will be counted as an absence.

Leaving Class Early

- Leaving greater than 10 minutes before the designated end of class time for a lecture or laboratory.
- 3 events of leaving class early will be counted as an absence.

Absence

- Not arriving at all for a lecture or laboratory

More than **3 absences** from lecture and/ or lab for a full semester course will result in punitive

action ranging from, but not limited to, reduction of course grade to withdrawal from the course. In the case of extenuating circumstances, please contact the instructor directly. Each situation will be evaluated on an individual basis.

Make up missed work/examinations

- It is the students' responsibility to make up all missed work and must be done so at a time convenient to both student and instructor.
- It is the students' responsibility to make up missed examinations and must be done so at a time convenient to both student and instructor. Missed examinations must be made up within 1 week.

Grading

Grades are assigned from the total number of correct answers on all written, oral, and practical examinations as well as any other assignments given. The comprehensive final exam grade will equal 25% of the total course grade. All other quizzes/tests will account for 55% of the grade. Lab reports will count for 20% of the grade. The course MUST be passed with a 73% or better or you will be withdrawn from the program. Final exam may be replaced with ARDMS SPI exam. The passing scores (555-700) will be rescaled to the STCC grading scale. For example, 555 will be 73 points and 700 will be 100 points.

<i>Assignment</i>	<i>Points</i>
<i>Exam 1</i>	<i>18.33</i>
<i>Exam 2</i>	<i>18.33</i>
<i>Exam 3</i>	<i>18.34</i>
<i>Lab</i>	<i>20</i>
<i>Final exam</i>	<i>25</i>
<i>Total</i>	<i>100</i>

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Grading Scale

The STCC grade scale can be found in the [STCC catalog grading system](#).

Quantitative estimate = letter grade

93.00 to 100.0 = A
90.00 to 92.99 = A-
87.00 to 89.99 = B+
83.00 to 86.99 = B
80.00 to 82.99 = B-
77.00 to 79.99 = C+
73.00 to 76.99 = C
70.00 to 72.99 = C-
67.00 to 69.99 = D+

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63.00 to 66.99 = D
60.00 to 62.99 = D-
Less than 60.00 = F

Blackboard resources

Course materials including lab assignments will be posted on Blackboard.

Code of Conduct

Springfield Technical Community College is an institution that is committed to offering students the best possible education. The educational environment is compromised when individuals infringe on the rights of others to succeed in learning. Therefore, the following policies and procedures are intended to serve as guidelines for acceptable behavior at STCC. Conduct which could subject a student to disciplinary action includes, but is not limited to:

Acts of dishonesty, disruption or obstruction of teaching or research, physical abuse, verbal abuse, threats, intimidation, harassment, coercion, or other conduct which threatens or endangers the health and safety of any member of the campus, attempted or actual theft of and/or damage to property of the college or property of a member of the college, hazing, failure to comply with directions of College officials or law enforcement officials, unauthorized possession, duplication or use of keys to any College premises or unauthorized entrance, violations of published College policies, rules or regulations, violation of federal, state, or local laws on College premises, use, possession or distribution of narcotics or other controlled substances, use possession or distribution of alcoholic beverages, illegal or unauthorized possession of firearms, explosives, other weapons or dangerous chemicals, conduct which is disorderly, lewd, or indecent, theft. For a more complete listing refer to your college catalog.

Class cancellation:

Notification of class cancellation (other than weather or emergencies) will be posted on the blackboard. An attempt will be made to notify the class by email also. A student should wait 15 minutes for faculty before leaving the area.

Students with disabilities

In compliance with Springfield Technical Community College's policy and equal access laws, disability-related accommodations are available. Students who desire such accommodations should provide documentation of a disability to register with the Office of Disability Services (ODS). Proper registration will enable ODS counselors to verify the disability and determine reasonable academic accommodations. Students who desire such services are to meet with the professor in a timely manner, preferably the first week of class, to discuss their disability-related needs. Students will not receive services until they register with the Office of disability Services (ODS). Proper registration will enable the ODS to verify the disability and determine reasonable academic accommodations. ODS is located in Building 19 on the 1st floor (Room 141).

Documentation can be sent:

Email: disability_services@stcc.edu.

Fax: (413) 755-6323

Mail: STCC, Attn: Disability Services, One Armory Square, Springfield, MA 01105

Please see additional information on [registering with the Office of Disability Services](#) or contact ODS at 413-755-4785 or via email at disability_services@stcc.edu.

Veterans

Veterans and active duty military personnel with special circumstances and/or concerns are welcome and encouraged to communicate these, in advance if possible, to the instructor.

Miscellaneous suggestions, hints, and rules

A calculator is a handy tool to have for this class. Anything with more functions than those available in the scientific version of the standard Windows calculator is unnecessary. Non-programmable calculators are usually allowed for testing. **Programmable calculators are never allowed for testing.** Sound recording of lectures is permitted. There are several sources information on the physics of sound and medical ultrasound out there. The journal JDMS, available in the library and by joining the SDMS or the AIUM, periodically has had some good physics review articles in it as well as informative recorded webinars. The internet can be an excellent resource only if information is gotten from a trusted source. I am always available for extra help by appointment. I recommend joining the Society of Diagnostic Medical Sonography as a student member (subscription to JDMS is included). See me for applications. The discussion forum is a good place to post questions that come up after or between lectures. This format allows students to ask questions of the Professor (and each other) and allows everyone to benefit from the answers. Subscribe to it so you know when new questions and answers have been posted. *This is a difficult subject matter for many students* and I recommend reviewing and studying in as large a group as possible.

Office Hours

Office hour is from 12 p.m. to 1 p.m. on Monday and Tuesday. Appointments are suggested. I may also be available outside of posted office hours by prior arrangement.

Course Outline

(Subject to change over time)

Week (Dates)	Topic	Assignment
1 6/3	Artifact Doppler & Hemodynamics Lab 1-1 Artifact	Chapter 6 Chapter 4, 5
2 6/10	Doppler & Hemodynamics Lab 2 Renal US	Chapter 4, 5
3 6/17	Test 1 Doppler Instrumentation Lab 2 Doppler	Lab #1 due
4 6/24	Ergonomics Biologic Effects Quality Control Lab 2	Chapter 7
5 7/1	Test 2 Adv. Signal Processing Lab 3 Scanner functions	Lab #2 due
6 7/8	Adv. Signal Processing Research statistics Hx and Relevant Labwork Lab 3	Chapter 2, 4
7 7/15	Test 3 Sono. Physics review Lab 3	
8 7/22	Sono. Physics review Lab Review	Lab #3 due
9 8/7 (TBD)	8 am	Final exam