LINCOLN UNIVERSITY

DI 244 – Vascular Scanning (Lab)

Course Syllabus

Spring 2026

Instructor: Dr. Olesya Smolyarchuk

Lecture Schedule: Monday and Wednesday, 12:30 pm – 3:15 pm

Credits: 3 units (90 lab hours)

Pre-requisites: *DI 234*

Level: Advanced (A)

Office Hours: by appointment

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Diagnostic Imaging Lab Telephone: (510) 238-9744

TEXTBOOKS:

1. **Introduction to Vascular Ultrasonography.** William J. Zwiebel, John S. Pellerito. 6th Edition (2012). ISBN-13: 978-1437714173, ISBN-10: 143771417X.
2. **Peripheral Vascular Sonography,** by Joseph F. Polak . 1st Edition (2004) ISBN-13: 978-0781748711; ISBN-10: 0781748712
3. **Vascular Technology: An illustrated Review,** by Claudia Rumwell, Michalene McPharlin, 5th Edition (2014) ISBN-13: 978-0941022859; ISBN-10: 0941022854

Additional recommended textbooks and instructional materials will be given during classes.

Last Revision: January 2026.

NOTE: Instructor may change this syllabus and course schedule at any time according to the judgment as to what is best for the class. Any changes will be declared ahead of time in class

CATALOG DESCRIPTION

The focus of this course is Peripheral and Abdominal Doppler scanning. Laboratory sessions are provided to acquire intermediate scanning skills necessary to succeed in the clinical setting. (3 units)

COURSE OBJECTIVES

Upon completion, students should be able to:

- Demonstrate knowledge and understanding of the anatomy, physiology and normal variations of the abdomen, abdominal vascular systems and small parts.
- Understand and expand the routine ultrasound protocols and presenting sonographic images in a logical sequence.
- Describe the proper scanning technique and commonly used sonographic acoustic windows.
- Utilize the principles of instrumentation to set up the ultrasound equipment for acquiring optimal quality of diagnostic images.
- Demonstrate an increased knowledge of the applications of the ultrasound Doppler.
- Be familiar with the standard measurements and diagnostic criteria for duplex evaluation of the abdomen.
- Recognize sonographic signs of abdominal pathological findings.
- Correlate sonographic and laboratory data.
- Recognize and be able to compensate for common pitfalls in the diagnosis of abdominal and small parts pathologies.

COURSE LEARNING OUTCOMES[1]

	Course Learning Outcome	Program LO	Institutional LO	Assessment Activities
1	Employ proper hands-on techniques to master and expand the routine ultrasound protocols.	PLO 5	ILO 1a ILO 3a	In-class hands-on scanning; laboratory live & video demonstrations; self-study scanning training; midterm/final exams.
2	Utilize the principles of instrumentation, related to field size, TGC, focal zones, color scale, gain, depth, etc. for image interpretation.	PLO 4 PLO 5	ILO 1a, ILO 7a	In-class hands-on scanning; laboratory live & video demonstrations
3	Recognize sonographic signs of vascular pathological findings and differential diagnosis.	PLO 5	ILO 6a	Ultrasound case analysis and group discussions; quizzes
4	Explain the significance of clinical tests relevant to pathology. Correlate sonographic and laboratory data.	PLO 3 PLO 4 PLO 7	ILO 6a ILO 7a	Case studies; presentations and discussions of students' projects.

[1] Detailed description of learning outcomes and information about the assessment procedure are available at the Learning Outcomes Assessment section of LU website.

5	Demonstrate knowledge of diagnostic criteria for duplex evaluation of the vascular system.	PLO 5 PLO 7	ILO 7a	Case studies and group discussions.

INSTRUCTIONAL METHODS

Instructional methods will include:

- In-class hands-on scanning, using ultrasound machines and other lab equipment
- Live demonstration of vascular ultrasound imaging
- The instructor's guidance to developing students' scanning skills.
- Students' ultrasound hands-on self-study training: ***30 lab hours*** minimum of independent scanning throughout the semester
- Group work, discussions and ultrasound case analysis
- Quizzes based on the relevant topics
- Ultrasound lab video demonstrations
- Presentations and discussions of students' projects.

Assignments and projects require students to actively use resources of the library. Detailed guide to business *resources of the library* as well as the description of Lincoln University approach to *information literacy* are available at the LU Library website (lincolnuca.libguides.com).

SCANNING LAB RULES

Students must wear university uniform with logo, face masks if they are sick.
Audio and video recordings are prohibited without the consent of an instructor and all present students.
Students should speak only English language during classes and exams.

Lab Hours:

Lab hours are posted on the front door. Please respect class time, try not to enter when a class is in session, or be quiet if you come late.
Use student suggestion envelope for questions or concerns. Also, students can email their questions to an instructor.
Sign in on the preferred machine with your name, start time and finish time. You must re-sign in if you want to continue to scan after you finish it. Ask a lab assistant about rules.
Self-study log sheet: should be signed every time by pen and by the present lab assistant otherwise the study time will not be counted. You should submit the self-study log sheet before every exam.

Respect Others and Lab:

- **No eating or drinking in the lab.**
- **No cell phones** (exit the room if must use phone with permission of the instructor).
- **No perfume or scented lotions.**

  Suggestions and hygiene rules:
  1) If you wear perfume from the previous day, take a shower before leaving home.
  2) If you have strong scent or odor on your clothes/shoes change to clean clothes/shoes before leaving your place.
  3) Wash your uniforms/scrubs/shoes regularly.

4) If you are sweating a lot, a suggestion is to bring extra clothes that you can change during the long day and use cleaning wipes for body.
5) Wash your hands before eating and after, after toilet use, and after coughing/sneezing; cover coughs/sneezes with elbow or tissue, dispose of used tissues and glows.

- **No long nails**
- **Clean up after yourself** (table, transducer, put away chairs and other equipment, trash, etc.).
- **Inform instructor or staff of needed supplies or equipment broken.**
- **Keep a low tone of voice.** The lab is small; speaking loudly can be very disruptive to students who need their concentration on scanning.
- **Do not interrupt students' scanning time.** Ask the students whether it is okay to ask them questions while they are scanning.
- **Students should properly cooperate with each other as it is a part of the educational scanning process: to scan each other (get scanning skills) and learn communicational skills as a patient and a sonographer.**
- **Learn and follow ethical and moral principles** at work with classmates/future co-workers and patients, respect each other and be polite.
- Never leave your **personal property** unattended. Although Lincoln University does have zero tolerance for theft, the university is not responsible for lost or stolen items. Any students caught stealing will be prosecuted.
- **Please do not remove any objects from the lab** (LU lab books and study materials).
- **Leave personal conversation outside the lab.**
- **Outside patients:** reconcile with instructor or Lab assistant.
- **No children are allowed in the lab.**

Machines (Acuson, Phillips, and GE):

- Your studying name should be properly registered in the system of the machine.
- Please kindly shut down the machine after the scanning class and check the cords, **they should not be on the floor.**
- Do not erase any information on machines (only instructors and lab assistants may do).
- Please inform lab assistants of needed supplies (wipes, paper towels, gel).
- **Wipe down the transducer and cords** after every patient, using the antiseptic spray/wipes.
- Change paper after every patient, and place pillow under paper, not on top.
- Please safely move around the equipment (ultrasound machines, chairs, and patient tables).

Homework:

The goal of the homework is to help students achieve the course learning objectives. Homework consists of two parts. The first part is to read the textbooks and printed materials to review the topic of the previous class session.

Project Presentation:

Students will acquire, record and analyze ultrasound images during each lab session.
Images containing anomalies should be selected and kept for the future presentation to others.

Each student will perform library research on a selected topic in the field of Vascular Scanning and present the findings along with their own images during a lab class orally, using Power Point. A 10-minute presentation will be followed by a 5-minute question period.
Students should include enough background information, ultrasound images received during classes, pictures and references, for their peers to be able to understand the topic.
Each student will choose the topic of his/her presentation with the instructor's approval.

Evaluation Criteria for Presentation:

- Clinical statement: 2%
- Background information: 2%
- Slide content: 2%
- Slide design: 1%
- Resolution of the problem: 2%
- Oral presentation: 1%

Total: 10% of all the course grading elements

Hands-On Lab Examination:

During the final ultrasound hands-on examination, students have to demonstrate the understanding of the information presented during the course laboratory training.

1. The knowledge of the ultrasound machine.
2. The knowledge of the anatomy, physiology, normal variations, and pathology of the human vascular system.
3. In-depth knowledge of the ultrasound scanning protocols and the ability to present images in a logical sequence.
4. The knowledge of the ultrasound machine capabilities for the optimal quality of diagnostic images (frequency, TGC, B-mode, focal zones, color scale, gain, depth, spectral and color Doppler, etc.).
5. Ability to demonstrate the optimal scanning technique and proper images acquisition in B-, Color-Modes, and M-mode.
6. The utilization of different acoustic windows to achieve the best picture quality possible.
7. The knowledge of the structures/elements of the proper image labeling.
8. The explanation of the sonographic findings and differential diagnosis of vascular pathology.

Since the intent of the lab examination is for students to demonstrate the knowledge of the scanning protocol, students are not allowed to ask questions and discuss the scanning procedures with classmates.

Reference materials are not allowed.

Only one time exam RETEST will be given to students with a valid excuse such as illness, family emergency, unforeseen traffic conditions or natural disaster.

Midterm/Final Exam Grading System

Midterm and Final Exams will be performed on the scheduled days in the presence of the lab instructor.

The length of the examination will depend on the type of the ultrasound protocol. The type of the protocol for the exam will be chosen by the instructor for each student individually.

The score (%) will be determined by acquiring the ratio of the correct / incorrect images recorded by the student.

Depending on the quantity of the required images of the particular protocol, each image will be valued at certain amount of points.

The points for missed (or completely incorrect) ultrasound images will be subtracted from the total 100% score.

The added score of the correct ultrasound images (according to the protocol requirements) will represent the total examination grade.

To successfully complete this course, the students must pass the midterm and final exams with a 70% (both) or better. **Students should attend all the class meetings - labs.**

The term grade is based on attendance, class activity, self-study complete hours, midterm, and final examination.

Midterm cannot be retaken.

Final examination, if failed, can be retaken only once. If failed a second time, the subject is considered failed. The course is failed if a student fails Lab final examination and total scanning performance for the lab course is less than 70%.

Attendance and Participation:

Efficient use of the lab time, demonstration of the development of the scanning skills, effective use of ultrasound machines, active participation during the class meetings is expected.

Students are encouraged to use open lab time as needed.

Students are expected to arrive to class on time and stay through the end of the laboratory class. Absence, late arrival, poor use of class time, early leave will result in a lower grade.

Instructor may dismiss a student from the course after missing 3 consecutive class meetings.

GRADING

All activities will be graded according to the points as shown below.

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Points	93-100	90-92	87-89	84-86	81-83	78-80	76-77	74-75	72-73	70-71	0-69

The final grade for the course will be given as the total weighted score for all activities according to the percentage shown in the table below.

Activity	Percent
Class Attendance and Participation	10%
Homework, self-study, and Presentation	10%
Scanning Performance: Midterm Exam	40%
Scanning Performance: Final Exam	40%
TOTAL	100%

CLASS TOPICS SCHEDULE:

1/26/2026 – Vascular System Anatomy and Physiology. Arterial Physiology and Hemodynamics. Extracranial Cerebrovascular (Carotid) System

1/28/2026 – Extracranial Cerebrovascular System: Vascular Anatomy and Anatomical Variations. Scanning Techniques and Image Optimization

2/02–04 – Carotid Arteries Duplex Ultrasound Protocol. Various Scanning Approaches

2/09/2026 – Carotid Arteries Plaque Assessment and Waveform Analysis.

2/11/2026 – Carotid Arteries Duplex Ultrasound Protocol: Measurements and Utilization of the Diagnostic Criteria

2/18/2026 – Bilateral Carotid Arteries Ultrasound Protocol

2/23/2026 – Upper Extremity Arterial Duplex Ultrasound

2/25/2026 – Bilateral Upper Extremity Arterial Duplex Ultrasound

3/02/2026 – Lower Extremity Arterial Duplex Ultrasound Protocol

3/04/2026 – Lower Extremity Arteries Diagnostic Criteria

3/09/2026 – Bilateral Lower Extremity Arterial Duplex Ultrasound Protocol

3/11/2026 – Lower Extremity Physiological Testing. Ankle-Brachial Index

3/16/2026 – Lower Extremity Segmental Pressures

3/23/2026 – MIDTERM EXAM

3/25/2026 – Venous System Hemodynamics. Upper Extremity Venous Duplex Ultrasound: DVT, Superficial Veins

3/30/2026 – Lower Extremity Duplex Ultrasound: Deep Venous Thrombosis. Diagnostic Criteria.

4/01/2026 – Lower Extremity DVT Protocol: Calf Veins

4/06/2026 – Bilateral Lower Extremity DVT Protocol

4/08/2026 – Lower Extremity Venous Insufficiency. Reflux Study

4/13/2026 – Abdominal Arterial Duplex Ultrasound. Aorta and Its Branches

4/15/2026 – Mesenteric Duplex Ultrasound

4/20/2026 – Renal Duplex Ultrasound

4/22/2026 – Abdominal Venous System. IVC and Its Tributaries

4/27/2026 – Liver Vascular System Duplex Ultrasound

4/29/2026 – Portal Venous System Ultrasound. Diagnostic Criteria

5/04-05/2026 – Final Exam Review and Practice.

5/11-13/2026 – **FINAL EXAM**. Presentations.

Syllabus Revised: January 2026.