

LINCOLN UNIVERSITY



DI 114 – Vascular Anatomy and Hemodynamics

Course Syllabus

Fall 2026

Instructor: Marina Kay, RDMS (Abd), RVT
Lecture Schedule: Thursday, 9:00 am – 11:45 am (online)
Credits: 3 units (45 hours of lectures)
Pre-requisites: DI 110
Level: Developed (D)
Office Hours: By appointment
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Diagnostic Imaging Lab Telephone: (510) 238-9744

TEXTBOOKS:

1. **Ultrasound Physics and Instrumentation.** Frank Miele.
5th Edition (2013). Volume II ISBN-10: **0988582503**; ISBN-13: **978-0988582507**
 2. **Vascular Ultrasound: How, Why and When.** Abigail Thrush, Tim Hartshorne.
3rd Edition (2009). ISBN-10: **0443069182**; ISBN-13: **978-044306918**
- Additional recommended textbooks and instructional materials will be given during classes.

READING ASSIGNMENTS

Introduction to Vascular Ultrasonography. William J. Zwiebel, John S. Pellerito.
6th Edition (2012). ISBN-10: **143771417X**; ISBN-13: **978-1437714173**

The link to Google Meet classroom will be available on Canvas. To log into Canvas LMS:
<https://students.lincolnuca.edu/canvas/>

Last Revision: August 1, 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

This course provides the knowledge of gross anatomy of the central, peripheral and cerebrovascular systems, principles of the dynamics of blood circulation in the human body, the factors that influence blood flow, and hemodynamic consequences of occlusive disease.

COURSE OBJECTIVES

This is an online instruction course. Canvas by Instructure LMS will be used as a web-based learning system. Via Canvas, students will be able to access and manage the online course assignments, grades, course calendars, learning materials and communicate with the instructor. Exams will be administered via Canvas.

Upon satisfactory completion of this course, students will be able to:

- Demonstrate the basic understanding of the normal physiology and physical principles of the blood circulation
- Describe the anatomy, physiology and normal variations of central and peripheral arterial and venous systems
- Understand the use of color Doppler and pulsed wave Doppler in the process of vascular evaluation
- Be able to perform the basic Doppler waveform analysis
- Describe standard measurements for duplex vascular evaluation
- Recognize abnormalities that can occur in the presence of vascular obstruction
- Differentiate normal from abnormal blood flow patterns
- Know the different diagnostic criteria for peripheral arterial disease
- Apply the diagnostic criteria and link Doppler image information to the manifestations of cerebrovascular disease
- Understand normal venous physiology by the evaluation of Doppler imaging
- Recognize the significance of venous pathophysiology by the use of ultrasound imaging
- Apply the diagnostic criteria to determine the extent of venous insufficiency
- Determine the presence of thrombosis in deep and superficial venous systems

COURSE LEARNING OUTCOMES¹

	Course Learning Outcome	Program Learning Outcomes	Institutional Learning Outcomes	Assessment activities
1	Understand the anatomy, physiology and normal variations of central and	PLO 1	ILO 1a, ILO 2a, ILO 3a	In-class activities, quizzes, midterm and final exams.

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

	peripheral vascular systems.			
2	Recognize sonographic signs of vascular pathological findings and differential diagnosis.	PLO 1 PLO 3	ILO 1a, ILO 2a, ILO 3a, ILO 4a	Ultrasound case analysis and group discussions, quizzes, course projects presentations and discussions of students' projects.
3	Demonstrate knowledge of diagnostic criteria for duplex evaluation of the vascular system.	PLO 1 PLO 3	ILO 1a, ILO 2a, ILO 3a, ILO 4a	Ultrasound case studies, quizzes, midterm and final exams, course projects presentations and discussions of students' projects.
4	Be able to perform the basic Doppler waveform analysis.	PLO 1 PLO 3	ILO 1a, ILO 2a, ILO 3a, ILO 4a	Ultrasound case studies; course project presentations and discussions of students' projects.

INSTRUCTIONAL METHODOLOGY

Instructional methods will include on-line lectures and learning activities via Google Meet.

The topics of the course will be presented through the following activities:

- Reading assigned textbooks and lecture outlines;
- Presentation of material (lectures) by the instructor, using Power Point and visual aids on Canvas by Instructure Learning Management System (LMS).
- Quizzes based on reading assignments (text and lecture readings);
- Internet resources;
- Final and midterm examinations;
- Group discussions of relevant topics and ultrasound case analyses;
- Students' in-class projects presentations and discussions.

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](http://lincolnuca.libguides.com) website (lincolnuca.libguides.com).

Reading Assignments:

Students are expected to be prepared in advance before the class sessions. Being prepared includes the following: having read text materials (e.g. reading textbooks, lecture outlines and handouts) to review and analyze the lecture given during a previous class session; bringing required work materials (e.g. textbook, handouts, writing supplies, etc.) to the session.

These assignments are graded through short quizzes given at the beginning of the following class session.

Project:

Each student will choose the topic for the project or will be assigned one by the instructor. The project will be presented at the end of the course.

The presentation should be approximately 10 minutes long plus 5 minutes for a discussion.

The presentation should include ultrasound images, related to the topic of presentation.

The topic and format of the presentation will be discussed in class for more details.

Evaluation Criteria for the Project:

- Clinical statement: 3%
- Slide content: 3%
- Slide design: 1%
- Oral presentation in class: 3%

Total: 10% of all the course grading elements

Quizzes:

- Students will take 10 quizzes throughout the course. These quizzes will address the detailed content and major concepts presented in the lectures, lecture outlines and text readings to evaluate students' work outside of the classroom.
- Every class session will start with a 15 minutes quiz, based on the previous homework assignment.
- A quiz will consist of 10-15 questions, some combination of true/false, multiple choice, and "fill-in" questions.
- Each quiz will be timed, 1 minute for every question to complete.
- The correct answers of the quiz and a relevant topic will be discussed and reviewed.
- No make-up quizzes for missed quizzes will be administered (students will receive no score for missed quizzes).
- The primary purpose of these quizzes is to encourage and reward the students' progress through the course materials.

Midterm and Final Examinations:

- The exams will consist of the questions based on the course material, studied through the semester.
- The written examinations (multiple choice and true/false format and will be closed-book exams).
- The Midterm Exam will consist of 100 multiple choice and true/false questions and will cover Lectures 1-5
- The Final Exam will consist of 100 multiple choice and true/false questions, and will cover Lectures 1-8
- A student must take the exam during the scheduled time period.

There will be no make-up for a missed exam, unless you have the instructor's approval obtained prior to the exam date, with the exception of an emergency.

ATTENDANCE

- Attendance at all classes is essential for successful completion of this course.
- The topics covered in the lectures are related to each other. You can move forward only if you are familiar with the material of the previous lecture.

- Students are expected to attend and be prepared for all regularly scheduled classes: arriving on time, remaining quiet when others are speaking, and paying attention to whoever has the floor in the classroom.
- Students are to remain in class during the entire session *with the computer camera turned on*. Your attendance and participation grade will be determined by the duration of time your camera is live during class. Failure to have a working camera will result in a loss of attendance.
- Students are required to behave in accordance with Lincoln University's Student Honor Code and Standards of Conduct, which can be found in the Student Handbook.

STUDENT RESPONSIBILITIES

- Students are expected to attend class, to participate in individual and group work in a productive manner, perform well on tests, and to complete assignments according to schedule.
- Every student should take personal responsibility for meeting the objectives of the course.
- Students are expected to treat faculty and fellow students with respect.
- Students engaging in disruptive behavior in class will be asked to leave and may be subjected to other penalties if the behavior continues.
- No eating, sleeping or personal grooming is permitted during the class
- A computer can be used in class only to take notes, to access course materials from the course webpage, or to locate information relevant to the class discussion. Do not use your computer to surf the web, check emails, or send/receive messages.

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	95-100	90-94	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	10%
Project	10%
Quizzes	20%
Midterm Exam	30%
Final Exam	30%
TOTAL	100%

LECTURES SCHEDULE

Dates	Lectures	Topics	Quiz
27-Aug	Lecture 1	Human Circulatory System. Systemic and Pulmonary Blood Circulation.	
3-Sep	Lecture 2	Gross Anatomy of the Central and Peripheral Arterial System	1
10-Sep	Lecture 3 Part I	Physiology and Hemodynamics of the Arterial System. Types of Pressures. Blood Flow Characteristics.	2
17-Sep	Lecture 3 Part II	Physical Principles of Fluid Dynamics. Poiseuille's Law, Bernoulli Equation, Reynolds Number.	3a
24-Sep	Lecture 4	Arterial Doppler Waveform Analysis. Peripheral Resistance. Effects of Stenosis and Exercise on the Arterial Flow.	3b
1-Oct	Lecture 5 Part I	Gross Anatomy of the Extracranial and Intracranial Cerebrovascular System	4
8-Oct	Lecture 5 Part II	Physiology and Hemodynamics of the Cerebrovascular System. Spectral and Color Doppler Analysis.	5
15-Oct		Midterm Exam (Closed Books)	
22-Oct	Lecture 6 Part I	Anatomy of the Peripheral Venous System	
29-Oct	Lecture 6 Part II	Peripheral Venous System. Muscle Pump Mechanism. Venous Valvular Function.	6a
5-Nov	Lecture 7	Hemodynamics of the Peripheral Venous System. Effect of Respiration on Venous Pressure. Spectral and Color Doppler Analysis.	6b
12-Nov	Lecture 8 Part I	Abdominal Venous System Anatomy and Hemodynamics. Portal Venous System. Abdominal Venous System B-scan, Spectral and Color Doppler Analysis.	7
19-Nov	Lecture 8 Part II	Abdominal Venous System B-scan, Spectral and Color Doppler Analysis. Presentations of Projects.	8
26-Nov		Fall Recess	
3-Dec		Final Exam (Closed Books).	
10-Dec		Make-Ups	