



LINCOLN UNIVERSITY

DI 255 – Advanced Echo Imaging

Course Syllabus

Fall 2022

Instructor: Dr. Olesya Smolyarchuk

Lecture Schedule: Wednesday 12:30 pm – 3:15 pm (Lecture)
Wednesday 6:15 pm – 9:15 pm (Lab) **09/14 – 11/16/2022**

Credits: 4 units: 3-unit lecture and 1-unit lab
(75 total hours: 45 hours of lectures and 30 hours of lab)

Pre-requisites: DI 235

Level: Advanced (A)

Office Hours: By appointment
E-mail: osmolyarchuk@lincolnuca.edu

Lab Instructor: Mr. Delbert Davis
E-mail: ddavis@lincolnuca.edu

TEXTBOOKS:

1. Echocardiographer's Pocket Reference, 4th edition [Spiral-Bound], 2013 or 3rd edition [Spiral-Bound], 2008, Terry Reynolds.
ISBN-10: 001405101X, ISBN-13: 978-0014051014
2. Textbook of Clinical Echocardiography, 5th edition, Catherine M. Otto, MD, 2013
ISBN-10: 0323227589
ISBN-13: 978-0323227582
3. Echocardiography Review Guide: Companion to the Textbook of Clinical Echocardiography 2nd edition, Catherine M. Otto, and Rebecca G. Schwaegler, 2011
ISBN-10: 1437720218, ISBN-13: 978-1437720211

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

Last Revision: August, 2022

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

A continuation of study of imaging methods and technology based on 2-dimensional echo, M-Mode, and Doppler sonographic imaging. Applications to recording and interpretation of echo imaging for detection of heart abnormalities are emphasized. (4 units)

LEARNING OUTCOMES

This advanced echocardiography course utilizes a "Case Studies Based Approach". Upon satisfactory completion of this course, the students will be able to:

- Utilize Two-dimensional echocardiography and M-Mode modalities to identify and assess the normal and abnormal anatomical structures of the heart and great vessels in patients with congenital abnormalities and heart assist devices, heart transplants.
- Spectral and Color Doppler – identify and evaluate direction and velocity information given in the color and spectral Doppler images/waveforms in patients with congenital abnormalities and heart assist devices.
- Doppler Calculations – perform Doppler calculations, i.e., stroke volume, cardiac output and valve areas and shunts.
- EKG and Auscultation – describe commonly encountered abnormal EKG findings. Explain normal and abnormal heart sounds and their relationship to the cardiac cycle and role of echocardiography in evaluation of the
- Systolic and Diastolic Function – perform echocardiographic measurement parameters to assess LV and RV systolic and diastolic dysfunction in patients with cardiac and noncardiac disorders. Utilizing contrast agents in evaluation of the heart.
- LA, RA, and RV Function – explain and describe the echocardiographic measurement parameters that assess LA, RA and RV normal and abnormal function.
- Introduction to Trans Esophageal echocardiography and role of the sonographer. Introduction to Tree-Dimensional echocardiography and other methods of evaluation of the heart diseases.
- Examination – utilize protocols recommended by the ASE in the complete transthoracic echocardiogram of the heart abnormalities.

COURSE LEARNING OUTCOMES¹

	Course Learning Outcome	Program Learning Outcomes	Institutional Learning Outcomes	Assessment activities
1	Properly judge the quality of acquired data and communicate any limitations. State the normal range measurement values for each principal cardiac structure and physiologic function. Identify each anatomic region and	PLO 3 PLO 5	ILO 1a, ILO 2a	In-class activities

¹ Detailed description of learning outcomes and information about the assessment procedure are available at the [Center for Teaching and Learning](http://ctl.lincolnuca.edu) website (ctl.lincolnuca.edu).

	segment of the heart from any given echocardiographic view; relate it to its usual coronary distribution.			
2	Identify abnormalities of resting cardiac wall motion and thickening using standard terminology; classify each according to its clinical significance. Discuss the basis, significance, and pitfalls of the following measures of cardiac function (ejection fraction & fractional shortening; % Wall thickening; MAPSE, TAPSE; stroke volume; cardiac output; cardiac index; LV mass).	PLO 4 PLO 5	ILO 6a,	In-class activities, lab activities, quizzes
3	Identify and differentiate ventricular hypertrophy by chamber, type, and degree. Identify, stratify, and discuss the clinical significance of pericardial effusion in the assessment of suspected tamponade. Identify and discuss the image and Doppler parameters associated with subaortic obstruction. Demonstrate the technique to image the posteromedial apical fossa and LA appendage to inspect for thrombus. Identify and distinguish the characteristics of pedunculated vs. mural thrombus vs. tumor. Identify and distinguish the characteristics of valvular vegetative excrescence vs. fibrotic thickening.	PLO 3 PLO 6	ILO 6a, ILO 7a	In-class activities, lab activities, quizzes, midterm, and final exams
4	Document and measure the course of blood flow through the entire heart using color and spectral Doppler. Correct operator errors to maximize system sensitivity of color/spectral Doppler to avoid the most common false negative findings. Define the following terms and relate them to their clinical impact in Doppler assessment of altered hemodynamic states (preload, afterload)	PLO 4 PLO7	ILO 6a	In-class activities, lab activities, quizzes, midterm, and final exams

INSTRUCTIONAL METHODS

- Lectures and assigned reading material
- Internet resources
- Group discussions and ultrasound case analyses
- Student will complete worksheets for each echo case discussed during the lecture.

Assignments and projects require students to actively use resources of the library. A detailed guide to business resources of the library as well as the description of Lincoln University approach to information literacy are available at the [Center for Teaching and Learning](http://ctl.lincolnuca.edu) website (ctl.lincolnuca.edu).

REQUIREMENTS

Ultrasound Hands-on Laboratory Training

Practical experience students will gain under the guidance of a lab instructor. Students are expected to arrive at class on time and stay through the end of the ultrasound laboratory class.

SCANNING LAB RULES

Students must wear university uniform with logo and face mask in the Lab.

Audio and video recordings are prohibited without consent of an instructor and present students.

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 submission envelope for questions or concerns.

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.

Respect Others and Lab:

- **No eating or drinking in the lab.**
- **No cell phones** (exit the room if must use phone).
- **No perfume or scented lotions**
- **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.
- Never leave your **personal property** unattended. Although Lincoln University does have a 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** (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):

- Please kindly shut down the machine after the scanning class and check 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 (baby 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).

Attendance and Participation:

- **Students are not allowed to be more than 5 minutes late at the beginning of the class or after break, who arrive after roll is taken will not allowed to stay in the class.**
- If you are late or absent, a valid excuse such as illness, family emergency, or natural disaster is expected.
- If you are late because of unforeseen heavy traffic more than 1 time during the semester it will consider as absence.
- No requirements to make up any work missed as a result of an absence. However, it is your responsibility to obtain notes from other class members regarding the class session you missed.
- Instructor may dismiss a student from the course after missing 3 consecutive class meetings.

COURSE GUIDELINES

- To successfully complete this course, the students must pass the midterm and final exam portions with a 70% or better. **Students should attend all the class meetings – lectures and labs.**
- The term grade is based on attendance, class activity, project, quizzes, midterm, final examination, and lab. Individual projects will be assigned at the beginning of the semester.
- Project is due by the last meeting before the final examination. No project will be accepted after the last meeting.
- If students have missed a class without a valid reason, no make-up will be allowed.

- **Midterm cannot be retaken.**
- **Final examination, if failed, can be retaken only once. If failed second time, the subject is considered failed. The course is considered failed if student fails Lab final examination.** Dictionaries can be used during the class time. No electronic devices during the test time. A student must take the exam during the scheduled time. A student missing an exam because of an illness or legitimate emergency may take a make-up exam as soon as possible after the student returns from the illness and as determined by the instructor. In such a circumstance, the student should make every reasonable attempt to contact the instructor before the exam period is over (or as soon as possible). While make-up exams will cover the same content area as a missed exam, the exam format and specific questions may be different.
- **During the exam, any student observed in a situation that could be considered suspicious (e.g., an open book or notebook within his/her field of vision, looking around or checking a cell phone, or other wireless devices, helping the examinee-sonographer to take images by guiding manually or verbally, etc.) but no cheating is observed, will be warned. Once warned, any applicant found cheating on the exam will be failed for the exam and prohibited from retaking the exam without permission from the dean.**
- Students cannot leave the room during the test/exam. As soon as a student leaves, his/her exam is considered finished.
- Lecture is not a substitute for textbooks. Students should read textbooks, review lectures from previous course, and use other sources to be prepared for the exam. Lecture is to guide the students to prepare for the course subjects.
- Instructor may dismiss a student from the course after missing 3 consecutive class meetings.

EVALUATION

Quizzes:

- The student will take 5 -10 quizzes 10-15 questions each at the beginning of the class.
- These quizzes will address the detailed content and major concepts presented in the lectures, lecture outlines, text readings, and study guide activities.
- No make-up quizzes for missed quizzes will be administered (the student will receive no score for missed quizzes).
- All quizzes and exams may include a video portion to assess identification and recognition of echocardiographic structures, views, and or measurements.

Midterm & Final Examinations:

- Midterm consists of 50 questions and final examination of 100 questions.
- The written examinations are proctored and will be closed-book exams.
- Every student **MUST** take the exam during the scheduled time period.
- If the reason of a missing exam is an illness or legitimate emergency the exam may be retaken as soon as possible after the student returns from the illness and as it would be determined by

the instructor. Absences covering such emergencies as serious illness or similar may be excused by the Dean provided the absence is properly documented.

- If no excuse is received by the Records Office, the student will be considered as having no excuse.

Ultrasound Hands-on Laboratory Examination:

- In the final ultrasound hands-on examination, students have to demonstrate understanding of information presented during lectures and hands-on laboratory training.
- Students have to perform echocardiographic protocols and demonstrate scanning technique and images in B-, Color-Modes, and M-mode.
- Students will schedule the time and date 2-3 weeks ahead of the Ultrasound hands-on laboratory examination.

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	94-100	91-93	87-90	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%
Presentation		10%
Scanning Performance: Midterm Exam		25%
Scanning Performance: Final Exam		25%
Laboratory	Performing of scanning protocol	20%
	Attendance lab classes	10%
TOTAL		100%

LECTURE SCHEDULE

WEEKS	DATE	TOPICS	PRACTICE
WEEK 1	08/24	Pulmonary Hypertension/Embolism. Definition, etiology, echo findings. QP/QS evaluation. RV evaluation.	Presentation of Echo cases with pulmonary hypertension, PVSP determination.
WEEK 2	08/31	Quiz. Chronic Hypertension. Ischemic heart diseases. Cardiac auscultation.	Echo presentation of cases with chronic hypertension.
WEEK 3	09/07	Quiz. Cardiomyopathies 1: definition, classification, causes, echo evaluation.	Echo presentation of cardiomyopathies cases.
WEEK 4	09/14	Cardiomyopathies 2, Echo evaluation.	Presentation of echo studies with cardiomyopathies.
WEEK 5	09/21	Quiz. Contemporary assessment of LV diastolic function according to ASE recommendations.	Practicing all stages of left ventricular diastolic dysfunction based on ASE recommendations.
WEEK 6	09/28	Quiz. New assessment of prosthetic valves. Cardiac tumors.	Cases presentation with echo evaluation.
WEEK 7-8	10/05 10/12	Midterm examination. TEE, indications, evaluation of different cardiac functions and structures. Recognizing cardiac chambers and structures on TEE.	Different cases of TEE echocardiograms. Different Findings.

WEEK 9	10/19	Congenital Heart diseases Presentation of echo cases in congenital pathology.	
WEEK 10- 11	10/26- 11/-2	Quiz. Cardiac transplantation. Indications, echo evaluation, complications. Acute/Recurrent Pericarditis. Pericardial masses/cysts	Echo presentation of relevant studies.
WEEK 12	11/09	Quiz. Echo findings in Chaga's disease, drug addiction, Kawasaki's disease, Takayasu's disease, obesity.	Presentation of relevant cases.
WEEK 13	11/16	Quiz. Athletes Heart. Heart failure: Echo findings.	Echo cases presentation.
WEEK 15	11/30	Final examination.	Practicing echo formulas, evaluating echo studies.
WEEK 16	12/07	Presentation	

DI 255 Fall 2022 Laboratory Syllabus

09/14/2022 – 11/16/2022

Monday, 6:15 PM – 9:15 PM

Ultrasound Hands-on Laboratory Training

Ultrasound hands-on laboratory training will involve:

- Using the theoretical material presented during lectures as a basis for hands-on training. Applying theoretical knowledge to practice.
- Learning to follow proper ultrasound scanning protocols.
- Acquiring optimal quality of diagnostic images.
- Proper operating of ultrasound machines and maximizing the us machines' capabilities.
- Gaining practical experience under the guidance of the lab instructor.

Instructional Methods

- In-class hands-on scanning, using ultrasound machines and other lab equipment.
- Live demonstration ultrasound imaging of the ECHO protocols
- The instructor's guidance to developing students' scanning skills.
- Group work, discussions, and ultrasound case analysis.
- Ultrasound laboratory video demonstrations.
- Students Self Study scanning: **10 lab hours** minimum of independent scanning throughout the semester.

Ultrasound Hands-on Laboratory Examination:

During the Hands-On Lab Examination, students should demonstrate:

1. The understanding of the information presented primarily during the lectures and hands-on laboratory training.
2. The knowledge of the anatomy, physiology, normal variations, and pathology of the heart.
3. In-depth knowledge of the ultrasound scanning protocols and the ability to present images in a logical sequence.
4. The use of different acoustic windows to achieve the best picture quality possible.
5. The ability to select the proper transducer for the exam.
6. The knowledge of the ultrasound machine capabilities for the optimal quality of diagnostic images (frequency, TGC, B-mode, focal zones, color scale, gain, depth, etc.).
7. The ability to describe the optimal techniques related to the field size, power, gain, contrast for the interpretation.
8. Knowledge of the elements of the image labeling.
9. Explanation of the sonographic findings and differential diagnosis of Heart Pathology.
10. Since the intent of the lab examination is for students to demonstrate the knowledge of the scanning protocol, it is not allowed to ask questions and discuss the scanning procedures with classmates.

Midterm / Final Exam Grading System

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

The length of the examination will depend on the type of the ultrasound protocol.

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

Depending on the quantity, each image of the protocol will be valued at certain number 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 exam, the student must pass it with a total score 70% or better.

Grading Scale

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Points	94-100	90-93	87-89	84-86	81-83	78-80	76-77	74-75	72-73	70-71	0-69

Lab Term Grading (30% of the total DI 255 grade)

The term grade is based on:

- Midterm and Final examination grade (20%),
- Attendance (10%).