

**Course Description****SON2400C | Echocardiography 1 | 2.00 credits**

An in-depth course designed to cover all aspects of clinical cardiovascular ultrasound studies. Topics discussed are the physiological basis of diseases, clinical presentation and clinical data, Doppler and echocardiographic findings in disease, hemodynamic relationships, scanning pitfalls, and differential diagnosis. Cardiac pathologies that will be covered are valvular pathology, ischemic heart disease, infective endocarditis, pericardial effusion, tamponade, and congestive heart failure. Prerequisite: SON1000L.

**Course Competencies**

**Competency 1:** The student will demonstrate knowledge of sonographic appearance, sonographic technique, measurements, quantitative principles, and Doppler patterns of the normal heart by:

1. Identifying the regular appearance of the heart in all two-dimensional echocardiography views
2. Identifying normal anatomy in each echocardiography view
3. Discuss average cardiac circulation, hemodynamics, and physiology
4. Identifying normal and abnormal M-Mode, 2 D, and Doppler measurements
5. Identifying and discussing quantitative principles
6. Defining cardiac output, stroke volume, and ejection fraction
7. Identify echo protocol measurements and discuss their importance and use in quantification
8. Identifying normal continuous and pulse wave patterns in each echocardiographic view
9. Identifying standard color Doppler patterns seen on each echocardiographic view
10. Discussing and identifying tissue Doppler. Discussing strain and how to calculate it
11. Identify anatomy displayed on Transthoracic and Transesophageal echocardiography images
12. Discuss console controls used to produce and optimize the image in an adult echo
13. List necessary and normal ranges of measurements in a 2D exam
14. Measuring walls, ventricular volumes, ejection fractions, and cardiac outputs on case presentations
15. Discussing the cause of abnormal measurements
16. Differentiate volume and pressure overload and describe the various causes
17. Discussing the protocol and application of contrast-enhanced echocardiography
18. Describe and identify how each protocol measurement is performed in M Mode, 2 D, and Doppler
19. Discuss evaluating normal and abnormal systolic and diastolic ventricular function
20. Identifying the severity of valve stenosis and regurgitation and views and measurements used to demonstrate this
21. Comparing and contrasting normal and abnormal 2 D and M Mode images

**Competency 2:** Demonstrate knowledge of mechanisms of disease, cardiovascular pathophysiology, and hemodynamics, sonographic technique, measurements, quantitative principles, and Doppler patterns in Valvular pathologies by:

1. Listing and identifying the definition of each of the valvular diseases
2. Describe the etiology and list the risk factors of each valvular disease
3. Identifying history, signs, and symptoms for each valvular disease
4. Listing and identifying findings of the physical examination
5. Identifying and discussing pathophysiology and possible complications
6. Discuss how the disease will affect the hemodynamics of the heart
7. Discuss cardiac auscultation findings for each of the valvular diseases

**Competency 3:** The student will demonstrate knowledge of mechanisms of disease, cardiovascular pathophysiology, hemodynamics, sonographic technique, measurements, quantitative principles, and Doppler patterns in ischemic heart disease by:

1. Demonstrate awareness of scanning protocol and modification(s) based on the sonographic findings and the differential diagnoses
2. Listing and identifying the definition of ischemic heart disease and myocardial infarction

3. Describe the etiology and risk factors
4. Discuss how ischemic heart disease will affect the hemodynamics of the heart
5. Discuss the pathophysiology of ischemic heart disease
6. Identifying history, signs, and symptoms for each
7. Discussing stable angina, unstable angina, and variant angina
8. Discussing findings of the physical examination
9. Identifying and discussing pathophysiology and possible complications
10. Discuss findings on EKG, chest x-ray, cardiac catheterization, and stress echocardiography
11. Discussing treatment
12. Identifying and listing findings of 2d echocardiography and m mode
13. Identifying pulse doppler, continuous wave doppler, and color doppler findings of ischemia heart disease
14. Listing routine measurements and abnormal measurements on 2d and doppler echocardiography
15. Listing standard measurements and abnormal measurements on m-mode
16. Identifying formulas and required measurements on 2d echocardiography
17. Identify formulas and perform required measurements on doppler
18. Identifying how pathology will affect left ventricular function
19. Discussing and describing left ventricular function measurements
20. Reviewing and identifying wall segments and coronary artery distribution
21. Identifying and describing wall motion abnormalities

**Competency 4:** The student will demonstrate knowledge of mechanisms of disease, cardiovascular pathophysiology, hemodynamics, sonographic technique, measurements, quantitative principles, and Doppler patterns in infective endocarditis by:

1. Measuring walls, ventricular volumes, ejection fractions, and cardiac outputs on case presentations
2. Discussing the cause of abnormal measurements
3. Differentiate volume and pressure overload and describe the various causes
4. Discuss the protocol and application of contrast-enhanced echocardiography
5. Describe and identify how each protocol measurement is performed in M Mode, 2 D, and Doppler
6. Discuss evaluating normal and abnormal systolic and diastolic ventricular function
7. Identifying the severity of valve stenosis and regurgitation and views and measurements used to demonstrate this
8. Comparing and contrasting normal and abnormal 2 D and M Mode images

**Competency 5:** The student will demonstrate knowledge of mechanisms of disease, cardiovascular pathophysiology, hemodynamics, sonographic technique, measurements, quantitative principles, and Doppler patterns in pericardial effusion and tamponade by:

1. Describe the etiology and risk factors
2. Discuss how ischemic heart disease will affect the hemodynamics of the heart
3. Discuss the pathophysiology of ischemic heart disease
4. Identifying history, signs, and symptoms for each
5. Discussing stable angina, unstable angina, and variant angina
6. Discussing findings of the physical examination
7. Identifying and discussing pathophysiology and possible complications
8. Discuss findings on EKG, chest x-ray, cardiac catheterization, and stress echocardiography
9. Discussing treatment

**Competency 6:** The student will demonstrate knowledge of mechanisms of disease, cardiovascular pathophysiology, and hemodynamics, sonographic technique, measurements, quantitative principles, and Doppler patterns in congestive heart failure (CHF) by:

1. Measuring walls, ventricular volumes, ejection fractions, cardiac outputs on case presentations
2. Discussing the cause of abnormal measurements
3. Differentiate volume and pressure overload and describe the various causes
4. Discussing the protocol and application of contrast enhanced echocardiography
5. Describing and identifying how each protocol measurement is performed in M Mode, 2 D, and Doppler

6. Discussing the evaluation of normal and abnormal systolic and diastolic ventricular function
7. Identifying the severity of valve stenosis and regurgitation and views and measurements used to demonstrate this
8. Comparing and contrasting normal and abnormal 2 D and M Mode images

**Competency 7:** Demonstrate knowledge and comprehension of measurements done on Doppler by:

1. Identifying Doppler measurements done in normal and abnormal cases
2. Listing the normal ranges of measurements done on the Doppler exam
3. Interpreting the cause of abnormal measurements on Doppler
4. Performing measurements on case presentations

**Competency 8:** Demonstrate knowledge and comprehension of cardiac surgical procedures and invasive procedures by:

1. Listing and describing alternative imaging techniques used to evaluate the heart
2. Listing treatments of valvular disease, including types of valvular replacements
3. Describing pericardiocentesis
4. Describing ultrasound-guided procedures (i.e., TEE, intracardiac echo)
5. Listing and defining the types of invasive procedures and their purpose
6. Defining the types of cardiac surgical procedures (i.e., CABG, TAVR)

**Learning Outcomes:**

- Communicate effectively using listening, speaking, reading, and writing skills
- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information
- Use computer and emerging technologies effectively