Structured Learning Plan for Adult Echocardiography: 20-Day Hands-on Training

Week 1: Fundamentals of Echocardiography

Day 1: Introduction to Echocardiography

- **Lecture Topics:**
  - Basic principles and indications of echocardiography
  - History and clinical significance
  - Types: Transthoracic, Transesophageal, Stress Echo
- **Hands-on:** Basic orientation with echo machine
- **Visual Quiz 1:** Normal heart chambers labeled in 2D views

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Day 2: Theory and Methodology of Echocardiography

- **Lecture Topics:**
  - Physics of ultrasound specific to echo
  - Beam direction, angle of insonation, acoustic impedance
  - Knobology for echo: gain, depth, focus, frame rate
- **Hands-on:** Machine setup, image optimization
- **Assessment:** Written quiz

Day 3: Echocardiography Machine Instrumentation

- **Lecture Topics:**
  - Transducer types (phased array), signal processing
  - Harmonic imaging, frame rate vs resolution
  - Digital storage, PACS, and DICOM standards
- **Hands-on:** Controls for 2D, M-mode, Doppler
- **Oral Exam:** Echo system components and usage

Day 4: Human Heart Anatomy & Sonographic Correlate

- **Lecture Topics:**
  - Anatomical structures: chambers, valves, vessels
  - Sonographic views and cross-sectional orientation
- **Hands-on:** 2D visualization of basic anatomy
- **Visual Quiz 2:** Label heart structures on echo stills

Day 5: Acoustic Windows & Basic Echo Views

- **Lecture Topics:**
  - Parasternal, apical, subcostal, suprasternal, subxiphoid windows
  - Probe placement, patient positioning
- **Hands-on:** View acquisition and probe manipulation
- **Assessment:** Oral practical on acoustic windows

🔷 Week 2: Echo Imaging Modalities

Day 6: 2D B-Mode Imaging and Views

- **Lecture Topics:**

  - PLAX, PSAX, A4C, A2C, A3C, subcostal views
  - Orientation, anatomical landmarks
- **Hands-on:** Acquire B-mode views
- **Visual Quiz 3:** Identify 2D views and interpret anatomy

Day 7: M-Mode Echocardiography

- **Lecture Topics:**
  - Principles of M-mode
  - Applications in valve motion, wall thickness, chamber size
- **Hands-on:** Parasternal long axis M-mode capture
- **Assessment:** Written and oral M-mode interpretation

Day 8: Color Flow Doppler Imaging

- **Lecture Topics:**
  - Principles of color Doppler
  - Aliasing, direction of flow, color interpretation
- **Hands-on:** Acquire mitral, aortic, tricuspid flow
- **Visual Quiz 4:** Color Doppler pathology (e.g., regurgitation)

Day 9: Spectral Doppler (PW, CW)

- **Lecture Topics:**
  - Pulsed-wave vs continuous-wave Doppler
  - Velocity measurements, E/A ratio, pressure gradients
- **Hands-on:** Doppler signal acquisition and adjustment
- **Assessment:** Oral interpretation of normal vs abnormal Doppler

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Day 10: Integrative Imaging Review

- **Lecture Topics:**
  - Optimizing all modes: 2D + M-mode + Doppler + Color
  - Common errors in image acquisition
- **Hands-on:** Composite scanning session
- **Written Quiz 2:** Multiple choice and image-based items

🔷 **Week 3: Quantification and Pathology**

Day 11: Chamber Quantification – Part 1

- **Lecture Topics:**
  - LV, RV, LA, RA size and volume
  - Linear vs volumetric methods
- **Hands-on:** Measurement practice
- **Visual Quiz 5:** Quantify given chamber sizes

Day 12: Chamber Quantification – Part 2

- **Lecture Topics:**
  - Ejection fraction (Teichholz, Simpson's)
  - Wall motion analysis

- **Hands-on:** LV function estimation
- **Assessment:** Practical + oral on chamber quantification

Day 13: Valve Assessment – Mitral & Aortic

- **Lecture Topics:**
  - Mitral stenosis/regurgitation
  - Aortic stenosis/regurgitation
  - Quantification techniques: pressure half-time, continuity equation
- **Hands-on:** Doppler interrogation of mitral/aortic valves
- **Visual Quiz 6:** Identify valvular lesions on Doppler

Day 14: Valve Assessment – Tricuspid & Pulmonary

- **Lecture Topics:**
  - Tricuspid insufficiency, RVSP estimation
  - Pulmonary valve abnormalities
- **Hands-on:** Right heart scanning
- **Assessment:** Oral and practical

Day 15: Cardiomyopathies & Wall Motion Abnormalities

- **Lecture Topics:**
  - Dilated, hypertrophic, and restrictive cardiomyopathy
  - Segmental motion abnormalities and ischemic changes
- **Hands-on:** Identify wall motion abnormalities
- **Written Quiz 3:** Cardiomyopathies + chamber function

🔷 **Week 4: Advanced Topics, Reporting & Assessment**

Day 16: Pericardial and Aortic Disease

- **Lecture Topics:**
  - Pericardial effusion, tamponade
  - Aortic root dilation, dissection
- **Hands-on:** Subcostal and suprasternal views
- **Visual Quiz 7:** Effusion vs tamponade vs artifact

Day 17: Special Echo Procedures

- **Lecture Topics:**
  - Contrast echocardiography
  - Stress echocardiography
  - Transesophageal echocardiography (TEE)
- **Video Case Presentation:** TEE probe handling, contrast echo video cases

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Day 18: Final Written Examination

- **Format:**
  - Multiple choice + case-based

- Normal vs pathological findings
- Measurement interpretation and calculations

Day 19: Final Oral & Practical Examination

- **Format:**
  - Present one normal and one pathological case
  - Image acquisition, interpretation, and verbal reporting

Day 20: Certificate Awarding & Final Review

- **Activities:**
  - Summary of key learning points
  - Student feedback and discussion
  - Certificate awarding ceremony

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