CONTENT SPECIFICATIONS FOR THE EXAMINATION IN BREAST SONOGRAPHY

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The purpose of the ARRT Examination in Breast Sonography is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of staff sonographers practicing in this specialized area. In order to identify the knowledge and skills covered by the examination, the ARRT conducted a practice analysis study involving a nationwide sample of breast sonographers[1]. The results of the practice analysis are reflected in this document.

The table below presents the four major content categories covered on the examination, along with the number of test questions in each category. The remaining pages of this document list the specific topics addressed within each major content category. The approximate number of test questions allocated to each topic appears in parentheses.

	CONTENT CATEGORY	NUMBER OF QUESTIONS[2]
A.	Physics, Instrumentation, and Equipment Operation	52
B.	Clinical Image Production and Evaluation	64
C.	Breast Sonography Anatomy, Physiology, and Pathology	59
D.	Interventional Breast Sonography	10
		185

1. A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents, and reviewers.

2. Each exam includes an additional 20 unscored (pilot) questions. On the pages that follow, the approximate number of test questions allocated to each content category appears in parentheses.

A. PHYSICS, INSTRUMENTATION, AND EQUIPMENT OPERATION (52)

1. Sonographic Equipment (15)

A. Ultrasound Unit
   1. console
   2. monitor

B. Transducers
   1. piezoelectric effect
   2. components
   3. resonance frequency
   4. beam characteristics (e.g., near zone/field, far zone)
   5. focusing
   6. array types

2. Basic Principles of Ultrasound (28)

A. Generation of Signal

B. Ultrasound Wave Characteristics
   1. speed of sound (propagation speed)
   2. frequency
   3. geometry – reflection and refraction
   4. intensity of signal
   5. acoustic impedance
   6. attenuation coefficient
   7. pulsed
   8. Doppler
   9. specular reflectors
   10. amplitude

C. Fundamentals
   1. relationship of speed of sound, frequency, and wavelength
   2. image resolution
      a) axial
      b) lateral
      c) contrast
   3. range equation
   4. dynamic range

3. Evaluation of Sonographic Equipment and Accessories (3)

A. Equipment Quality Control: Utilizing Tissue Equivalent (mimicking) Phantom
   1. sensitivity (e.g., contrast resolution, detection of lesion, dead zone)
   2. vertical and horizontal display accuracy
   3. focal zone
   4. resolution (e.g., lateral, axial)
   5. TGC characteristics
   6. dynamic range

B. Doppler Quality Control Tests
   1. flow phantoms
   2. string phantoms

C. Recognition of Equipment Malfunctions

D. Quality Control of Recording Devices

4. Image Display and Storage (5)

A. Display
   1. pre- and post-processing
   2. brightness and contrast
   3. display mode (e.g., Doppler, brightness)

B. Recording Media
   1. types (e.g., paper, film, digital storage)

5. Cleaning and Disinfecting Equipment (1)
(e.g., transducers, keyboard, monitor)

B. CLINICAL IMAGE PRODUCTION AND EVALUATION (64)

1. Patient Communication, Education, and Assessment (14)

A. Explanation of Current Procedure

B. Respond to Inquires About Other Breast Imaging Procedures (mammography, CT, MRI, nuclear medicine)

C. Respond Regarding Accreditation of Ultrasound Facilities and Personnel

D. Verification of Requested Examination
   1. comparison of request to clinical indications for appropriateness
   2. review of pertinent patient data (e.g., lab values, allergies, medications, breast imaging studies)
   3. perform physical breast assessment and document findings
   4. obtain appropriate clinical history

E. Breast Cancer
   1. epidemiology
      a) incidence
      b) risk factors
   2. detection
      a) ACS guidelines for mammography screening
      b) breast self-examination (BSE)
      c) clinical breast examination (CBE)
      d) signs and symptoms

2. Image Production (25)

A. Transducer Selection
   1. frequency
   2. type

B. Selection and Adjustment of Technical Factors
   1. power
   2. focal zone
   3. field of view
   4. time-gain compensation (TGC)
   5. overall (coarse) gain
   6. Doppler, as applicable
   7. dynamic range

C. Safety and Bioeffects

D. Patient Positioning

E. Acoustic Transmission Media (e.g., gel, stand-off pads)

F. Image Orientation

G. Image Annotation
   1. side
   2. scan plane
   3. clock face

(Section B continues on the following page)

B. CLINICAL IMAGE PRODUCTION AND EVALUATION (cont.)

3. Evaluation and Selection of Representative Images (25)

A. Criteria for Diagnostic Quality
   1. demonstration of anatomical structure
   2. demonstration of pathological conditions
   3. use of calipers

B. Artifact Recognition
   1. shadowing
   2. enhancement
   3. reverberation
   4. color Doppler flash
   5. other

C. Modification of Technique to Optimize Images

D. Selection of Mammographic Views
   1. standard views
      a) craniocaudal (CC)
      b) mediolateral oblique (MLO)
   2. additional views
      a) mediolateral (ML)
      b) lateromedial (LM)
   3. ACR labeling

E. Correlation with Mammographic Findings
   1. triangulation
   2. image concordance

C. ANATOMY, PHYSIOLOGY, AND PATHOLOGY (59)

1. Anatomy and Physiology (17)

A. Ducts

B. Fibroglandular Tissue

C. Fat

D. Skin

E. Cooper's Ligaments

F. Fascia

G. Pectoralis Muscle

H. Ribs

I. Pregnancy Induced Changes

J. Nipple

K. Vascular System

L. Lymphatic System

2. Pathology (35)

A. Benign Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)

1. cyst
2. galactocele
3. sebaceous cyst
4. fibroadenoma
5. papilloma
6. lipoma
7. hamartoma
8. abscess and inflammation
9. traumatic changes
10. fat necrosis
11. ductal ectasia
12. edema
13. diabetic mastitis
14. pseudoangiomatous hyperplasia
15. phyllodes
16. radial scar
17. gynecomastia

B. Malignant Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)

1. DCIS
2. invasive ductal carcinoma
3. invasive lobular carcinoma
4. medullary carcinoma
5. mucinous (colloid) carcinoma
6. inflammatory carcinoma
7. phyllodes
8. lymphoma
9. metastasis
10. lymph nodes
11. papillary carcinoma
12. Paget's disease

3. Surgical/Treatment Changes (7)

A. Post-Surgical Changes (i.e., lumpectomy, axillary dissection, and mastectomy)

B. Hematomas

C. Breast Reduction

D. Breast Augmentation

E. Post-Radiation Changes

F. Neo-Adjuvant Chemotherapy

G. Hormonal Therapy (e.g., tamoxifen)

H. Post Mastectomy Reconstruction (e.g., TRAM flap, latissimus dorsi)

D. INTERVENTIONAL BREAST SONOGRAPHY (10)

1. Procedures (10)

A. Localizations

B. Core Biopsy

C. FNA

D. Cyst Aspiration

E. Abscess Drainage

F. Breast Specimen Imaging

G. Clip Placement

FOCUS OF QUESTIONS

Questions about each of the procedures listed on the left may focus on any of the following factors:

1. Sterile Technique
2. Infection Control and Prevention
3. Patient Monitoring
4. Complications
5. Post-Procedural Care