

Diagnostic Medical Sonography Mississippi Curriculum Framework

Program CIP: 51.0910 – Diagnostic Medical Sonography/Sonographer and Ultrasound

2018



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The Office of Curriculum and Instruction (OCI) was founded in 2013 under the Division of Workforce, Career, and Technical Education at the Mississippi Community College Board (MCCB). The office is funded through a partnership with The Mississippi Department of Education (MDE), who serves as Mississippi's fiscal agent for state and federal Career and Technical Education (CTE) Funds. The OCI is tasked with developing statewide CTE curriculum, programming, and professional development designed to meet the local and statewide economic demand.

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ADOPTION OF NATIONAL CERTIFICATION STANDARDS

The American Registry for Diagnostic Medical Sonography® (ARDMS®) administers examinations and awards credentials in areas of ultrasound. Through its mission, ARDMS empowers sonographers to provide exceptional patient care through rigorous assessments and continual learning. Inteleos is the non-profit governance and management organization for ARDMS and its companion Council the Alliance for Physician Certifications & Advancement (APCA).

- Inteleos Family of Brands Video
- ARDMS New 2016 Organizational Structure
- ARDMS Council Members
- Legislation
- Mission and Vision
- ARDMS Trademarks
- Careers at ARDMS

ARDMS administers examinations and award the following credentials:

- Registered Diagnostic Medical Sonographer® (RDMS®)
- Registered Diagnostic Cardiac Sonographer® (RDCS®)
- Registered Vascular Technologist® (RVT®)
- Registered Musculoskeletal™ Sonographer(RMSKS™)

ARDMS credentials have been awarded to over 90,000 medical professionals worldwide and are recognized as the international standard in sonography credentialing.

INDUSTRY JOB PROJECTION DATA

The Diagnostic Medical Sonographers occupations require an education level of short-term on-the-job training or work experience in a related field. There is expected to be a 7.38% increase in occupational demand at the regional level and 22.82% increase at the state level. Median annual income for this occupation is \$56,534.40 at the state level. A summary of occupational data from the State Workforce Investment Board Data Center is displayed below:

Table 1: Education Level

Program Occupations	Education Level
Diagnostic Medical Sonographers	Associate Degree

Table 2: Occupational Overview

	Region	State	United States
2014 Occupational Jobs	631	631	62326
2024 Occupational Jobs	775	775	66927
Total Change	144	144	4601
Total % Change	22.82%	22.82%	7.38%
2010 Median Hourly Earnings	\$27.18	\$27.18	\$32.47
2010 Median Annual Earnings	\$56,534.40	\$56,534.40	\$67,537.60
Annual Openings	14	14	460

Table 3: Occupational Breakdown

Description	2010 Jobs	2020 Jobs	Annual Openings	2010 Hourly Earnings	2010 Annual Earnings 2,080 Work Hours
Diagnostic Medical Sonographers	631	775	14	\$27.18	\$56,534.40
TOTAL	631	775	14	\$27.18	\$56,534.40

Table 4: Occupational Change

Description	Regional Change	Regional % Change	State % Change	National % Change
Diagnostic Medical Sonographers	144	22.82%	22.82%	7.38%

ARTICULATION

At this time, there is no secondary Diagnostic Medical Sonography program to articulate into this postsecondary program.

TECHNICAL SKILLS ASSESSMENT

Colleges should report the following for students who complete the program with a career certificate, technical certificate, or an Associate of Applied Science Degrees for technical skills attainment. To use the approved Alternate Assessment for the following programs of study, colleges should provide a Letter of Notification to the Director of Career Technical Education at the MS Community College Board. Please see the following link for further instructions: <http://www.mccb.edu/wkfEdu/CTDefault.aspx>.

CIP Code	Program of Study	
51.0910	Diagnostic Medical Sonography	
Level	Standard Assessment	Alternate Assessment
Career		
Level	Standard Assessment	Alternate Assessment
Technical/AAS	American Registry for Diagnostic Medical Sonographers ARDMS SPI,AB, *OB *OB is not required. It is the student's choice to take the exam	

ASSESSMENT STRATEGIES

The Office of Curriculum and Instruction's professional development offer assessment strategies to faculty members implementing the curriculum. Additionally, standards were included in course content when appropriate.

RESEARCH ABSTRACT

In the fall of 2018, the Office of Curriculum and Instruction (OCI) met with the different industry members who made up the advisory committees the Diagnostic Medical Sonography program. An industry questionnaire was used to gather feedback concerning the trends and needs, both current and future, of their field. Program faculty, administrators, and industry members were consulted regarding industry workforce needs and trends. Industry advisory team members from the college involved with this program were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills are oral and written communication, critical thinking, and use of technology. Occupation-specific skills include ergonomics, physics, knowledge of medical terminology, knowledge of anatomy, medical ethnics, patient care safety, and a desire to continually learn with the advancement in Diagnostic Medical Sonography.

REVISION HISTORY:

2011 Research and Curriculum Unit, Mississippi State University
2018 Mississippi Community College Board

PROGRAM DESCRIPTION

Diagnostic Medical Sonography uses high frequency sound waves to produce images of organs, masses, fluid collections, and vascular structures within the human body. Sonography is user dependent, requiring competent and highly skilled professionals to be a part of the integral health care system. Sonographers have extensive, direct patient contact, providing care to a variety of people from healthy to critically ill. The sonographer is responsible for obtaining pertinent patient history, performing the sonographic examination, providing for the needs and comfort of the patient during examination, and recording anatomy and pathology or other data for interpretation by the supervising physician to aid in diagnosis. Sonography is commonly used in the field of obstetrics and gynecology for purposes ranging from confirming and/or dating pregnancies to diagnosing disease processes of the female reproductive system. Sonographers must have knowledge of normal structure and functional anatomy of the human body and use independent judgment in recognizing the need to perform procedures according to sonographic findings.

Upon completion of the 2-year program of study, the student will be awarded the Associate of Applied Science degree. Until a Diagnostic Medical Sonography program reaches accreditation approval from CAAHEP, the students must meet the following criteria in order to apply to sit for the *American Registry for Diagnostic Medical Sonographers*:

- Be a graduate from a 2-year allied health program that is patient care related that includes but is not limited to Diagnostic Medical Sonography, Radiologic Technology, Respiratory Therapy, Registered Nurse, Occupational Therapy, and Physical Therapy; and have 12 months of full-time clinical ultrasound/vascular experience.
 - Hold a Bachelor's degree and have 12 months of full-time clinical ultrasound/vascular experience.
- Graduates from a CAAHEP accredited Diagnostic Medical Sonography Program may apply to take the ARDMS without further experience.

Industry standards referenced are from the *CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography* (2007).

SUGGESTED COURSE SEQUENCE

Required Courses

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab/Clinical	Total Contact Hours	Lecture	Lab	Certification Name
*PHY 1212 OR *RGT 1613	Survey of Physics OR Physics of Imaging Equipment	2 OR 3	2	0	90			American Registry for Diagnostic Medical Sonographers ARDMS SPI,AB
HIT 1213	Medical Terminology	3	3	0	45			
DMS 1114	Introduction to Ultrasound	4	3	2	75			
DMS 1213	Sectional Anatomy	3	3	0	45			
DMS 1313	Ultrasound Physics and Instrumentation I	3	3	2	60			
DMS 1323	Ultrasound Physics and Instrumentation II	3	3	2	60			
DMS 1415	Clinical Experience I	5	0	15	225			
DMS 1426	Clinical Experience II	6	0	18	270			
DMS 1513	Abdominal Sonography	3	3	0	45			
DMS 1524	Obstetrical and Gynecological Sonography	4	3	2	75			
DMS 1533	Advanced Sonographic Procedures	3	3	0	45			
DMS 1435	Clinical Experience III	5	0	15	225			
DMS 1612	Sonography Seminar	2	2	0	30			
DMS 1622	Ultrasound Examination Critique	2	2	0	90			
	TOTAL	47 OR 48						

Applicants without a 2-year allied health patient care related degree must take basic patient care and medical-legal ethics courses.

*PHY 1212 Survey of Physics OR RGT 1613 Physics of Imaging Equipment; HIT 1213 Medical Terminology in Allied Health are Pre-requisites to enter the Diagnostic Medical Sonography Program.

General Education Core Courses – Diagnostic Medical Sonography

To receive the Associate of Applied Science Degree, a student must complete all of the required coursework found in the Career Certificate option, Technical Certificate option and a minimum of 15 semester hours of General Education Core. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester or provided primarily within the last semester. Each community college will specify the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college. The Southern Association of Colleges and Schools (SACS) Commission on Colleges Standard 2.7.3 from the Principles of Accreditation: Foundations for Quality Enhancement¹ describes the general education core.

Section 2.7.3 In each undergraduate degree program, the institution requires the successful completion of a general education component at the collegiate level that (1) is substantial component of each undergraduate degree, (2) ensures breadth of knowledge, and (3) is based on a coherent rationale. For degree completion in associate programs, the component constitutes a minimum of 15 semester hours or the equivalent. These credit hours are to be drawn from and include at least one course from the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics. The courses do not narrowly focus on those skills, techniques, and procedures specific to a particular occupation or profession.

General Education Courses

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
	Humanities/Fine Arts	3						
	Social/Behavioral Sciences	3						
MAT 1313	College Algebra	3						
	Academic electives	6						
	TOTAL	15						

¹

Southern Association of Colleges and Schools Commission on Colleges. (2012). *The principles of accreditation: Foundations for quality enhancement*. Retrieved from <http://www.sacscoc.org/pdf/2012PrinciplesOfAccreditation.pdf>

²

Commission on Accreditation of Allied Health Education Programs. (2011).

Listing

			SCH Breakdown				Contact Hour Breakdown		
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Externship	Total Contact Hours	Lecture	Lab	Externship
*PHY 1212 OR *RGT 1613	Survey of Physics OR Physics of Imaging Equipment								
HIT 1213	Medical Terminology								
DMS 1114	Introduction to Ultrasound								
DMS 1213	Sectional Anatomy								
DMS 1313	Ultrasound Physics and Instrumentation I								
DMS 1323	Ultrasound Physics and Instrumentation II								
DMS 1415	Clinical Experience I								
DMS 1426	Clinical Experience II								
DMS 1513	Abdominal Sonography								
DMS 1524	Obstetrical and Gynecological Sonography								
DMS 1533	Advanced Sonographic Procedures								
DMS 1435	Clinical Experience III								
DMS 1612	Sonography Seminar								
DMS 1622	Ultrasound Examination Critique								

DIAGNOSTIC MEDICAL SONOGRAPHY COURSES

Course Number and Name: DMS 1114 Introduction to Ultrasound

Description: Students will be introduced to ultrasound equipment. Cleaning and disinfectant procedures will be shown. Types of film, paper printers, video recorders, scanning tables, ultrasound probes, and recording methods will be discussed. Legal/ethical issues and patient contact within the ultrasound department, as well as scanning protocols, are included. Students will learn the sonographer's role in patient care.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
4	3	2	75

Prerequisite: Instructor approved

Student Learning Outcomes:

- Describe the role, organization, and structure of the ultrasound program, ultrasound department, hospital, or clinic as well as the profession. DMSIII C3, DMSC1, DMSC2, DMSC3,
 - State the rules and regulations of the ultrasound program regarding class attendance, grading, vacation/sick leave, and the appeals procedure.
 - Discuss the departmental and hospital/clinic rules and regulations that directly and indirectly affect ultrasound students.
 - List the major duties and responsibilities of an ultrasound student.
 - Define the *Essentials and Guidelines of an Accredited Educational Program for the Sonographer* and its purpose.
 - State policies concerning communicable disease and pregnancy for ultrasound students.
 - Identify other health science professions that impact the total health care provided to ultrasound patients.
 - Describe the relationship of ultrasound health-care workers to the integrated care of patients.
 - Identify key personnel, and discuss their function in the ultrasound department.
 - Define accreditation, credentialing, certification, licensure, and regulations associated with ultrasound.
 - Describe how the information in *JRCDCMS Standards and Guidelines for an Accredited Educational Program for the Sonographer* relates to the ultrasound program.
 - Explain the difference between the accreditation and credentialing processes, and identify agencies involved in each process associated with ultrasound.
 - Describe purposes, functions, and activities of professional organizations associated with ultrasound.
 - Identify international, national, state, and local organizations for the sonographer.
 - Discuss general employment outlook and economic return for the sonography graduate.
 - Discuss career advancement and opportunities for the sonographer.
 - Identify benefits of continuing education of the sonographer.
- Assess and resolve ethical issues and dilemmas in health care. DMSC1 e,f,g,h; DMSC3 a,b,f,g,h
 - Describe the major milestones in the development of codes of behavior and ethical standards in the healing arts.
 - Identify the significance of health-care professions.
 - Recognize the moral, social, and cultural basis of the development of an ethic.
 - Discuss the role of ethical behavior in health-care delivery.
 - Differentiate between empathetic and sympathetic involvement in relationships with patients.

- f. Identify concepts of personal honesty, integrity, accountability, competence, and compassion as ethical imperatives in health care.
 - g. Recognize situations and conditions that give rise to ethical dilemmas in health care.
 - h. Discuss the legal implications of professional liability, malpractice, professional /carelessness, and other legal doctrines applicable to professional practice.
 - i. Discuss the significance of accurate, complete, and correct methods of medical record keeping as a legal/ethical imperative.
 - j. Articulate responses to theoretical situations and questions relating to the ethics of care and health-care delivery.
3. Identify legal responsibilities related to the scope of practice for sonography. ^{DMSC1 f,g,h,i,j}
- a. Define the scope of practice for the diagnostic medical sonographer.
 - b. Identify the requirements of the sonographer according to the scope of practice.
4. Describe clinical practice standards in diagnostic ultrasound. ^{DMSC3 a,b,f,g,h,i,}
- a. Identify patient history and correlate with the sonographic procedure requested.
 - b. Determine patient ability to tolerate the sonographic procedure.
 - c. Evaluate any contraindications to the sonographic procedure such as medications, inappropriate patient preparation, or unwillingness of the patient to tolerate the sonographic procedure.
 - d. Explain the sonography procedure to the patient and respond to patient questions.
 - e. Refer specific diagnostic, treatment, or prognosis questions to the patient's physician.
 - f. Develop a procedure plan for the sonographic exam.
 - g. Adapt the sonographic procedure plan to optimize exam results.
 - h. Determine if contrast media will enhance image quality and provide additional diagnostic information.
 - i. Determine the need for additional accessory equipment or additional personnel.
 - j. Modify sonographic procedure plan according to patient disease process and circumstances under which the procedure must be performed (i.e., operating room, ultrasound room, patient bedside, or emergency room).
 - k. Modify sonographic procedure plan according to patient physical and mental status during the exam.
 - l. Perform basic patient care tasks.
 - m. Analyze sonographic findings throughout the exam, and perform measurements to provide accurate diagnosis for treatment plan.
 - n. Confirm that the sonographic exam complies with applicable protocols and guidelines.
 - o. Document sonographic exam results.
 - p. Notify the appropriate health-care provider when immediate medical attention is necessary.
 - q. Provide a written summary of preliminary sonographic findings.
 - r. Implement quality assurance within the ultrasound department.
5. Maintain patient care. ^{DMSC3 a,b,c,d,e,f,g,h}
- a. Work in partnership with other health-care professionals.
 - b. Maintain appropriate professional credentials.
 - c. Provide a diagnostic sonographic exam for the patient by applying professional judgment and discretion.
 - d. Maintain continuing medical education on current issues in sonography.
 - e. Identify personal strengths and use them to benefit patients, coworkers, and the profession.
 - f. Perform diagnostic sonographic procedures in supervised clinical experiences.
 - g. Communicate effectively with all members of the health-care team.
 - h. Maintain patient confidentiality.
 - i. Utilize standard precautions.
6. Use ultrasound equipment and accessory items. ^{DMSC3 a, e, f, h, j}
- a. Demonstrate use of ultrasound equipment.

- b. Scan and document findings in the ultrasound lab setting.
- c. Produce ultrasound images according to standards of care.
- d. Identify ultrasound scanning techniques.
- e. Use proper gain controls to produce diagnostic ultrasound images.
- f. Document total ultrasound scanning time in each procedure.
- g. Perform the required images for ultrasound abdominal scanning.
- h. Perform the required ultrasound images for obstetrical and gynecological scanning.
- i. Recognize the importance of an employer ergonomically correct scanning techniques.
- j. Demonstrate knowledge and understanding between ultrasound and tissue and the probability of biological effects in clinical examination.

**CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography
2011 updates 2016**

DMSC1 Utilize oral and written communication.

DMSC2 Provide basic patient care and comfort.

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy. DMSC4

Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSC9 Recognize the importance of continuing education.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Course Number and Name: DMS 1213 Sectional Anatomy

Description: This course provides student with ultrasound appearance of abdominal and pelvic sectional anatomy. It includes a description of gross sectional anatomy and identification of sonographic appearance of normal anatomy

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Describe the anatomy, physiology, and sonographic appearance of abdominal structures in cross-sectional longitudinal and transverse planes. DMSC1, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSD2, DMSD3, DMSD4
 - a. Describe the anatomy and sonographic appearance of the abdominal aorta.
 - b. Describe the anatomy and sonographic appearance of the inferior vena cava.
 - c. Describe the anatomy and sonographic appearance of the liver.
 - d. Describe the anatomy and sonographic appearance of the gallbladder and biliary system.
 - e. Describe the anatomy and sonographic appearance of the spleen.
 - f. Describe the anatomy and sonographic appearance of kidneys.
 - g. Describe the anatomy and sonographic appearance of the pancreas.
 - h. Label abdominal structures on sonographic images in both longitudinal and transverse planes.
2. Describe the anatomy and physiology of female pelvic structures in cross-sectional longitudinal and transverse planes. DMSC1, DMSC3, DMSC7, DMSD2, DMSD4, DMSD6
 - a. Describe the anatomy and sonographic appearance of the uterus and pelvic cavity.
 - b. Describe the anatomy and sonographic appearance of ovaries.
 - c. Label female pelvic structures on sonographic images in both longitudinal and transverse planes.
3. Describe the anatomy, physiology, and sonographic appearance of obstetrical structures in cross-sectional longitudinal and transverse planes. DMSC1, DMSC3, DMSC7, DMSD2, DMSD5, DMSD7
 - a. Describe the anatomy and sonographic appearance of the pregnant uterus, placenta, cervix, ovaries, and associated structures.
 - b. Describe the anatomy and sonographic appearance of a fetus during pregnancy.
 - c. Label obstetrical structures on sonographic images in both longitudinal and transverse planes.
4. Describe the anatomy, physiology, and sonographic appearance of superficial structures in cross-sectional longitudinal and transverse planes. DMSC1, DMS C3, DMSC7, DMSD2, DMSD5, DMSD7
 - a. Describe the anatomy and sonographic appearance of adrenal glands.
 - b. Describe the anatomy and sonographic appearance of the thyroid, parathyroid, and breasts.
 - c. Describe the anatomy and sonographic appearance of the prostate and scrotum.
 - d. Label small parts on sonographic images in both longitudinal and transverse planes.

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography 2011 updates 2016

DMSC1 Utilize oral and written communication.

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.

DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC7 Employ professional judgment and discretion.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Course Number and Name: DMS 1313 Ultrasound Physics and Instrumentation I

Description: In- depth presentation of basic principles of diagnostic medical ultrasound physics and instrumentation. Description of diagnostic ultrasound transducers and ultrasound interaction with human tissue will be presented.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Discuss elementary principles of diagnostic medical sonography physics. ^{DMSC1, DMSC5, DMSC6, DMSC14a}
 - a. Discuss the nature of ultrasound.
 - b. Describe frequency, wavelength, and propagation speed as associated with ultrasound.
 - c. Describe the properties of ultrasound waves.
 - d. Describe decibel notation in relation to ultrasound.
 - e. Describe physical units associated with diagnostic ultrasound.
 - f. Describe measurement dimensions used in diagnostic ultrasound.
2. Describe propagation of ultrasound through tissues. ^{DMSC1 3a, DMSC5, DMSC6, DMSC14a}
 - a. Describe the speed of sound through human tissues.
 - b. Describe reflection of ultrasound within human tissues.
 - c. Describe refraction of ultrasound within human tissues.
 - d. Describe attenuation of ultrasound within human tissues.
 - e. Describe the useful range of frequencies in diagnostic ultrasound.
 - f. Describe terminology of ultrasound image characteristics.
3. Describe the function of ultrasound transducers. ^{DMSC13a, DMSC53e, DMSC63f, DMSC14a}
 - a. Describe the piezoelectric effect.
 - b. Identify transducer construction and characteristics.
 - c. Describe ultrasound beam formation.
 - d. Describe axial resolution of ultrasound beams.
 - e. Describe lateral resolution of ultrasound beams.
 - f. Describe slice thickness of ultrasound beams.
 - g. Describe focusing methods of ultrasound transducers.
 - h. Describe transducer arrays and image appearance of ultrasound transducers.
 - i. Describe ultrasound transducer care and maintenance.
4. Describe pulsed-echo instrumentation of diagnostic ultrasound equipment. ^{DMSC1, DMSC5, DMSC6, DMSC14a}
 - a. Describe the general concepts of the range equation as associated with diagnostic ultrasound.
 - b. Describe pulsing characteristics of diagnostic ultrasound equipment.
 - c. Describe the effects of output power of ultrasound transducers on ultrasound imaging.
 - d. Describe the functions of the ultrasound receiver.
5. Describe the principles of diagnostic ultrasound pulsed-echo imaging ^{DMSC1, DMSC5, DMSC6, DMSC14a}
 - a. Describe principal display modes of diagnostic ultrasound imaging equipment.
 - b. Describe the principles of real-time, B-mode image formation of diagnostic medical ultrasound equipment.
 - c. Describe limitations of scanning speed of diagnostic medical ultrasound equipment.
 - d. Describe the principles of 3D/4D imaging.

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography 2011 updates 2016

DMSC1 Utilize oral and written communication.

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

Course Number and Name: DMS 1323 Ultrasound Physics and Instrumentation II

Description: A continuation of Ultrasound Physics and Instrumentation I (DMS 1313). This class includes an in-depth presentation of image display modes, Doppler, color, and hemodynamics of diagnostic ultrasound. The cause of artifacts and how to scan safely, conduct instrument performance measurements, and prepare for registry examinations.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Describe images, storage, and display methods used in diagnostic medical ultrasound. DMSC1 3a, DMSC5 ce, DMSC6 3f, DMSC7 3g, DMSC1
 - a. Describe the role of the scan converter in diagnostic ultrasound imaging.
 - b. Describe digital devices used in diagnostic ultrasound equipment.
 - c. Describe pre- and post-processing functions of diagnostic medical ultrasound equipment.
 - d. Describe the display devices used with diagnostic medical ultrasound equipment.
 - e. Describe recording and archiving techniques employed in diagnostic medical ultrasound.
2. Describe Doppler instrumentation of diagnostic medical ultrasound. DMSC1 3a, 4a, DMSC5, DMSC6, DMSC7
 - a. Describe hemodynamics.
 - b. Describe the physical principles of Doppler ultrasound imaging.
 - c. Describe continuous and pulsed wave Doppler instrumentation in diagnostic medical ultrasound.
 - d. Describe color flow imaging in diagnostic ultrasound.
 - e. Describe color power mode imaging in diagnostic ultrasound.
3. Discuss ultrasound artifacts. DMSC1 3a, DMSC5 ce, DMSC6 3f, DMSC7 3g
 - a. Define artifacts in ultrasound imaging.
 - b. Describe artifacts associated with resolution of ultrasound waves in human tissues.
 - c. Describe ultrasound artifacts associated with propagation of ultrasound waves in human tissues.
 - d. Describe ultrasound artifacts associated with attenuation of ultrasound waves in human tissues.
 - e. Describe artifacts associated with Doppler and color flow instrumentation in diagnostic ultrasound.
 - f. Describe artifacts caused by electronic noise and equipment malfunction in diagnostic ultrasound.
 - g. Describe the effects of artifacts on measurements in diagnostic ultrasound.
4. Perform performance and safety standards for ultrasound equipment. DMSC1 3a, DMSC5 ce, DMSC6 3f, DMSC7 3g, DMSC8 3h
 - a. Discuss general concepts regarding the need for quality assurance in diagnostic ultrasound.
 - b. Discuss methods for evaluating ultrasound instrument performance.
 - c. Identify parameters to be evaluated in quality assurance of diagnostic medical ultrasound equipment.
 - d. Describe preventative maintenance of diagnostic ultrasound equipment.
 - e. Describe record keeping techniques involved with quality assurance in diagnostic ultrasound.

- f. Discuss statistical indices associated with diagnostic ultrasound.
- 5. Describe bioeffects and safety of diagnostic ultrasound. DMSC1 3a, DMSC3 3c, DMSC5 ce, DMSC6 3f, DMS C8 3h
 - a. Describe acoustic output quantities of diagnostic ultrasound.
 - b. Describe acoustic labeling standards for diagnostic ultrasound equipment.
 - c. Describe acoustic exposure of diagnostic ultrasound.
 - d. Describe primary mechanisms of biological effects of diagnostic ultrasound.
 - e. Describe experimental biological effect studies of diagnostic ultrasound.
 - f. Describe guidelines and regulations of diagnostic ultrasound equipment use.
 - g. Describe electrical and mechanical hazards associated with diagnostic ultrasound equipment.

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DMSC1 Utilize oral and written communication.

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

Course Number and Name: DMS 1415 Clinical Experience I

Description: This class includes clinical instruction in the scanning lab and in clinical site institutions. Students will first receive hands-on experience in the scanning lab and then in clinical rotations.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
5	0	15	225

Prerequisite: Instructor approved

Student Learning Outcomes:

- Obtain scanning experience in the program scanning lab. DMSC1 3a, DMSC2 3b, DMSC3 3c, DMSC4 3d, DMSC5 3e, DMSC6, DMSC7 3g, DMSC8 3h, DMSD1 4a, 4b, 4c, 4d
 - Describe the ultrasound machine and accessories.
 - Obtain ultrasound images.
 - Operate ultrasound equipment.
 - Discuss protocols for sonographic procedures at clinical sites.
 - Develop a personal log of ultrasound exams performed/observed/assisted.
 - Document guidelines for reporting diagnostic sonographic findings.
 - Perform a mock sonographic exam.
- Apply knowledge of ultrasound procedures in clinical site rotation. DMSC1 3a, DMSC2 3b, DMSC3 3c, DMSC4 3d, DMSC5 3e, DMSC6 3a, DMSC7, DMSC8 3h, DMSD1 4a, 4b, 4c, 4d
 - Observe sonographers at clinical affiliates.
 - Scan patients under the direct supervision of the sonographer.
 - Demonstrate clinical site protocols for scanning, image documentation, record keeping, patient contact, and reporting procedures.
 - Maintain a personal log of all ultrasound scans and procedures and the level of performance in each exam.
- Demonstrate tasks associated with sonographic procedures. DMSC1 3a, DMSC2 3b, DMSC3 3c, DMSC4 3d, DMSC5 3e, DMSC7 3g, DMSC8 3h, DMSD1 4a, 4b, 4c, 4d
 - Identify patient.
 - Explain sonographic procedure to patient.
 - Obtain patient history pertinent to ultrasound exam.
 - Place patient in correct position(s) for a given sonographic procedure.
 - Select ultrasound equipment to be used.
 - Select proper scanning protocol for sonographic procedure.
 - Image and measure specific areas of interest with ultrasound.
 - Evaluate patient positioning and need for additional ultrasound imaging.
 - Document sonographic diagnostic images.
 - Demonstrate written and oral responses regarding ultrasound images.
 - Dismiss patient after ultrasound exam is complete.
 - Document sonographic exam results in proper logs.
 - Prepare room for next sonographic exam.
 - Maintain standard precautions.
- Under direct supervision, perform clinical application skills for sonographic procedures of the abdominal wall and peritoneal space, gallbladder and biliary system, liver, pancreas, spleen, kidney, and abdominal vascular structures. DMSC1 3a, DMSC2, DMSC3 3c, DMSC4 3d, DMSC5 3e, DMSC6 3a, DMSC7, DMSC8 3h, DMSD1 4a, 4b, 4c, 4d
 - Perform routine sonographic exam of the abdominal wall and peritoneal space.
 - Perform routine sonographic exam of the gallbladder and biliary system.
 - Perform routine sonographic exam of the liver, pancreas, spleen, and kidney.
 - Perform routine sonographic exam of abdominal vascular structures.

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DMSC C3a Utilize oral and written communication.

DMSC 3b Provide basic patient care and comfort.

DMSC 3c Demonstrate knowledge and understanding of human gross and sectional anatomy.

DMSC 3d Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC 3e Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC 3f Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC 3g Employ professional judgment and discretion.

DMSC 3h Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSC 3i Recognize the importance of continuing education

DMSC 3j Recognize the importance of and employ ergonomically correct scanning techniques.

DMSC 4a Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSC 4b Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSC 4c Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSC 4d Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

Course Number and Name: DMS 1426 Clinical Experience II

Description: This course includes clinical practice and instruction in a clinical rotation site.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
6	0	18	270

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Under direct supervision, perform clinical application skills for sonographic procedures for first, second, and third trimester pregnancy; female pelvis; breast; male pelvis thyroid, non-cardiac chest, and musculoskeletal structures. DMSC1 3a, DMSC2 3b, DMSC3 3c, DMSC7, DMSD1, DMSD2 4b, DMSD3 4c, DMSD4 4d, DMSD5 4e, DMSD6 4f, DMSD7 4g

- Perform routine sonographic exam for first trimester pregnancy.
- Perform routine sonographic exam for second trimester pregnancy.
- Perform routine sonographic exam for third trimester pregnancy.
- Perform routine sonographic exam of the female pelvis.
- Perform routine sonographic exam of the breast.
- Perform routine sonographic exam of the male pelvis.
- Perform routine sonographic exam of the thyroid.
- Perform routine sonographic exam of the non-cardiac chest.
- Perform routine sonographic exam of musculoskeletal structures.

2. Under direct supervision, perform routine abdomen sonographic procedures. DMSC1 3a, DMSC2 3b, DMSC3 3c, DMSC4 3d, DMSC7 3g, DMSD1 4a, DMSD2 4b, DMSD3 4c, DMSD8 4h

- Perform routine sonographic exam of the gallbladder and biliary system.
- Perform routine sonographic exam of the liver, pancreas, and spleen.
- Perform routine sonographic exam of abdominal vascular structures.

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DMSC1 Utilize oral and written communication.

DMSC2 Provide basic patient care and comfort.

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.

DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC7 Employ professional judgment and discretion.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

Course Number and Name: DMS 1435 Clinical Experience III

Description: This course is a clinical practice and instruction in a clinical affiliate. Areas included are patient care and management, operation of equipment, and sonographic procedures. All procedures will be performed under direct supervision

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
5	0	15	225

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Perform clinical application skills for sonographic procedures for the gallbladder and biliary system, liver, pancreas, spleen, kidney, abdominal vascular structures, abdominal wall, and peritoneal space. DMSC2 3b, DMSC3 3c, DMSC3 3c, DMSC4 3d, DMSC7 3g, DMSD1 4a, DMSD2 4b, DMSD3 4c, DMSD8 4h
 - a. Perform routine sonographic exam of the gallbladder and biliary system.
 - b. Perform routine sonographic exam of the liver, pancreas, spleen, and kidney.
 - c. Perform routine sonographic exam of abdominal vascular structures.
 - d. Perform routine sonographic exam of the abdominal wall and peritoneal space.
2. Perform clinical application skills for sonographic procedures for first, second, and third trimester pregnancy. DMSC1 3a, DMSC2 3b, DMSC3 3c, DMSC4 3d, DMSC7 3g, DMSD2 4b, DMSD4 4d, DMSD5 4e, DMSD7 4g
 - a. Perform routine sonographic exam for first trimester pregnancy.
 - b. Perform routine sonographic exam for second trimester pregnancy.
 - c. Perform routine sonographic exam for third trimester pregnancy.
3. Perform clinical application skills for sonographic procedures for the female pelvis, breast, male pelvis, thyroid non-cardiac chest, and musculoskeletal structures. DMSC1 3a, DMSC2 3b, DMSC3 3c, DMSC4 3d, DMSC7 3g, DMSD1 4a, DMSD2 4b, DMSD3 4c, DMSD4 4d, DMSD6 4f
 - a. Perform routine sonographic exam of the female pelvis.
 - b. Perform routine sonographic exam of the breast.
 - c. Perform routine sonographic exam of the male pelvis.
 - d. Perform routine sonographic exam of the thyroid.
 - e. Perform routine sonographic exam of the non-cardiac chest.
 - f. Perform routine sonographic exam of musculoskeletal structures.

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DMSC1 Utilize oral and written communication.

DMSC2 Provide basic patient care and comfort.

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.

DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC7 Employ professional judgment and discretion.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Course Number and Name: DMS 1513 Abdominal Sonography

Description: Presentation of pathology/pathophysiology of abdominal anatomy including liver, spleen, gallbladder, pancreas, and vascular structures associated with organs, as well as the abdominal cavities and the non-cardiac chest. Normal again changes and laboratory values are presented.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
3	3	0	45

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Describe pathology/pathophysiology of abdominal cavity structures as presented on the sonographic exams.

DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8

- Describe sonographic appearance of the abdominal wall and any associated pathology.
- Describe sonographic appearance of the peritoneal cavity and any related pathology.
- Describe the sonographic appearance of abdominal vascular structures and related pathology.
- Describe the sonographic appearance of the non-cardiac chest and associated pathology.

2. Describe pathology/pathophysiology of the liver and associated vascular structures as presented on the sonographic exams.

DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8

- Discuss the development, location, size, vascular structures, and normal sonographic appearance of the liver and associated vascular and pathologic structures.
- Recognize the lobes of the liver sonographically.
- Recognize anatomic variations of the liver and associated vascular and pathologic structures sonographically.
- Discuss liver function tests and the relationship of these to sonographic examinations.
- Describe patient preparation, breathing instructions, positioning, scanning techniques, and pitfalls for sonography procedures involving the liver and associated vascular pathologic structures.
- Identify sonographic appearance of liver diseases, vascular abnormalities, cysts, hematomas, abscesses, infections, metastases, neoplasms, and liver transplants.
- Discuss other imaging procedures of the liver and associated vascular and pathologic structures.

3. Describe pathology/pathophysiology of the gallbladder and biliary system.

DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9

ch,ci,4a,4b,4c,4h

- Discuss anatomy, variations, and physiology of the gallbladder and biliary system.
- Describe patient preparation, breathing instructions, and positioning for sonographic procedures involving the gallbladder and biliary system.
- Discuss indications, lab values, and the association with sonographic appearance for the gallbladder and biliary system.
- Describe sonographic appearance of variations of the gallbladder.
- Describe acquired diseases of the gallbladder.
- Discuss other imaging procedures of the gallbladder and biliary system.

4. Describe pathology/pathophysiology of the pancreas.

DMSC1 3a,3c,3d,3g,DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 ch,ci,4a,4b,4c,4h,

- Discuss anatomy, location, and physiology of the pancreas.
- Describe sectional views of the pancreas sonographically.
- Discuss preparation and indications for pancreatic sonography.
- Discuss sonographic appearance of pancreatic pathology, neoplasm, inflammation, and other abnormal findings.

- e. Discuss pancreatic transplants.
- f. Discuss related imaging procedures of the pancreas.
- 5. Describe pathology/pathophysiology of the spleen. DMSC1 3a, 3c, 3d, 3g, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 ch,ci,4a,4b,4c,4h
 - a. Discuss normal anatomy, variations, and physiology of the spleen.
 - b. Discuss the functions of the spleen.
 - c. Demonstrate normal sonographic appearance of the spleen.
 - d. Discuss ultrasound imaging techniques of the spleen.
 - e. Identify sonographic appearance of splenic diseases, cysts, abscesses, infarcts, trauma, rupture, hematomas, calcifications, hemangiomas, and other abnormalities.
- 6. Describe pathology/pathophysiology of the renal system. DMSC1 3a, 3c, 3d, 3g, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 ch,ci,4a,4b,4c,4h
 - a. Discuss normal anatomy, variations, and physiology of the renal system.
 - b. Demonstrate normal sonographic appearance of the renal system.
 - c. Discuss ultrasound imaging techniques of the renal system.
 - d. Discuss sonographic appearance of renal system diseases, cysts, abscesses, trauma, calcifications, and other renal system pathology as well as laboratory values.
 - e. Discuss ultrasound procedures of renal transplants.
 - f. Describe sonographic appearance of pathology/pathophysiology of the adrenal glands.
- 7. Describe pathology/pathophysiology of the gastrointestinal tract. DMSC1 3a, 3c, 3d, 3g, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 ch,ci,4a,4b,4c,4h
 - a. Discuss location, anatomy, and physiology of the intestinal tract.
 - b. Demonstrate sonographic appearance of a normal and an abnormal bowel.
 - c. Describe appearance of the appendix on ultrasound.
 - d. Discuss ultrasound appearance of gastric and bowel obstruction and fluid collections

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DMSC1 Utilize oral and written communication.

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.

DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSC9 Recognize the importance of continuing education.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Course Number and Name: DMS 1524 Obstetrical and Gynecological Sonography

Description: This class discusses pathology/ pathophysiology with female anatomy and obstetrical sonographic examinations. Sonographic appearance of the female pelvis premenopausal through post-menopausal and evaluation of pregnancy from conception to delivery will be discussed. Evaluating infertility and related laboratory values, as well as other imaging procedures, will be included.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
4	3	2	75

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Discuss ultrasound applications in obstetrical exams during the first trimester of pregnancy. DMSC1 3a,DMSC3 3c,DMSC4 3d, 3e,3f, 3g, 3h, 3i ,DMSD1 4a, 4c, 4d, 4e, 4f, 4g, 4h
 - a. Describe embryonic development.
 - b. Describe ultrasound evaluation of first trimester pregnancy.
 - c. Determine fetal age in the first trimester of pregnancy with ultrasound measurements.
 - d. Define fetal life sonographically.
 - e. Discuss laboratory tests utilized in first trimester pregnancies.
 - f. Discuss abnormal first trimester pregnancies and correlate with ultrasound.
 - g. Discuss clinical indications for ultrasound during the first trimester of pregnancy.
 - h. Discuss transducer selection and patient preparation for first trimester ultrasound exam.
 - i. Discuss the sonographer's role in talking with the patient and discussing sonographic results.
 - j. Explain reporting sonographic results and sonographic videotaping procedures.
2. Describe ultrasound applications in obstetrical exams during the second and third trimester of pregnancy. DMSC1 3a,DMSC3 3c,DMSC4 3d, 3e,3f, 3g, 3h, 3i ,DMSD1 4a, 4c, 4d, 4e, 4f, 4g, 4h
 - a. Discuss normal fetal development during second and third trimesters of pregnancy.
 - b. Discuss normal fetal ultrasound appearance in second and third trimesters of pregnancy.
 - c. Discuss ultrasound fetal measurements in second and third trimesters of pregnancy.
 - d. Discuss amniotic fluid measurements with ultrasound.
 - e. Explain intrauterine growth restriction.
 - f. Explain placental development.
 - g. Discuss how maternal illness affects the developing fetus.
 - h. Discuss genetic studies.
 - i. Discuss fetal abnormalities seen on ultrasound examinations.
 - j. Discuss multiple gestations.
 - k. Discuss the biophysical fetal profile.
 - l. Discuss clinical indications for ultrasound examination in second and third trimesters of pregnancy.
 - m. Discuss the sonographer's role in patient reporting and videotaping.
 - n. Discuss the postpartum appearance of the uterus on ultrasound exams.
 - o. Discuss intrauterine fetal therapy.
 - p. Discuss the role of the sonographer in invasive/interventional procedures.
3. Describe gynecological ultrasound evaluations DMSC1 3a,DMSC3 3c,DMSC4 3d, 3e,3f, 3g, 3h, 3i ,DMSD1 4a, 4c, 4d, 4e, 4f, 4g, 4h
 - a. Describe normal pelvic anatomy.
 - b. Identify normal sonographic appearance of the female pelvis.
 - c. Identify sonographic appearance of congenital uterine malformations, ovarian masses, endometriosis, polycystic ovarian disease, pelvic inflammatory disease, and associated

pathologies.

- d. Discuss the role of sonography in the assessment of the infertility patient.
- e. Discuss differential diagnosis of sonographic pelvic masses.
- f. Identify uterine and ovarian disorders and masses sonographically.
- g. Identify the sonographic appearance of contraceptive devices.

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DMSC1 Utilize oral and written communication.

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.

DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSC9 Recognize the importance of continuing education.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Course Number and Name: DMS 1533 Advanced Sonographic Procedures

Description: Neurosonology, sonography of extremities, and vascular technology will be discussed. Superficial structures scanning including prostate, thyroid, scrotum and breast organ transplant, interventional procedures, and non-cardiac chest will be included.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor approved

Student Learning Outcomes:

- Describe pathology/pathophysiology of the thyroid, parathyroid, and associated vascular structures as presented on the sonographic exam. DMSC1 3a, 3b, 3c, 3d, 3e, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD8
 - Discuss sonographic indications and laboratory values associated with the thyroid.
 - Discuss related imaging procedures for thyroid, parathyroid, and vascular structures of the neck.
 - Describe sonographic appearance of cysts, masses, hematomas, and other pathology associated with the thyroid/parathyroid.
 - Discuss sonographic protocols and procedures for thyroid, parathyroid, and vascular structures of the neck.
 - Document patient history and physical findings.
 - Communicate sonographic findings and verbal history given by the patient to physician.
 - Identify vascular structures in the neck sonographically.
 - Document blood flow, intravasculature structures, and pathology sonographically.
- Describe pathology/pathophysiology appearance of the prostate as presented on the sonographic exam. DMSC1 3a, 3b, 3c, 3d, 3e, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD8
 - Discuss indications for prostate sonography.
 - List prostate laboratory values and patient history.
 - Identify prostate scanning techniques and protocols.
 - Identify sonographic images of masses, cysts, abscesses, parenchymal disease, and benign hypertrophy.
 - Document patient history and physical findings pertinent to ultrasound exam of prostate.
- Describe sonographic appearance of pathology/pathophysiology of the scrotum. DMSC1 3a, 3b, 3c, 3d, 3e, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD8
 - Discuss scrotal scanning techniques and protocols.
 - List scrotal laboratory values and patient history.
 - Discuss clinical indications for ultrasound exam of scrotum.
 - Identify sonographic images of masses, inflammation, cysts, fluid collections, hematomas, and parenchymal disease of scrotum.
 - List all protocols for scrotal ultrasound imaging.
 - Document patient history and physical findings pertinent of ultrasound exam of scrotum.
- Describe vascular sonography. DMSC1 3a, 3b, 3c, 3d, 3e, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD8
 - Discuss vascular anatomy and indications for ultrasound examination.
 - Discuss educational requirements for the vascular sonography registry.
 - Describe sonographic appearance of normal vascular anatomy.
 - Describe sonographic appearance of pathology of vascular structures.
 - Identify protocols for vascular scanning techniques.

- f. Identify sonographic appearance of vascular pathology/pathophysiology.
- 5. Discuss pre-vertebral vessels, non-cardiac chest procedures, and describe ultrasound-guided interventional techniques. DMSC1 3a, 3b, 3c, 3d, 3e, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSC1, DMSD3, DMSD8
 - a. Discuss advantages of ultrasound-guided procedures
 - b. Discuss benefits of sonographer involvement in procedures
 - c. Discuss the advantage and disadvantage of free hand and needle guided technique
 - d. List potential complications of interventional techniques
 - e. Discuss indications and contraindications for interventional techniques
 - f. Discuss non-cardiac chest procedures
 - g. Discuss indications and contraindications for non-cardiac chest procedures
- 6. Describe normal and pathology/pathophysiology of the breast as presented on the sonographic exam. DMSC1 3a, 3b, 3c, 3d, 3e, 4b, 4c, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD8
 - a. Discuss anatomy of the breast.
 - b. Identify sonographic appearance of normal breast structures.
 - c. Discuss sonographic appearance of breast masses.
 - d. Discuss related breast imaging.
 - e. Differentiate between whole breast imaging and imaging a palpable mass with ultrasound.
 - f. Document patient positioning and measurements of masses for ultrasound imaging of the breast.
 - g. Discuss patient history and clinical indications pertinent to ultrasound exam of breast.
 - h. Discuss differential diagnosis of sonographic masses.
 - i. Identify appearance of breast implants sonographically.

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DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSC9 Recognize the importance of continuing education.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Course Number and Name: DMS 1612 Sonography Seminar

Description: This course will prepare students for ARDMS/ARRT certification.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	2	0	30

Prerequisite: Instructor approved

Student Learning Outcomes:

- Review ultrasound physics and principles. DMSC1 3a, 3b, 3c,3d,3e, 3f,3g,3h, 3i, 4a, 4h
 - Define diagnostic ultrasound.
 - Discuss how ultrasound works to produce an image.
 - Explain how ultrasound equipment turns sound into diagnostic images.
 - Describe how Doppler ultrasound works.
 - Describe ultrasound artifacts.
 - Discuss performance and safety standards for ultrasound equipment.
 - Perform simulated registries for ultrasound physics and instrumentation.
- Examine all aspects of patient care. DMSC1 3a, 3b, 3c, 3d, 3e, 3f 3g, 3h, 3i, 4a, 4c, 4h
 - Describe patient care legal and professional responsibilities.
 - Discuss patient education and safety.
 - Explain patient care and standard precautions.
- Discuss general sonographic procedures. DMSC1 3a,3b,3c,3d, 4g,4a, 4b,4c,4d,4e,4f,4g,4h
 - Identify the sonographic anatomy, pathology, and physiology of the abdomen.
 - Identify the sonographic anatomy, pathology, and physiology of obstetrics.
 - Identify the sonographic anatomy, pathology, and physiology of gynecology.
 - Identify general procedural considerations for abdominal sonography.
 - Identify general procedural considerations for obstetrical sonography.
 - Identify general procedural considerations for gynecological sonography.
 - Perform simulated registries of abdomen, superficial structures, and obstetrical and gynecological sonography.

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography 2011 updates 2016

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSC9 Recognize the importance of continuing education.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Course Number and Name: DMS 1622 Ultrasound Examination Critique

Description: This course will present case studies of normal and abnormal sonographic exams. Students will attend presentations of guest lecturers.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	2	0	30

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Discuss obstetrical and gynecological case studies obtained in clinical site rotations. DMSC1 3a,eb,3c,3d, 3g, 3i, 4a, 4b,4c, 4d, 4e,4f, 4h
 - a. Discuss case studies pertaining to obstetrical sonography.
 - b. Discuss case studies pertaining to gynecological sonography.
2. Discuss case studies pertaining to abdominal sonography. DMSC1 3a,3b,3c,3d,3e,3g, 3i, 4a, 4b,4c, 4d, 4e,4f, 4h
 - a. Discuss sonographic case studies of the abdominal wall.
 - b. Discuss sonographic case studies of the liver.
 - c. Discuss sonographic case studies of the gallbladder and biliary system.
 - d. Discuss sonographic case studies of the pancreas.
 - e. Discuss sonographic case studies of the spleen.
 - f. Discuss sonographic case studies of the renal system.
 - g. Discuss sonographic case studies of the gastrointestinal system.
3. Review abdominal, obstetrical, and gynecological sonography case studies from clinical site rotations. DMSC1 3a, 3c,3d,3e,3f,3h, 3g, 3i, 4a, 4b,4c, 4d, 4e,4f, 4g, 4h
 - a. Discuss abdominal sonographic case studies.
 - b. Discuss obstetrical sonographic case studies.
 - c. Discuss gynecologic sonographic case studies.
 - d. Critique case studies associated with abdominal, obstetrical, and gynecological sonography.

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography 2011 updates 2016

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.

DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.

DMSC9 Recognize the importance of continuing education.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

RECOMMENDED TOOLS AND EQUIPMENT

CAPITALIZED ITEMS

1. General Purpose Ultrasound Phantom (1 per lab)
2. Doppler Ultrasound Phantom (1 per lab)
3. AIUM 100 mm Test Object (1 per lab)
4. Beam Profile/Slice Thickness Phantom (1 per lab)
5. Ultrasound Scanning Table (1 per lab)
6. Ultrasound Machine (1 per lab)
7. 3.5 Megahertz Probe (1 per machine)
8. 7.0 Megahertz Transvaginal Probe (1 per machine)
9. 10.0 Megahertz Probe (1 per machine)
10. 3-D Probe (1 per machine)
11. Endo-cavity 10-16 Megahertz Probe (1 per lab)
12. Color Printer (for Ultrasound Machine) (1 per lab)
13. Computers (1 per student)
14. Wheelchair (1 per lab)
15. Illuminators, Mobile Stand System (1 per 5 students)
16. Power Point System/Boxlight Projection System (1 per lab)
17. Stretcher (1 per lab)
18. Cross Sectional Model (1 per lab)
19. High Intensity Overhead Projector (1 per lab)
20. UltraSim (1 per lab)
21. Washer/Dryer (1 per lab)
22. Sectional Torso (1 per lab)
23. Kidney Model (1 per lab)
24. Classic Pregnancy Series Model (1 per lab)
25. Male Pelvis Model (1 per lab)
26. Female Pelvis Model (1 per lab)
27. Liver Model (1 per lab)
28. Thermal Printer (for Ultrasound Machine) (1 per lab)

NON-CAPITALIZED ITEMS

1. Supply Storage Cabinet (1 per program)
2. Laser Printer (1 per lab)
3. Sheets (48)
4. Pillow (1 per ultrasound table)
5. Pillow Cases
6. Step Stool (1 per lab)
7. Adjustable Stool (1 per lab)
8. Cut Film Holders (6 per lab)
9. Digital Camera
10. Towels (shop type) (50)

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Scanner
2. TV
3. DVD Player

CONSUMABLE SUPPLIES

These supplies are to be provided on an annual basis (a local level responsibility).

1. Ultrasound Gel
2. Disinfectants

3. Paper for Printer
4. Table Paper
5. Laundry Detergent
6. Disposable Exam Gloves

CURRICULUM DEFINITIONS AND TERMS

- Course Name – A common name that will be used by all community colleges in reporting students
- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students
- Classification – Courses may be classified as the following:
 - Career Certificate Required Course – A required course for all students completing a career certificate.
 - Technical Certificate Required Course – A required course for all students completing a technical certificate.
 - Technical Elective – Elective courses that are available for colleges to offer to students.
- Description – A short narrative that includes the major purpose(s) of the course
- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course
- Corequisites – A listing of courses that may be taken while enrolled in the course
- Student Learning Outcomes – A listing of the student outcomes (major concepts and performances) that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
 - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
 - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
 - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
 - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
 - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas
- Sequencing of the course within a program is left to the discretion of the local college. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors. Programs that offer an Associate of Applied Science Degree must include all of the required Career Certificate courses, Technical Certificate courses **AND** a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college.

- In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:
 - Adding new student learning outcomes to complement the existing competencies and suggested objectives in the program framework
 - Revising or extending the student learning outcomes
 - Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)

COURSE CROSSWALK

Course Crosswalk Diagnostic Medical Sonography CIP 51.0910 – Diagnostic Medical Sonography/ Sonographer and Ultrasound					
<i>Note: Courses that have been added or changed in the 2018 curriculum are highlighted.</i>					
Existing			Revised		
2011 MS Curriculum Framework			2018 MS Curriculum Framework		
Course Number	Course Title	Hours	Course Number	Course Title	Hours
PHY 1212	Survey of Physics	2	PHY 1212	Survey of Physics	2
TAH 1113	Medical Terminology in Allied Health	3	HIT 1213	Medical Terminology	3
DMS 1114	Introduction to Ultrasound	4	DMS 1114	Introduction to Ultrasound	4
DMS 1213	Sectional Anatomy	3	DMS 1213	Sectional Anatomy	3
DMS 1313	Ultrasound Physics and Instrumentation I	3	DMS 1313	Ultrasound Physics and Instrumentation I	3
DMS 1323	Ultrasound Physics and Instrumentation II	3	DMS 1323	Ultrasound Physics and Instrumentation II	3
DMS 1414	Clinical Experience I	4	DMS 1415	Clinical Experience I	5
DMS 1426	Clinical Experience II	6	DMS 1426	Clinical Experience II	6
DMS 1513	Abdominal Sonography	3	DMS 1513	Abdominal Sonography	3
DMS 1523	Obstetrical and Gynecological Sonography	3	DMS 1524	Obstetrical and Gynecological Sonography	4
DMS 1533	Advanced Sonographic Procedures	3	DMS 1533	Advanced Sonographic Procedures	3
DMS 1436	Clinical Experience III	6	DMS 1436	Clinical Experience III	6
DMS 1613	Sonography Seminar	3	DMS 1612	Sonography Seminar	2
DMS 1623	Ultrasound Examination Critique	3	DMS 1622	Ultrasound Examination Critique	2

APPENDIX D: RECOMMENDED TEXTBOOK LIST

Recommended Diagnostic Medical Sonography Text Book List CIP: 51.0910- Diagnostic Medical Sonography		
Book Title	Author (s)	ISBN
Textbook of Diagnostic Ultrasonography 8 th Edition	Hagen-Ansert	978-0-323353755
Sonography, An Introduction to Normal Structure and Function 4 rd Edition	Curry and Tempkin	978-0-0323322843
Ultrasound Scanning, Principles and Protocols 4 th Edition	Tempkin	978-4557-7321-3
Understanding Ultrasound Physics 4 th Edition	Edelman	0-9626444-5-5
Sonography Exam Review 2 nd Edition	Susanna Ovel	978-0-323-10046-5