

# Radiographic and Imaging Sciences; Diagnostic Medical Sonography

## Mission Statement

The Mission of the Associate of Science Degree Program is to educate students to become competent radiographers who can serve the needs of a diverse patient population in an ethical and compassionate manner. Our basic goals are to

1. Graduate students that are clinically and technically prepared to enter the current job market.
2. Graduate students that are professional and ethical.
3. Graduate students that communicate effectively in the work care setting.
4. Graduate students that demonstrate clinical thinking and problem solving skills in the classroom, laboratory and clinical settings.

The 24-month Radiographic and Imaging Program is a continuous program which begins each year in the Summer Semester. The program is designed to prepare a radiographer to perform all diagnostic procedures in an X-ray department, as well as other health settings. The program is accredited by the Joint Review Committee on Education in Radiologic Technology, (312) 704-5300, and the California Department of Public Health, (916) 323-2786. JRCERT accreditation qualifies all graduates of the RT Program to take the Diagnostic Radiography ARRT Certification Examination (provided they have not been convicted of a felony). Anyone convicted of a misdemeanor or felony must pre-apply to the ARRT before entering the program to assure that they will be able to take the national certification examination upon completion of the program.

Courses are arranged in a meaningful sequence and must be taken in the order planned. Progression toward and completion of the Associate Degree requires the attainment of a minimum grade of "C" in all program and adjunct courses. (See "Department

Requirements" to follow.) Campus classes provide theory and laboratory practice, which are correlated with clinical experience in the radiology departments of affiliated institutions. A prescribed, a regulation uniform is worn during clinical assignments. Students must provide their own transportation to all facilities and must be willing to travel 70 miles each way to the various clinical sites. Students are required to complete four clinical site rotations at any of the 16 affiliate sites they are assigned to. Clinical site locations extend from Santa Paula to San Luis Obispo. There is no guarantee that the clinic site will be in their city of residence. Any student who misses 10% or more of the clinical portion of the program, in a given semester, is subject to dismissal pending faculty review.

All students are required to pass a physical exam before entering the program. If at any time before or after acceptance into the program, the student's conduct or physical or emotional health is such that there is potential threat to the well-being of patients, the applicant will be denied admission to, or be withdrawn from, the major. In addition to the policies and standards of Santa Barbara City College, Health Technologies programs have policies and requirements based on the professional standards and guidelines of their individual regulating state and national accrediting boards. These additional policies and requirements are listed in the student handbook and are reviewed in RT 100, Introduction to Radiography. All policies, including our pregnancy policy, are available upon request.

Returning students must fill out a petition (within the given time frame) to be approved before readmission into the program. Each petition will be reviewed on an individual basis and considered on space availability. Limited-license radiographers may be eligible for transfer into the program with advanced standing. Contact the Department Chair (ext. 2504) or the Health Technologies Office (ext. 2366) for further information. Certified radiographers who have completed a hospital-based training program may be eligible for up to 30 units of transfer credit toward an Associate in Arts Degree or for transfer to a California State University. Contact the Department Chair (ext. 2504) for more information. Certified radiographers who wish to complete an Associate in Science Degree in Radiographic and Imaging Sciences at SBCC are required to complete the last two (2) semesters in the program.

## Program Student Learning Outcomes

1. *Radiation Protection:* Students are able to apply the principles of radiation protection as required by the state and federal agencies.
2. *Equipment Operation and Quality Control:* Students are able to safely operate and perform quality control measurements on radiographic equipment.
3. *Image Production and Evaluation:* Students are able to evaluate radiographic images for proper anatomy, positioning and technical factors.
4. *Radiographic Procedures:* Students are able to perform radiographic procedures on various anatomical regions based on physical and pathologic conditions.
5. *Patient Care and Education:* Students are able to apply the principles of oral, written and verbal communication to effectively deliver patient care.

## Department Offices

Health Technologies Office (A-218, ext. 2366)  
*Application Secretary:* Lorraine Michalak

## Faculty and Offices

Debra McMahan, *Chair* (A-213, ext. 2504)  
 Bruce Oda (A-245 ext. 4374)

## Degree Awarded

### A.S. Degree: Radiography

#### Department Requirements (69.9 units)

AH 120* — Medical Technology .....	1.0
RT 101 — Introduction to Radiography .....	2.3
RT 102 — Fundamentals of Radiographic Positioning and Procedures I.....	4.0
RT 103 — Fundamentals of Radiographic Positioning and Procedures II.....	4.0
RT 109 — Principles of Radiographic Exposure .....	3.0
RT 111 — Advanced Principles of Exposure .....	3.0
RT 119 — Radiologic Physics .....	3.0
RT 120 — Patient Care in Radiography .....	3.0

RT 191 — Radiographic Technology Clinical Practicum 1 .....	4.7
RT 191A — Radiographic Technology Clinical Practicum 1A.....	2.1
RT 192 — Radiographic Technology: Clinical Pract. 2.....	4.7
RT 202 — Advanced Radiographic Procedures .....	3.0
RT 203 — Radiology Certification Preparation.....	4.0
RT 220 — Radiation Biology and Protection .....	3.0
RT 230 — Radiographic Pathology .....	3.0
RT 250 — Principles and Applications of Cross-Sectional Anatomy in Imaging.....	2.0
RT 293 — Radiographic Technology: Clinical Practicum 3 .....	5.9
RT 294 — Radiographic Technology: Clinical Practicum 4 .....	7.1
RT 295 — Radiographic Technology: Clinical Practicum 5 .....	7.1

*\*Note: HIT 135 has been approved by the Radiography Department as a possible substitute for AH 120.*

*Complete each course with a minimum grade of “C” or better.*

#### *Recommended Elective:*

RT 251 — Principles of Mammography and Procedures ..	2.0
RT 290 — Work Experience in Radiography.....	1-4

## College Requirements

For complete information, see “Graduation Requirements” in the *Catalog* Index.

## Admission Requirements

1. Obtain application in person from the Health Technologies Office (Admin. Bldg., Room 218).
2. High school graduation or equivalency. “Official” high school transcript (in a sealed envelope directly from the school) is required.
3. Eligibility for ENG 110 or 110GB or 110H — Composition and Reading.
4. Eligibility for MATH 104 or MATH 107 or 111 — Intermediate Algebra.

5. Complete BMS 107, Human Anatomy (4 units), and BMS 108, Human Physiology (4 units), or equivalent, with a grade of “C” or better.

*Before entering the program, applicant will be required to:*

1. Complete RT 100;
2. Attend a Program Orientation Meeting;
3. Complete a physical examination, including immunizations and/or titers (must be on the SBCC physical exam form which will be provided);
4. Obtain a CPR card—must be kept current throughout the program;
5. Pay required badge and materials fees;
6. Pass a criminal background check and drug screening examination; and
7. Students will need a valid, government-issued Social Security card prior to testing for the ARRT and CRT board exams after the completion of the program.

Failure to comply with any of the above requirements will make the student ineligible for admission to the program.

### Refresher Students

Refresher students are those who are certified as radiographers in California and who want to participate in one or more SBCC Radiographic and Imaging courses. In most cases, this will be done because of a time lapse since being actively exposed to the practice of radiography. To participate in the program, call ext. 2366 for information.

## Recommended Program

### First Year

*Summer Session*  
Radiography 101

*Fall*  
Radiography 102  
Radiography 109  
Radiography 120  
Allied Health 120  
Radiography 191  
General Ed. course\*

*Spring*  
Radiography 103  
Radiography 111  
Radiography 119  
Radiography 192  
General Ed. course\*

*Winter Intersession*  
Radiography 191A

### Second Year

*Summer Session*  
Radiography 293  
General Ed. course\*

*Fall*  
Radiography 220  
  
Radiography 230  
Radiography 250  
Radiography 251  
Radiography 294  
General Ed. course\*

*Spring*  
Radiography 202  
Radiography 203  
Radiography 295  
General Ed. course\*

*\*For a complete listing of General Education requirements, pick up a requirement sheet in the Counseling Center or see “Graduation Requirements” in this Catalog.*

## Course Descriptions

### Radiographic and Imaging Sciences

#### RT 100 — Radiography and Health Care (2.0) F, S — CSU

Introduction, overview and orientation for those interested in exploring radiographic imaging or other health care careers. Completion of this course and the prerequisites satisfy departmental requirements for entry into the Radiography Associate Degree Program.

**RT 101 — Introduction to Radiography**

**(2.3) F, S — CSU**

*Prerequisites: RT 100.*

*Limitation on Enrollment: Passing criminal background check, pass a physical exam, valid CPR card.*

Orientation to Radiography, providing students with entry-level information and skills to begin practice in an X-ray department. Topics include ethics, darkroom techniques, introduction to fluoroscopy, lab practice, basic radiation protection and patient care. Course concludes with a one-day orientation to an X-ray department.

**RT 102 — Fundamentals of Radiographic Positioning and Procedures I**

**(4) F — CSU**

*Prerequisites: RT 101.*

Precise and detailed information on routine radiographic procedures of the chest, abdomen, appendicular skeleton and vertebral column. Portable and traumatic exams also included.

**RT 103 — Fundamentals of Radiographic Positioning and Procedures II**

**(4) S — CSU**

*Prerequisites: RT 102 with a "C" or better.*

Basic principles of positioning for the skull, facial bones and various contrast procedures for the gastrointestinal and genito-urinal tract.

**RT 109 — Principles of Radiographic Exposure**

**(3) F — CSU**

*Prerequisites: RT 101.*

Provides first-year radiography students with the basic principles of radiation production and exposure techniques. Photographic and geometric factors which contribute to image quality and detail are discussed.

**RT 111 — Advanced Principles of Exposure**

**(3) S — CSU**

*Prerequisites: RT 109.*

Continuation of RT 109. Advanced analysis of the principles of techniques and their application in the clinical setting are studied. Students learn to calculate changes in technical factors and their effects on image production and quality.

**RT 119 — Radiologic Physics**

**(3) S — CSU**

*Skills Advisories: Math 4 and Eligibility for ENG 110 or ENG 110H.*

*Limitation on Enrollment: Concurrent enrollment in the Radiographic Program or employment in the field.*

Basic health physics, with an emphasis on electricity and electromagnetic radiation. Special emphasis is on a study of the physics principles applicable to apparatuses and procedures used in current practice of radiology.

**RT 120 — Patient Care in Radiography**

**(3) F — CSU**

Provides the student with the concepts of patient care. Routine and emergency patient care procedures are described. Also included are topics on venipuncture and contrast media/medication administration. The role of the radiographer in patient care administration identified. Aspects of death and dying reviewed.

**RT 121 — Venipuncture in Radiography**

**(0.6) F, S — CSU**

Provides the student with concepts of venipuncture and contrast media/medication administration. The role of the radiographer in administration of contrast media, legal aspects of contrast media injection, anatomy and physiology related to I.V. injections are covered.

**RT 191 — Radiographic Technology Clinical Practicum 1**

**(4.7) F — CSU**

*Prerequisites: RT 101.*

Introduction to clinical settings and exposure to departmental organization; patient flow; darkroom and processing procedures; observation of techniques employed; and policies and procedures of clinical cases. The student performs basic radiographic procedures under direct supervision.

**RT 191A — Radiographic Technology Clinical Practicum 1A**

**(2.1) Winter — CSU**

Designed to give each advanced student the opportunity to improve on clinical skills, as well as accumulate the clinical hours required by the California Department of Health.

**RT 192 — Radiographic Technology Clinical Practicum 2**

**(4.7) S — CSU**

*Prerequisites:* RT 191.

Second in a series of clinical education courses. Student is assigned 16 hours per week at a clinical education center. During this supervised experience, the student observes and performs diagnostic radiographic procedures. The student must demonstrate competency in recently taught radiographic exam, as well as in the exams previously evaluated.

**RT 202 — Advanced Radiographic Procedures**

**(3) S — CSU**

*Prerequisites:* RT 103.

Provides the advanced student with a survey of advanced imaging and an introduction to other specializations in the radiation sciences. It concludes with an introduction to special invasive procedures, especially those dealing with the heart/vascular area.

**RT 203 — Radiology Certification Preparation (4)**

Review of those subjects deemed critical for the ARRT examination. Consists of lectures, both by the instructor and guest, simulated registry examinations and a computer-assisted learning program.

**RT 220 — Radiation Biology and Protection (3) F — CSU**

The biological effects and interactions of ionizing radiation at the cellular level. Dose-effect relationships and long-term somatic and genetic effects of radiation exposure are discussed. The principles and methods of radiation protection, rules and regulations of NCRP, CFR-21 and Title 17 regarding personnel, equipment and departmental design prepare students for state and national certification.

**RT 230 — Radiographic Pathology (3) F — CSU**

Introduction to more advanced pathological conditions for second-year students. Differentiates normal radiographic anatomy from pathologic conditions. Encompasses both the anatomy and physiology of each pathologic condition. Students expected to identify, evaluate and present common pathologic conditions throughout the course.

**RT 240 —Fluoroscopic Imaging and Radiation Protection**

**(3) F — CSU**

Introduction to the fluoroscopic imaging system and methods of reducing public and occupational dose. Biological effects of high-dose radiation, interactions of ionizing radiation, and state and federal regulations pertaining to protection discussed. Prepares students for National Certification and the California Fluoroscopy Permit Exam.

**RT 250 — Principles and Applications of Cross-Sectional Anatomy in Imaging**

**(2) F — CSU**

Provides an understanding of cross-sectional anatomy and knowledge of the relationships of human organs to each other as they appear in the sagittal, coronal and axial plane. The practical applications of cross-sectional with C.T., M.R.I. and ultrasound are emphasized.

**RT 251 — Principles of Mammography and Procedures**

**(2) F — CSU**

Prepares the radiographer for state and national certification in mammography. Content covers the anatomy and physiology of the breast, positioning, radiation biology and protection, and QA and QC regulations for mammography equipment.

**RT 290 — Work Experience in Radiography  
(1-4) F, S, Summer — CSU**

*Limitation on Enrollment: Enrollment in a Radiology course, or current California Radiologic Technology license and at least one year's experience as a licensed Radiologic Technologist in a medical establishment within the preceding three years.*

Consists of supervised on-the-job work experience for students whose radiology career objectives and course of study or employment complement each other. Students must accomplish specific course objectives. Class meetings are scheduled each semester.

**RT 293 — Radiographic Technology Clinical Practicum 3**

**(5.9) Summer — CSU**

*Prerequisites: RT 192.*

Third in a series of clinical education courses, which requires 40 hours per week for eight weeks in the clinical setting. This rotation allows the student opportunity to enhance basic skills, positioning techniques, patient care and understanding of clinical operations. The student must demonstrate continued competency in those exams previously mastered and additional competencies throughout the semester.

**RT 294 — Radiographic Technology Clinical Practicum 4**

**(7.1) F — CSU**

*Prerequisites: RT 293.*

Fourth in a series of clinical education courses to increase technical and clinical proficiency in routine and advanced X-ray procedures under supervision of the clinical coordinator/clinical instructor and departmental radiographers. The student must demonstrate competency of recently taught radiographic exams, plus continued competency of exams previously evaluated.

**RT 295 — Radiographic Technology Clinical Practicum 5**

**(7.1) S — CSU**

*Prerequisites: RT 294.*

Fifth in a series of clinical education courses to increase technical and clinical proficiency in routine and advanced X-ray procedures under supervision of the clinical coordinator/clinical instructor and departmental radiographers. The student must demonstrate competency of recently taught radiographic exams, plus continued competency of exams previously evaluated.

**RT 298 — Diploma Radiography Credit  
(30) — CSU**

*Skills Advisories: MATH 107 and eligibility for ENG 110 or ENG 110H*

Provides an opportunity for registered (ARRT/CRT) radiographers currently licensed in California who have graduated from diploma programs to receive 30 units of program credit toward an Associate Degree. Prior academic and clinical background is assessed by the Program Chairperson before credit is granted.

**RT 299 — Independent Study in Radiography  
(1-4) — CSU**

*Course Advisories: RT 103.*

*Limitation on Enrollment: Completion of a minimum of 12 units at SBCC, with a 2.5 G.P.A., and a minimum of 6 units, with a 3.0 G.P.A. within the department.*

*One to three hours of work/conference time per week to be coordinated with number of enrolled units.*

Independent research in radiography under the guidance of a sponsoring faculty member. The project to be consistent with the ability and interest of the student and may be conducted in the laboratory and/or the field. Each unit of credit is equal to three hours of work.

*NOTE: Continuation in the clinical area on a full-time basis will take place after graduation. This is done in order to complete the 24-month program requirement and will terminate upon the student's anniversary date.*

## Sonography

Diagnostic Medical Sonography (DMS), sometimes referred to as ultrasound, is a diagnostic medical procedure that uses high frequency sound waves (ultrasound) to produce dynamic visual images of organs, tissues, or blood flow inside the body. Sonography is increasingly being used in the detection and treatment of heart disease, heart attack and vascular disease that can lead to stroke. It is also used to guide fine needle, tissue biopsy to assist in taking a sample of cells from an organ for lab testing (i.e. test for cancer in breast tissue). Unlike X-rays, sonography is a radiation-free imaging modality.

### Department Offices

Health Technologies Office (A-218, ext. 2366)  
*Application Secretary:* Lorraine Michalak (A-218, ext. 2366)  
 Debra vonBernuth, B.A., RDMS, RVT  
 Nick Spina, B.A., R.T., RDMS

### Certificate Awarded

Certificate of Achievement:  
 Diagnostic Medical Sonography

### Entrance Requirements

Before entering the DMS Program, students are required to:

1. Attend a DMS orientation meeting the semester prior to entry;
2. Complete the SBCC physical examination on SBCC form including immunizations and/or titers;
3. Obtain a CPR card, which must be kept current throughout the program; and
4. File a college application in the Admissions Office, the semester prior to beginning classes at SBCC.
5. Pass a criminal background check and drug screening examination.

### Application Procedure

Submit the following to SBCC Health Technologies Office:

- Completed DMS application
- A copy of professional license
- Official transcripts

## Certificate Requirements for Diagnostic Medical Sonography

**Limitation on Enrollment:** To enroll in DMS 150 and 155, students must have one of the following:

1. Completion of a two-year allied health education program that is patient-care related: Radiographic/Radiologic Technologist (R.T.), Respiratory Therapist (R.T.), Registered Nurse (R.N.), Occupational Therapist (O.T.), Physical Therapist (P.T.)  

OR
2. Bachelor's Degree with these prerequisites:  
 Anatomy (BMS 107 for 4 units at SBCC)  
 Physiology (BMS 108 for 4 units at SBCC)  
 Medical Terminology (AH 120 for 1 unit at SBCC)  
 Patient Care in Radiography (RT 120 for 3 units at SBCC)  

OR
3. Medical Doctor (M.D.) or Doctor of Osteopathy (D.O.) degrees from outside of the U.S., equivalent to those of the U.S. and Canada

*Please Note:* RT 120 (Patient Care in Radiography) is a prerequisite to DMS 182 (Clinical Experience I).

## Required Core Courses (53.9 units)

RT 250 — Principles and Applications of Cross-Sectional Anatomy in Imaging.....	2.0
DMS 150 — Physics and Instrumentation.....	3.0
DMS 155 — Abdominal and Small Parts Scanning.....	2.8
DMS 156 — OB/GYN Scanning.....	2.7
DMS 160 — Pathophysiology.....	3.0
DMS 165 — Abdom. and Small Parts Scan. and Pathol. ...	3.0
DMS 170 — Introduction to Vascular Ultrasound.....	4.0
DMS 182 — Clinical Experience I.....	9.0
DMS 183 — Clinical Experience II.....	9.5
DMS 184 — Clinical Experience III.....	2.4

DMS 185 — Clinical Experience IV .....	9.5
DMS 250 — Sonography Interpretation .....	3.0

**Length of Program**

This is an 21-month Certificate program in which courses are arranged in a meaningful sequence and must be taken in the order planned. The program begins each year with the start of the college's Fall Semester.

*Fall Session*

RT 250 — Principles and Applications of Cross-Sectional Anatomy in Imaging.....	2.0
DMS 150 — Physics and Instrumentation.....	3
DMS 155 — Abdominal and Small Parts Scanning.....	2.8

*Spring Semester*

DMS 156 — OB/GYN Scanning.....	2.7
DMS 160 — Pathophysiology.....	3
DMS 165 — Abd and Small Parts Scanning and Pathology	3

*Winter Intersession*

DMS 184 — Clinical Experience III .....	2.4
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*Fall Semester*

DMS 170 — Introduction to Vascular Ultrasound .....	4
DMS 183 — Clinical Experience II .....	9.5

*Summer Session*

DMS 182 — Clinical Experience I .....	8.9
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*Spring Semester*

DMS 250 — Sonography Interpretation .....	3
DMS 185 — Clinical Experience IV .....	9.5

**Course Descriptions**

**Diagnostic Medical Sonography**

**DMS 150 — Physics and Instrumentation  
(3) Fall — CSU**

*Limitation on Enrollment: Must have certification as R.T., R.N.*

Introduction to the basic acoustical physics and acoustical waves in human tissue. Emphasis is on ultrasound transmission in soft tissues, attenuation of sound energy, parameters affecting sound transmission and resolution of sound beams.

**DMS 155 — Abdominal and Small Parts Scanning  
(2.8) Fall — CSU**

*Limitation on Enrollment: Must have certification as R.T., R.N.*

Interpretation of normal anatomy, sonographic and gross anatomy, demonstrating scanning techniques and identifying normal sonographic protocols for abdomen and small parts.

**DMS 156 — OB/GYN Scanning  
(2.7) S — CSU**

*Prerequisites: DMS 155*

Interpretation of normal anatomy, sonographic and gross anatomy, demonstrating scanning techniques and identifying normal sonographic protocols for OB/GYN.

**DMS 160 — Pathophysiology  
(3) S — CSU**

*Prerequisites: None*

Specific study of pathology and pathophysiological mechanisms related to diagnostic medical sonography.

**DMS 165 — Abdominal and Small Parts Scanning and Pathology  
(3) S — CSU**

*Prerequisites: DMS 155*

Interpretation of normal and abnormal anatomy of abdomen and small parts, sonographic and gross anatomy, comparing one disease to another. Identification of pathophysiological anatomic structures in various sonographic planes and images.

**DMS 166 — OB/GYN Scanning and Pathology**  
**(2) F — CSU**

Interpretation of normal and abnormal OB/GYN anatomy, sonographic and gross anatomy, comparing one pathological condition to another. Identification of pathophysiological anatomic structures in various sonographic planes and images.

**DMS 170 — Introduction to Vascular Ultrasound**  
**(4) S — CSU**

*Prerequisites: DMS 150*

Introduction to Doppler (color flow), with a hands-on approach. Overview of normal and pathological sonographic data: arterial and venous peripheral vascular, abdominal vasculature and extracranial carotid.

**DMS 182 — Clinical Experience 1**  
**(9) Summer — CSU**

*Prerequisites: RT 120*

Introduction to the clinical setting and exposure to departmental organization, policies and procedures, patient flow, observation of clinical case techniques and protocols.

**DMS 183 — Clinical Experience 2**  
**(9.5) F — CSU**

*Prerequisites: DMS 182*

Continuation of clinical experience. Exposure to departmental organization, policies and procedures, patient flow, observation of clinical case techniques and protocols. Beginning hands-on experience and equipment set-up.

**DMS 184 — Clinical Experience 3**  
**(2.4) F — CSU**

*Prerequisites: DMS 183*

Clinical experience in ultrasound; equipment handling and patient management; and departmental operations and scope.

**DMS 185 — Clinical Experience 4**  
**(9.5) S — CSU**

*Prerequisites: DMS 184*

Intermediate clinical experience; sonographic study of the abdomen, small parts and pelvis with real-time equipment; and recognition of anatomical pathology.

**DMS 250 — Sonography Interpretation**  
**(3) S — CSU**

*Prerequisites: None*

Interpretation and critique of normal anatomy with correlation of didactic, clinical presentations and critiques. Written and oral case presentations, with emphasis on OB/GYN subjects.

**DMS 290 — Work Experience in Sonography**  
**(1-4) F — CSU**

*Limitation on Enrollment: Enrollment in a Sonography course, or current Sonography license and at least one year's experience as a licensed Sonographer in a medical establishment within the preceding three years.*

Consists of supervised on-the-job work experience for students whose sonography career objectives and course of study or employment complement each other. Students must accomplish specific course objectives. Class meetings are scheduled each semester.