

Carnegie Institute

*Anticipating training
requirements for
allied health support services
in Michigan since 1947.*

*The staff & faculty
extend a cordial invitation
to visit our school
to discuss your future
and plan your career*

CARNEGIE INSTITUTE

School of Allied Health Technology

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Suites 100 - 110
Troy, MI 48063

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Website: www.carnegie-institute.edu



**Specialists
in Allied Health
Career Education
since 1947**

Carnegie Institute



**School
Catalog
2026-2027**



CARNEGIE INSTITUTE is located at 550 Stephenson Hwy., Troy, Michigan, about 1/4 mile North of 14 Mile Road and one block West of I-75, with offices, classrooms and laboratories on the first floor of the 550 Building. The modern facilities of this beautiful four story building and the surrounding area make its campus-like atmosphere an ideal setting for an educational institution. Ample parking facilities adjacent to the building are provided. Refer to page 52 for an area map of the school.

**550 STEPHENSON HIGHWAY
SUITES 100 - 110
TROY, MICHIGAN 48083
PHONE (248) 589-1078
FAX (248) 589-1631
E-Mail: info@camegie-institute.edu
Website: www.camegie-institute.edu**



SCHOOL VISITS

You are invited to visit Carnegie Institute to explore your career interests and options. Find out for yourself whether a career in one of the allied health specialties is for you. Please Note: Prior to making a career decision or a commitment to enroll, Carnegie Institute requires two school visits. This policy allows time to make an informed decision which is essential for student satisfaction and ultimate career success. **The school is open for tours and individual information sessions Monday through Saturday; evening appointments can also be scheduled.** The Admissions staff is available to answer questions about our specialty programs and the related career opportunities in health services and technologies.

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All photos shown in this catalog were taken of Carnegie students at school facilities or Clinical Sites. For additional information, refer to the Catalog Supplements, Tuition Costs and Student Handbook.

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CARNEGIE INSTITUTE

Professional Training for Careers in Allied Health Since 1947

A Michigan Corporation

Licensed by the State of Michigan, Department of Labor and Economic Opportunity

APPROVALS:

- Department of Public Instruction, Office of Vocational Rehabilitation Service, Lansing, Michigan.
- Carnegie Institute is authorized under Federal law to enroll non-immigrant alien students.
- Carnegie Institute meets eligibility requirements under the Federal Direct Loan Program.
- The Massage Therapy Program at Carnegie Institute is an approved education program by the State of Michigan Board of Massage Therapy, Department of Licensing and Regulatory Affairs, Bureau of Health Care Services.

ACCREDITATIONS:

Accredited by the Accrediting Commission of Career Schools and Colleges (ACCSC).

The Medical Assistant Program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Medical Assisting Education Review Board (MAERB).

The Cardiovascular Technologist Program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Joint Review Committee on Education in Cardiovascular Technology (JRC-CVT).

The Invasive Cardiovascular Technologist Program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Joint Review Committee on Education in Cardiovascular Technology (JRC-CVT).

The Electroneurodiagnostic Technologist Program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Committee on Accreditation for Education in Neurodiagnostic Technology (CoA-NDT).

The Vascular Technologist Program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Joint Review Committee on Education in Cardiovascular Technology (JRC-CVT).

MEMBERSHIPS:

Association of Private Sector Colleges
and Universities

American Association of Medical Assistants

American Society of Electroneurodiagnostic
Technologists

Charter Member, Michigan Medical Assistant

Post-Secondary Educators Association

FINANCIAL AID PROGRAMS:

- Federal Direct Subsidized Loan
- Federal Direct Unsubsidized Loan
- Federal Direct Plus Loan
- Federal Pell Grant
- Federal Supplemental Education Opportunity Grant
- Michigan Works!
Local Workforce Development Boards,
Workforce Development Agency,
State of Michigan

SPECIALIZED ALLIED HEALTH EDUCATION FOR THE FOLLOWING HEALTH CAREER PROGRAMS:

- **Medical Assistant**
- **Medical Insurance Biller**
- **Massage Therapist**
- **Electroneurodiagnostic Technologist**
- **Cardiology Technician**
- **AOS Vascular Technologist**
- **AOS Cardiovascular Technologist**
- **AOS Invasive Cardiovascular Technologist**
- **AOS Cardiac Electrophysiology Technologist**
- **Pacemaker/ICD Technician**

OUR PROUD HISTORY AND HERITAGE

Carnegie Institute was founded in 1947, Detroit, Michigan. Its license was granted by the Michigan State Department of Education to establish post secondary education and training for the development of human resources in the allied health support services. The need for trained medical assistants was critical as specialized post secondary education was non-existent.

The Beginning Of Many “Firsts” For The Institute.

1947 - First school of its kind to achieve State recognition; and one of the leading schools in the country to offer a regularly scheduled instructional program for training Medical Assistants.

1950 - First Director of Education, James F. McEachern, M.S., ScD. established curriculum and quarterly schedules of instruction for allied health programs.

1968 - First Institutional Accreditation by Accrediting Commission of Career Schools and Colleges (ACCSC).

1974 - First CAAHEP Program Accreditation for Medical Assistants by Commission on Accreditation of Allied Health Education Programs on recommendation of the Committee on Accreditation for Medical Assistant Education.

2000 - First school in the State of Michigan to receive CAAHEP Program Accreditation for its Cardiovascular Technologist Program on recommendation of the Joint Review Committee on Education (JRC-CVT).

2002 - First school in the State of Michigan to receive CAAHEP Program Accreditation for its *Invasive* Cardiovascular Technologist Program on recommendation of the Joint Review Committee on Education (JRC-CVT).

2004 - First school in the State of Michigan to receive CAAHEP Program Accreditation for its Electroneurodiagnostic Technologist Program on recommendation of the Committee on Accreditation for Education in Neurodiagnostic Technology (CoA-NDT).

2006 - First school in the State of Michigan to receive CAAHEP Program Accreditation for its Vascular Technologist Program on recommendation of the Joint Review Committee on Education in Cardiovascular Technology (JRC-CVT).

2026 - Received approval from the State of Michigan to offer an Associate of Occupational Science (AOS) degree in the following cardiovascular specialties: Cardiovascular Technologist, Invasive Cardiovascular Technologist, Cardiac Electrophysiology Technologist, and Vascular Technologist.

The significance of *dual* accreditation distinguishes Carnegie Institute as the first private, post secondary school of allied health technology in the State of Michigan, and one of the few schools so accredited in the country to this day.

Graduating students at Carnegie have externship privileges at more than 300 medical facilities, and rotation privileges at 55 major hospitals in our service areas. We are proud of these accomplishments, and of the professional career achievements of Carnegie graduates.

MISSION STATEMENT

Our mission is to maintain an accredited post secondary school that provides competency-based curriculum in allied health technology and health care support services leading to career employment, national credentialing, board registry, and professional recognition of the Carnegie graduate.

School directors, administrators, faculty and staff are committed to maintaining the integrity of the Institute's philosophy through assessment and collective participation in the school's growth and development.

Our resolve is:

- To maintain a strong competency-based curriculum supported by supervised hands-on training in each specialty
- To maintain dual program accreditation, where applicable
- To maintain quality school facilities in an educational environment conducive to learning
- To maintain an experienced, credentialed faculty and support staff
- To maintain a good student-teacher ratio to address individual student needs
- To keep the curriculum and training relevant to career requirements enabling students to see the direct relationship between training and employer expectations
- To provide services that help students achieve their education/career goals
- To help Carnegie students develop a sense of responsibility and pride in the allied health professions
- To encourage national credentialing/board registry for professional recognition
- To maintain the respect and support of the education and medical communities who refer students to us for training and who hire our graduates

THE CARNEGIE DIFFERENCE

Our commitment to excellence enables us to make a meaningful difference in the lives of others through the professional services of Carnegie graduates.

Carnegie's time-tested philosophy of education has anticipated training requirements for the allied health support services in Michigan since 1947. Thousands of our multi-skilled graduates are making a difference as quality contributors in a wide range of health career services.



ADMINISTRATION

Robert J. McEachern **President and Chief Financial Officer**
Linda M. Ingraham **Vice President and Chief Operating Officer**
Bonnie M. Normile **Vice President and Director of Education**
Jane M. Brown **Associate Director of Education**
Kim E. Anderson **Director, Financial Aid Office**
Jannelle Yaden **Admissions Officer**
Jamie M. Salin **Admissions Officer**
Reyne M. Ciaramitaro **Student Educational and Admissions Services**

MEDICAL ADVISORY BOARD

Esther L. Young, DO, Yevgeniy Rits, MD

Leah Cecil, DO

Jeffrey Miller, MD, Richard Bloomingdale, MD, Ivan D. Janson, MD

FACULTY

Bonnie M. Normile

Diploma - Providence Hospital, School of Nursing
RN - State of Michigan
Oakland University
Wayne State University, School of Medicine
CMA - Certified Medical Assistant - AAMA

Jane M. Brown

BSN - University of Michigan, School of Nursing
RN - State of Michigan
Detroit College of Law
Massage Therapy - Carnegie Institute
LMT - Licensed Massage Therapist, State of Michigan

Karen M. Haynes

BS - University of Michigan
Medical Technologist - ASCP Certified

Natalie Affonso

BS - Michigan State University
Medical Technologist - ASCP Certified
CMAC - American Medical Certification Association

Cynthia K. Merimee

Medical Assistant - Carnegie Institute
CMA - Certified Medical Assistant - AAMA

Kim E. Anderson

Michigan State University
Medical Assistant - Carnegie Institute
CMA - Certified Medical Assistant - AAMA

Blerta Ndoj

MIB - Carnegie Institute

Doliana Nuro, CMA(AAMA)

Medical Assistant - Carnegie Institute
CMA - Certified Medical Assistant - AAMA
Macomb Community College

Alan C. Bennett

Rhode Island College
RCIS - Registered Cardiovascular Invasive Specialist - CCI

Amanda M. Cieslak

BAS - Siena Heights University
ICVT - Carnegie Institute
RCIS - Registered Cardiovascular Invasive Specialist - CCI
CCT - Certified Cardiographic Technician - CCI
ACLS - American Heart Association

Katherine Tomaszewski

ICVT - Carnegie Institute
RCIS - Registered Cardiovascular Invasive Specialist - CCI
AAS - Macomb Community College - Paramedic
AAS - Macomb Community College - EMT/Paramedic

Susan L. Scott

C-EP - Carnegie Institute
RCES - Registered Cardiovascular Electrophysiology Specialist - CCI
ACLS - American Heart Association

Deborah Crisan

ICVT - Carnegie Institute
RCIS - Registered Invasive Cardiovascular Specialist - CCI
ACLS - American Heart Association

Sarah N. Kemaïd

MPH - Ohio University
BS - Sienna Heights University
ICVT - Carnegie Institute
RCIS - Registered Invasive Cardiovascular Specialist - CCI
ACLS - American Heart Association

Director of Education

Director, Medical Assistant Program
Director of Clinical Site Coordination
Anatomy & Physiology/Medical Terminology

Associate Director of Education

Theory & Clinical Instruction
Anatomy & Physiology/Medical Terminology
Therapeutic Communications,
Pharmacology, Nursing Arts, ECG

Continuing Education Services

Associate Director, Medical Assistant Program

Assistant Director, Student Academic Affairs
Theory & Laboratory Instruction
Anatomy & Physiology/Medical Terminology

Medical Assistant Program
Computer Applications, Business Communications,
Medical Office Procedures, Medical Insurance Billing

ECG Practical and CPR

Medical Insurance Biller Program
Theory & Laboratory Instruction

Medical Assistant Program
Nursing Arts, Medical Office Procedures

Invasive Cardiovascular Technologist Program

Director, Invasive Cardiovascular Technologist Program

Theory & Laboratory Instruction

Invasive Cardiovascular Technologist Program

Cardiac Electrophysiology Technologist Program
Theory & Laboratory Instruction

Invasive Cardiovascular Technologist Program
Theory & Laboratory Instruction

Invasive Cardiovascular Technologist Program

FACULTY

Rhonda A. McMillian

BS - Oregon Institute of Technology
MSA - Central Michigan University
CVT - Carnegie Institute
Henry Ford Community College
RDMS - Registered Diagnostic Cardiac Sonographer - ARDMS
RVT - Registered Vascular Technologist - ARDMS
PhD - Central Michigan University

Jannelle Yaden

M.Ed - Wayne State University
BS - Western Michigan University

John E. Rudzinski

M.Ed. - Wayne State University
BS - Wayne State University
CVT - Carnegie Institute
RDMS - Registered Diagnostic Cardiac Sonographer - ARDMS

Nellie A. Wolak

RDMS - Registered Diagnostic Cardiac Sonographer - ARDMS

Ernestine Dubose

Wayne State University
CVT - Carnegie Institute
RCS - Registered Cardiac Sonographer - CCI

Lalitha Devardjy

MS - Annamalai University
CVT - Carnegie Institute
RDMS - Registered Diagnostic Medical Sonographer - ARDMS

Evelynne A. Somers

CVT - Carnegie Institute
AD - Oakland Community College
RDMS - Registered Diagnostic Cardiac Sonographer - ARDMS
RVT - Registered Vascular Technologist - ARDMS

Christopher E. Brown

MS - Wayne State University
BS - Wayne State University

Elizabeth L. Lawrence

Health Science Degree, Diagnostic Ultrasound - University of Oklahoma
RDMS - Registered Diagnostic Medical Sonographer - ARDMS
RDMS - Registered Diagnostic Cardiac Sonographer - ARDMS
RVT - Registered Vascular Technologist - ARDMS

Donna H. Stroud

Vascular Technologist - Carnegie Institute
Medical Assistant - Carnegie Institute
RVT - Registered Vascular Technologist - ARDMS

Brandon S. Hennings

VT - Carnegie Institute
RVT - Registered Vascular Technologist - ARDMS
Oakland University

Ewa U. Magda

BBA - Davenport University
VT - Carnegie Institute
RVT - Registered Vascular Technologist - ARDMS

Fadi Odeesho

BS - Baghdad, Iraq
VT - Carnegie Institute
RVT - Registered Vascular Technologist - ARDMS

Erin M. Hennings

VT - Carnegie Institute
RVT - Registered Vascular Technologist - ARDMS

Paul L. Kolar

BS - The University of Michigan
ACLS - American Heart Association

Kimberly A. Schaefer

EMT - Superior Medical Education
ENDT - Carnegie Institute
R.EEG T. - Registered EEG Technologist - ABRET
CLTM - Certification in Long Term Monitoring - ABRET
BS - Siena Heights University

Kathleen Smith

ENDT - Carnegie Institute
R.EEG T. - Registered EEG Technologist - ABRET

Anay Ismail

BS - Mississippi State University
ENDT - Carnegie Institute
R.EEG T. - Registered EEG Technologist - ABRET

Susan M. Proffitt

BSN - Madonna University, School of Nursing
RN - State of Michigan
MT - Ann Arbor Institute of Massage Therapy
LMT - Licensed Massage Therapist, State of Michigan

Sue Willman

BS - University of Windsor
MT - Carnegie Institute
LMT - Licensed Massage Therapist, State of Michigan

Director, Vascular Technologist Program

Director, Cardiovascular Technologist Program
Theory Instruction

Cardiovascular Technologist Programs
Theory & Laboratory Instruction

Cardiovascular Technologist Programs
Theory & Laboratory Instruction
Physics

Cardiovascular Technologist Program
Laboratory Instruction

Cardiovascular Technologist Program
Laboratory Instruction

Cardiovascular Technologist Program
Laboratory Instruction

Cardiovascular Technologist Program
Laboratory Instruction

Cardiovascular Technologist Programs
Physics

Cardiovascular Technologist Programs
Physics

Coordinator, Clinical Site Rotation

Vascular Technologist Program
Laboratory Instruction

Vascular Technologist Program
Lecture & Laboratory Instruction

Vascular Technologist Program
Laboratory Instruction

Vascular Technologist Program
Laboratory Instruction

Vascular Technologist Program
Laboratory Instruction

Pacemaker/ICD Technician Program
Theory & Laboratory Instruction

Director, Electroneurodiagnostic Technologist Program

Theory & Laboratory Instruction

Electroneurodiagnostic Technologist Program
Laboratory Instruction

Electroneurodiagnostic Technologist Program
Laboratory Instruction

Director, Massage Therapy Program

Theory & Laboratory Instruction
Anatomy & Physiology/Medical Terminology
Nursing Arts

Massage Therapy Program
Theory & Laboratory Instruction



THEORY PLUS TECHNICAL SKILL DEVELOPMENT PREPARES CARNEGIE STUDENTS FOR THE COMPETITIVE JOB MARKETS

Carnegie Institute is licensed by the State of Michigan Department of Labor and Economic Opportunity to define its programs in credit hours.

One quarter credit hour equals 30 units. One clock hour in a didactic learning environment equals 2 units. One clock hour in a supervised laboratory setting of instruction equals 1.5 units. One hour of externship equals 1 unit. One hour of out-of-class preparation equals .5 unit.

For financial aid purposes, U.S. Department of Education's clock hour to credit hour Conversion Formula is applied. For further details visit the financial aid office.



Professional Letters of Faculty and Associations:

AAMA	American Association of Medical Assistants
ABRET	American Board of Registration of Electroencephalographic Technologists and Evoked Potential Technologists
AAS	Associate of Applied Science
AAPC	American Academy of Professional Coders
ACLS	Advanced Cardiac Life Support
AD	Associate Degree
AMA	American Medical Association
AMTA	American Massage Therapy Association
AOS	Associate of Occupational Science
ARDMS	American Registry of Diagnostic Medical Sonography
BA	Bachelor of Arts
BAS	Bachelor of Applied Science
BBA	Bachelor of Business Administration
BLS	Basic Life Support
BS	Bachelor of Science
BSN	Bachelor of Science in Nursing
CCI	Cardiovascular Credentialing International
CCT	Certified Cardiographic Technician
CCVT	Certified Cardiovascular Technologist
CLTM	Certification in Long Term Monitoring
CMA	Certified Medical Assistant
CNIM	Certification in Neurophysiological Intraoperative Monitoring
CPC	Certified Professional Coder
CRAT	Certified Rhythm Analysis Technician
CVT	Cardiovascular Technologist
ICVT	Invasive Cardiovascular Technologist
LMT	Licensed Massage Therapist
MA	Master of Arts
MBA	Master of Business Administration
MD	Medical Doctor
M.Ed.	Master of Education
MHA	Master of Health Administration
MS	Master of Science
MSA	Master of Science in Administration
MT	Massage Therapist
PhD	Doctor of Philosophy
RCS	Registered Cardiac Sonographer
RCES	Registered Cardiovascular Electrophysiology Specialist
RCIS	Registered Cardiovascular Invasive Specialist
RDCS	Registered Diagnostic Cardiac Sonographer
RDMS	Registered Diagnostic Medical Sonographer
REETG	Registered Electroencephalographic Technologist
REPT	Registered Evoked Potential Technologist
RN	Registered Nurse
RVS	Registered Vascular Specialist
RVT	Registered Vascular Technologist



STUDENT ADVISORY SERVICES



ADMISSIONS

During the prospective student's initial conference with an Admissions Officer and prior to enrolling at Carnegie Institute, advisory services are provided to determine student's interest, qualifications and general aptitude for the allied health field.

ACADEMIC

Educational advisory services continue throughout the school year on an individual basis as the need is indicated. Also, small discussion/study groups are scheduled to assist students in achieving a better understanding of the material presented.

SCHOOL SUPPORT

Students in need of additional support services, such as community referral services, professional counselor, health care assistance, crisis intervention, etc., should see an instructor or school personnel for appropriate referral.

CAREER PLACEMENT

Carnegie Institute plays a vital role in preparing students to meet the demands of the workforce. The placement process for our graduates begins early with initial student orientation, and continues with group and individual sessions in career readiness and resume preparation to assist student in making a successful transition into the professional workplace. Interviews for job placement are held during the final phases of training to help prepare the student for employment. During this time, each student receives assistance from School Externship Supervisors and School Placement Coordinator to determine specialty areas which will most likely provide success and personal satisfaction. Our Placement Office maintains a database to manage the volume of placement requests from Michigan physicians, hospitals and other health care employers. Every effort is made to satisfy employer and student expectations and to achieve the school's goal of 100% graduate placement. The Placement Coordinator continues to work with each graduate until a successful outcome is achieved.

FINANCIAL AID

Information related to Federal Student Loans or Federal Pell Grants is provided on the school's website at www.carnegie-institute.edu; click on the Financial Aid link. Upon student completion of the Free Application for Federal Student Aid at <https://www.studentaid.gov/>, the Financial Aid Administrator will determine eligibility for federal funds.

SCHOOL PREROGATIVES

The school reserves the right to make changes in the curriculum, schedule of instruction, starting and completion dates, rules and regulations, admission requirements, textbooks, tuition, faculty, personnel or other changes deemed necessary and which in its judgment are in the best interest of the school and its students. If fewer than ten students are enrolled for any program, the school reserves the right to cancel the program and refund the student's deposit.



ADMISSION POLICIES AND PROCEDURES

The admission requirements of Carnegie Institute are designed to permit the student with a strong aptitude and proper motivation to qualify for training. The following standards must be met before an applicant can be considered.

ADMISSION REQUIREMENTS

Diploma Programs:

- A high school diploma or its equivalent.
- Documentation of official high school transcript or GED certificate.
- Documentation of official college transcript and advanced degree(s) if applicable.
- Proficiency in keyboarding
- Prior work experience or college credits in accounting, business, or banking is preferred for the Medical Insurance Biller Program.
- In addition, prior allied health training, recent clinical work experience and college credits in anatomy & physiology, math, and science are required for the Cardiology Technician and Pacemaker/ICD Technician programs. A letter grade of B, or a minimum GPA of 3.0 is required.
- Prior allied health training, recent clinical work experience and college credits in medical terminology, math and science are required for the Electroneurodiagnostic Technologist program. A letter grade of B, or a minimum GPA of 3.0 is required.
- A personal interview at the school between applicant and Admissions Officer is required.
- A pre-enrollment interview with the Director of Education is required for Cardiology Technician, Pacemaker/ICD Technician or Electroneurodiagnostic Technologist.
 - Successful completion of entrance examinations.
 - Three (3) professional/personal references are required.

- Submission of a formal application as provided by the school. Arrangements for high school or college transcripts will be made by the applicant prior to enrollment.

Associate in Occupational Science degree programs:

- A high school diploma or its equivalent.
- Documentation of official high school transcript or GED certificate.
- Documentation of official college transcript and advanced degree(s) if applicable.
- A letter grade of B, or a minimum GPA of 3.0 is required for all General Education courses in the AOS programs.
- All applicants for the AOS degree programs will be ranked using a point system in specific categories. Refer to the Admission Point System form with Admission Officer.
- One page resume is required.
- Ranking points are awarded for prior allied health work experience.
- Three (3) professional letters of recommendation are required.
- A personal interview at the school between applicant and Admissions Officer.
- Completion of entrance examination(s) including proficiency in keyboarding.
- A pre-enrollment group interview with the Director of Education.
- Submission of a formal application as provided by the school.
- The above factors will determine the applicant's ranking in the point system.

ENTRANCE EXAMINATIONS

Entrance examinations for each course of study are administered to determine the student's aptitude and potential for success. Each program has specific pre-requisites; therefore, examinations for each program will vary.

APPLICATION FORMS

Application forms may be obtained through the Admissions Office at Carnegie Institute. Prospective students are advised to file applications several months in advance of the selected quarterly starting date since the number of new students admitted to each class is limited.

MEDICAL HEALTH FORM

A health form, supplied by the school, is to be completed by applicant's physician and submitted to the school. Student will not participate in any practical applications of phlebotomy or injections until bloodwork results are submitted and approved by the Associate Director of Education.

STUDENT CONDUCT

Carnegie Institute has established regulations in order to maintain an environment that encourages professional demeanor. Students are expected to conduct themselves at all times in a manner which will reflect favorably on the school and the allied health professions that they have chosen to follow. Respect and consideration for school personnel, property, and the property and rights of other individuals is expected. Permanent dismissal from school will result from unsatisfactory conduct, non-compliance with Carnegie Institute's Drug and Alcohol Prevention Program, and our smoke-free environment policy as outlined in the Student Handbook. In addition, any willful destruction of school property will result in immediate expulsion.

Careers in allied health require a keen sense of self-discipline and an awareness of professional conduct. The high standards of professionalism expected of health care personnel can best be achieved through daily application of professional principles.

RESPONSIBILITY

All equipment, classrooms and laboratories must be left in proper condition after use. Students,

individually or collectively, may be held financially responsible for damage to school property caused by abuse or negligence on their part.

The school assumes no responsibility for loss of student property resulting from theft or neglect. In keeping with the **no smoking policy** adopted by health care employers, medical facilities, professional institutions and buildings, **smoking is not permitted** in the halls, entrances, classrooms, labs, lounge, or lavatories. Students are required to restrict the consumption of food and beverages to the student lounge provided for this purpose.

STUDENT DRESS CODE

The general appearance of all students in training for allied health careers should reflect good health, overall neatness, and hygiene. Hair must be clean and styled for uniform wear. All Carnegie students, while in training, are required to wear freshly laundered, white or navy blue clinical uniforms and appropriate clinical shoes. If a sweater or jacket is worn in the school building, it should be navy or white and free of ornamentation. Clothing bearing the Carnegie Institute name and logo is available for purchase and may not be altered in appearance in any way. Written permission is required for the use of the Carnegie Institute name and logo. Uniforms are available for student purchase at any uniform or retail store.

ATTENDANCE REGULATIONS

Subject matter is presented on a regularly assigned basis. Students are expected to attend all scheduled classes and to be punctual. Laboratory sessions, both clinical and administrative, are carefully scheduled to provide the student with the required hours of teacher supervision while the student is developing skill competencies. Absences, other than for serious illness or extenuating circumstances, are discouraged. The **School's Attendance Policy** is as follows:
Attendance Alert Report: If absences exceed 10% of the total hours in the

quarter, student will be placed on Attendance Alert.

Attendance Probation: If absences exceed 15% of the total hours in the **quarter**, student will be placed on Attendance Probation.

If absences exceed 25% of the total hours in the **quarter**, student will adhere to the recommendations of the **Attendance Review Board**. Under its direction, student **may be required** to make-up one hour of class time for each hour absent beyond 25% prior to the start of the next quarter, repeat the quarter, or be dismissed.

Student with excessive absenteeism will be required to complete one additional hour of externship for each hour of class time missed. Refer to page 8a of Student Handbook. Failure to comply with school attendance regulations is considered cause for dismissal, suspension, or an extended externship period after completion of the final quarter of training. The school requires a satisfactory evaluation of the student's externship performance from the externship site supervisor before a student is considered eligible for a diploma.

In the event a student must miss a consecutive number of class days for a normally excusable reason (illness, death in family, etc.) which makes continuance in the current term academically disadvantageous, or if student is unavailable for Externship/Clinical Rotation assignment for a normally excusable reason, student may be granted a Leave of Absence (LOA) by the School. LOA paperwork must be completed and

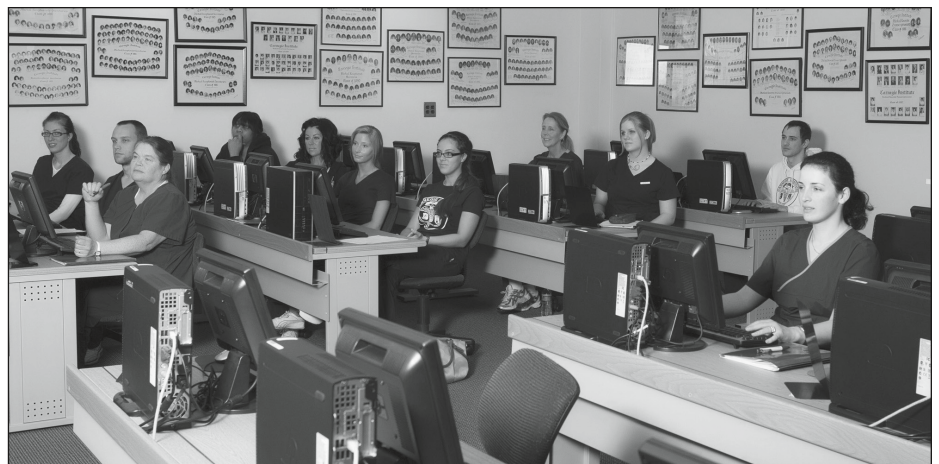
approved by three staff/faculty members. Student must provide supporting documentation (i.e., medical note, etc.) with LOA request. In compliance with Federal Regulations, students receiving Title IV financial aid will be required to withdraw and reenter the program at the next regular start date. If student fails to return from LOA, student will be considered withdrawn and published Refund Policy will apply.

PROGRAM COMPLETION

The maximum time frame in which training must be completed must not exceed 1.5 times the number of credit hours required to complete the program. Refer to Student Handbook, page 16 for additional details.

SUSPENSION AND DISMISSAL POLICY

A student who is late three times within any one quarter will be charged with one day of absence. A student may be required to drop a subject if the amount of absenteeism exceeds 25% of the total time allotted to that subject. Reinstatement of student will be at the discretion of the Director of Education after arrangements have been made between the student and instructor concerning make-up assignments and class hours missed. The school reserves the right to dismiss or suspend any student whose conduct or activities reflect unfavorably upon the school or the allied health professions.



IN-PERSON/ONLINE EDUCATION

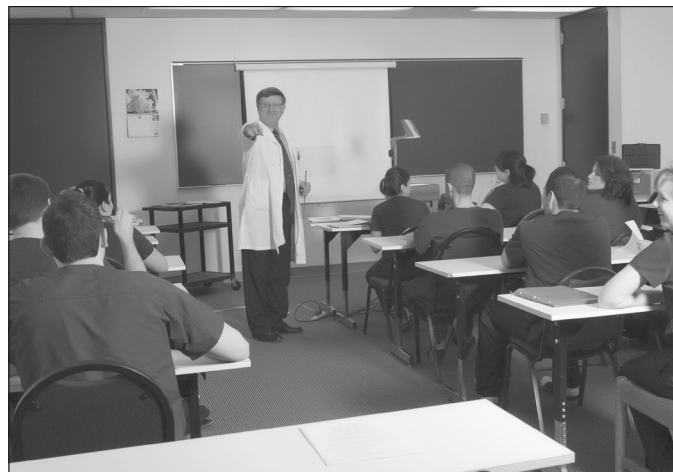
Depending on the program in which you are enrolled, courses may be delivered in either a blended learning environment or fully in-person format. In blended learning programs, students attend classes at Carnegie Institute for hands-on, practical application experiences, while select lecture (didactic) courses are completed remotely. In programs that are fully in-person, both lecture (didactic) instruction and hands-on, practical application courses are delivered on campus at Carnegie Institute.

Hybrid or blended courses mean some portion of on-campus instruction is replaced by distance education teaching and learning activities.

Synchronous means the course is presented live and all students are required to participate at the same time with the instructor; however, the students and the instructor are in separate locations.



Asynchronous means the course is presented, recorded, and provided to the student by the instructor to complete coursework within established deadlines. Students engage in learning activities based upon teaching materials and assignments compiled and made available by the instructor. Student attendance is recorded hourly, and participation during online instruction is monitored and evaluated by the instructor. The school's **Learning Management System (LMS)** consists of the GoToMeeting, Moodle teaching platforms with Office 365 and ClassMarker, as an online testing platform. For certain lecture (didactic) courses, students access instruction by logging into the GoToMeeting application via the internet using an invitation link provided by the instructor. Additionally, general education courses within the Associate of Occupational Science (AOS) degree



programs are delivered through asynchronous online education. This format allows students to complete coursework and learning activities on their own schedule, provided all assignments and requirements are completed by the established due dates. Active class participation is mandatory and required to receive attendance credit.

The prerequisites for participation and expected learning outcomes in our online education courses remain the same as those for students enrolled in a 100% in-person format. Course content is delivered on a regular schedule, and students are expected to attend all scheduled classes and maintain Satisfactory Academic Progress, as outlined in the School Catalog and the Student Handbook: A Catalog Supplement.

TEACHING FORMAT

The teaching format at Carnegie Institute has been tested through years of experience and service to the medical profession. The method of teaching applied in all courses at Carnegie combines theory with practice. A general discussion or lecture, usually accompanied by demonstration, is presented to students who then perform and practice the technique or procedure under supervision until proficiency is attained.

Approximately one-third to one-half of the total instruction time is spent on theory, with the remaining one-half to two-thirds being spent on the practical application of the principles presented.

Acquired skills are measured by classroom performance, assignments, quizzes, mid-term and final examinations to determine the student's level of competency and comprehension.

CLASS SIZE

Lecture classes are able to accommodate up to 75 students. Following each lecture, students are divided into small groups in order to maintain a low student-teacher ratio during laboratory practice.



The student-teacher ratio during laboratory procedures will vary from 1:1 to 1:12, depending on the nature of the procedure to be perfected. Medical office laboratory is limited to a maximum of 38 students for computer skills and other administrative subjects.

LEARNING RESOURCE SYSTEM

The school's Learning Resource System (LRS) consists of physical and electronic educational resources, instructional technologies, and support services that are integrated into the curriculum and made accessible to students and faculty to enhance and support student learning outcomes, and achievement of successful program completion. The primary Learning Resource Center is located in Suite 105, the Computer Lab and Annex Lab. Additional learning resource materials are organized by program area to provide convenient and relevant access for students. These resources are available within program-specific departments and classrooms to support course instruction and student learning needs.

GRADING

Student progress is under daily observation and appraisal by the teaching staff. At the completion of each quarter, final grades for all subjects taken during the quarter are calculated and filed as part of each student's permanent scholastic record. Student receives a copy of quarterly scholastic record. Students in the core programs must have a combined average grade of not less than 70% and a Minimum Cumulative Completion Rate of 67% to be eligible for graduation*. Students in the

Cardiology Technician, Cardiovascular Technologist, Vascular Technologist, Invasive Cardiovascular Technologist, Cardiac Electrophysiology Technologist, Pacemaker/ICD Technician and Electroneurodiagnostic Technologist programs must have a combined average grade of not less than 80% and a Minimum Cumulative Completion Rate of 67% to be eligible for graduation*. Final grades are determined on the basis of weekly quizzes, quarterly mid-term exams, final written and practical exams, demonstrated practical ability, proficiency, completion of assignments, deportment, application, and initiative.

If documented extenuating circumstances contributed to the scholastic failure, student may be allowed to repeat the subjects failed upon recommendation of the faculty and at the discretion of the Academic Review Board. Said student may be readmitted for a 12 week probationary period. The student will be re-evaluated at the end of the probationary period to determine status. Failure to maintain satisfactory academic progress during this period will result in permanent dismissal. See Student Handbook for additional information.

Satisfactory Academic Progress (SAP)

Standards apply to all students attending Carnegie Institute.

The specific SAP policy is outlined in detail in the Student Handbook, a catalog supplement.

For additional information, student may also contact the school Financial Aid Office.

The following grading system is in conformity with the Accrediting Commission of Career Schools and Colleges (ACCSC):

LETTER GRADE	PERCENT	GRADE POINT AVERAGE
A	95-100	4.0
A-	90-94	3.66
B+	85-89	3.33
B	80-84	3.0
B-	76-79	2.66
C+	73-75	2.33
C	70-72	2.0*
C-	66-69	1.66
D+	64-65	1.33
D	60-63	1.0
F	less than 60	0.0
I	Incomplete	

*Required to graduate

* See Student Handbook for details related to Satisfactory Academic Progress

The Medical Assistant ... A multi-skilled professional essential to today's health care team

MEDICAL ASSISTANT

Do you enjoy diverse responsibilities and receive personal satisfaction from helping others? Do you have an interest in health services or medicine and the ability to multi-task? If so, consider a meaningful career as a Medical Assistant.

Carnegie Institute offers specialized training in clinical nursing skills, proper use of diagnostic equipment, and competent performance of lab tests while developing a working knowledge of medical office management procedures. Instruction is provided to cultivate effective communication, human relations skills, critical thinking, and problem solving. The goal of our Medical Assistant program is to prepare competent entry-level medical assistants in the cognitive (knowledge), psychomotor (skills), and affective (behavior) learning domains to enter the profession.

Once employed as a Medical Assistant, you will value the distinct advantage your CAAHEP/MAERB accredited Carnegie training provides as you apply your knowledge of medical terminology, anatomy & physiology, pharmacology, and medical law & ethics in the performance of nursing arts, venipuncture, injections, ECG, laboratory sciences, and medical office procedures, including data management of electronic health care records. You will be prepared to work in a wide range of responsible career entry positions within the health care delivery system, including doctors' offices, medical clinics, urgent care and outpatient facilities.

Your Carnegie training will open many doors to employment and provide meaningful opportunities for career advancement in the field of allied health.

The American Association of Medical Assistants (AAMA) awards Certified Medical Assistant (CMA) credentials to those applicants who pass the national exam, indicating the Medical Assistant meets required standards of competency.

U.S. Bureau of Labor Statistics anticipates health care occupations to be the fastest growing sector. Employment of Medical Assistants is projected to grow by 14% through 2032, a much faster rate than the average for all occupations. Carnegie plays a vital role in preparing students to meet this workforce demand.



Course Descriptions

Anatomy and Physiology/Medical Terminology

This course is designed to familiarize the student with the concepts of human anatomy and physiology from the cellular level to the body systems. The most common diseases affecting the body systems, their symptoms and treatment are also emphasized. Medical terminology is integrated to provide a correlation and understanding of medical terms, prefixes and suffixes, and to provide logic in their appropriate applications.

Nursing Arts

Presents concepts to accurately perform clinical nursing procedures that are utilized in out-patient settings. Principles of pharmacology and administration of medications are covered thoroughly. Principles of obtaining vital signs and patient histories, charting and assisting with general physical examinations for each medical specialty are emphasized.

Nursing Arts Laboratory Practicum

Supervised hands-on training, 1-1 ratio, for all clinical nursing procedures is closely monitored by certified subject specialists to ensure quality control. Nursing Arts labs are limited in size to achieve professional confidence and successful development of clinical skills.



MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Medical Assistant graduates will be able to:

- Assist physician with patient care management
- Obtain a patient history utilizing specific communication tools
- Perform aseptic and sterile handwashing
- Prepare patient for physical examination
- Assist with general and specialty exam procedures and treatment
- Identify and prepare medical and surgical instruments
- Utilize sterile technique
- Prepare sterile field and assist with outpatient surgery
- Identify various suture designs and materials used
- Perform suture removal
- Operate autoclave for sterilization of materials and instruments
- Measure and interpret patient's temperature, pulse, respiration, and blood pressure
- Conduct hearing and vision testing
- Accurately pronounce, spell and use medical terms
- Perform accurate charting documentation of patient care and education
- Calculate proper medication dosage
- Prepare proper dosage of medication for administration
- Administer medications by injections and other routes as directed by physician
- Conduct and analyze routine diagnostic testing including allergy and TB screening
- Screen diagnostic test results
- Perform ECG testing and report ECG abnormalities
- Administer Pulmonary Function Testing
- Perform phlebotomy procedures
- Perform capillary puncture
- Perform eye and ear irrigations
- Perform Urinary Catheterization
- Administer Basic Life Support (BLS) through American Heart Association. Administer First Aid
- Schedule appointments utilizing computerized software and manual techniques for optimal patient flow management
- Manage incoming and outgoing telephone calls and utilize electronic communication
- Compose professional/business communication
- Conduct office triage and prioritize patient care needs
- Execute data management using electronic health care records including EMR and filing systems
- Manage accounts receivable/payable
- Maintain billing and collection system
- Complete bank deposits and maintain banking records
- Perform payroll procedures
- Accurately code, process insurance claims and apply third party guidelines
- Use Internet to access information related to the medical facility
- Perform office inventory and maintain office supplies and equipment
- Utilize OSHA Universal Standards and Precautions
- Utilize appropriate barrier/personal protective equipment (PPE) for potentially infectious situations
- Perform CLIA waived hematology testing
- Perform CLIA waived chemistry testing
- Perform CLIA waived urinalysis
- Perform CLIA waived immunology testing
- Perform CLIA waived microbiology testing
- Maintain laboratory test results using flow sheets
- Advocate on behalf of patient and incorporate the patient's Bill of Rights
- Complete an incident report
- Perform within Medical Assistant scope of practice
- Maintain a list of available community resources
- Exercise emergency preparedness
- Apply HIPAA rules in regard to privacy/release of information
- Adhere to the principles of medical law and ethics and standard of care as applied to role of the Medical Assistant
- Apply local, state and federal health care legislation and regulation appropriate to the medical practice

MEDICAL ASSISTANT PROGRAM

QUARTERLY SCHEDULE OF INSTRUCTION

(12 Months)

Four 12 Week Quarters

Morning Classes: Monday through Friday, 8 AM - Noon

Course	Contact Hours	Credit Hours
FALL QUARTER		
Anatomy & Physiology/Medical Terminology	36	2.5
Nursing Arts	60	3.5
Phlebotomy	12	0.5
Laboratory Science: Chemistry	48	3.0
Therapeutic Communications	12	0.5
Pediatrics	12	0.5
Medical Law & Ethics	12	0.5
Medical Office Procedures	12	0.5
Business Communications	12	0.5
Medical Insurance Billing & Coding	12	0.5
Computer Applications: EMR	12	0.5
Work Outside of Class: 60 Hours		
TOTALS:	240	13.0
WINTER QUARTER		
Anatomy & Physiology/Medical Terminology	36	2.5
Nursing Arts	48	3.0
Phlebotomy	24	1.5
Nutrition	12	0.5
Laboratory Science: Hematology	48	3.0
Geriatrics	12	0.5
Medical Office Procedures	12	0.5
Business Communications, Keyboarding	24	1.0
Medical Insurance Billing & Coding	12	0.5
Computer Applications: EMR	12	0.5
Work Outside of Class: 60 Hours		
TOTALS:	240	13.5
SPRING QUARTER		
Anatomy & Physiology/Medical Terminology	36	2.5
Nursing Arts	48	3.0
Phlebotomy	12	0.5
Pharmacology	36	2.5
First Aid/Basic Life Support	12	0.5
Laboratory Science: Microbiology	48	3.0
Record Keeping	12	0.5
Medical Office Procedures	12	0.5
Business Communications	12	0.5
Computer Applications: Appointment Scheduling	12	0.5
Work Outside of Class: 60 Hours		
TOTALS:	240	14.0
SUMMER QUARTER		
Anatomy & Physiology/Medical Terminology	36	2.5
Nursing Arts	48	3.0
Phlebotomy	12	0.5
Laboratory Science: Urinalysis	48	3.0
ECG	36	2.0
Introduction to X-Ray & Imaging	12	0.5
Medical Office Procedures	12	0.5
Business Communications	12	0.5
Medical Insurance Billing & Coding	12	0.5
Computer Applications: MS Word	12	0.5
Work Outside of Class: 60 Hours		
TOTALS:	240	13.5
TOTAL CONTACT HOURS/CREDIT HOURS	960	54.0
EXTERNSHIP HOURS	160	5.0
TOTAL HOURS OF INSTRUCTION	1120	59.0
TOTAL HOURS OUTSIDE OF CLASS: 240		

Note: Total hours outside of class are approximate.

- **National Credentialing** - As a graduate of a program accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Medical Assisting Education Review Board (MAERB), you will be eligible to take the American Association of Medical Assistants (AAMA) national certification exam **immediately** following completion of your training.
- **Membership** - In the American Association of Medical Assistants (AAMA) is open to you as a student and graduate.

MEDICAL ASSISTANT COURSE DESCRIPTIONS

ECG

Student performs ECG testing procedures and related diagnostic tests. Focus is placed on basic waveform morphology according to Einthoven triangle. Application of limb and chest electrodes, principles of machine operation, voltage and time values of ECG is also emphasized. Discussion of exercise stress testing and dynamic cardiograms is also included.

ECG Laboratory Practicum

Student develops skills in ECG testing procedures. Application of measurement techniques for placement of chest electrodes, principles of machine operations and troubleshooting to maintain quality of ECG tracing is thoroughly covered. Ancillary ECG tests such as dynamic cardiograms and stress testing are also presented. Technical skills are performed under the supervision of certified specialists to ensure quality control and professional skill development.

Pharmacology

This course provides the clinical information required for the informed and safe administration of medications that are most commonly given by the Medical Assistant. Classifications, actions, side effects, contraindications and nursing implications are covered. Emphasis is placed on patient teaching and the importance of quality control throughout this course.

Nutrition

The study of six major nutrients, their functions, classifications and recommended daily allowances of each group. The principles of diet therapy and the use of therapeutic diets is also presented.

Pediatric Specialty

Student learns the principles of human growth and development from infancy to adolescence. Mental and physical benchmarks are

described. Aspects of the physical examination and vaccination schedules as applied in the pediatric specialty are presented.

Geriatric Specialty

This course is the study of the physiological and psychological changes that occur in the elderly patient. Focus is placed on special needs, including emotional support, the importance of proper nutrition, deficiency in motor skills, and common symptoms associated with geriatric disorders.

Healthcare Provider

Basic Life Support

This is a programmed course designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

First Aid

Supervised hands-on training in first aid and safety procedures is performed by student. Emphasis is placed on emergent care for seizures, strokes, cardiac events and other common office emergencies. Instructors closely monitor techniques to ensure quality control and instill professional confidence. The role of the Medical Assistant in Emergency Preparedness is also explored.

Phlebotomy

This course trains the Medical Assistant in the proper procedural techniques of venipuncture. Special attention is given to various venipuncture sites and the utilization of equipment. Focus is placed on OSHA guidelines and how this pertains to the role of the allied health professional.

Phlebotomy Laboratory Practicum

Supervised hands-on training (1-1 ratio) for all phlebotomy procedures is closely monitored by licensed and certified subject specialists to ensure quality control and to instill

professional confidence.

Introduction to X-Ray & Imaging

Basic concepts of radiology and radiographic terminology are presented. Emphasis is placed on accurate positioning for commonly performed X-ray studies in the medical office or clinic. Concepts of MRI, MRA, and CAT Scan are also explored.

LABORATORY SCIENCE COURSE DESCRIPTIONS

Hematology

The study of cells in the circulating blood. The study covers the formation of red blood cells, white blood cells, platelets, and the function of each in the body. The normal range of cells, the significance of increased and decreased numbers, and the theory behind the various blood tests are emphasized.

Hematology Laboratory Practicum

Supervised hands-on training (1-1 ratio) for hematology testing procedures is monitored by certified subject specialists to ensure quality control and to instill professional confidence. Students learn to perform differential counts, hemoglobin, hematocrit and ESR procedures.

Clinical Chemistry

The study of substances in the liquid portion of the circulating blood. These substances and the significance of their increased and decreased levels are discussed. The



theories behind the most common clinical chemistry tests are emphasized. Other blood tests are also presented.

Clinical Chemistry Laboratory Practicum

Supervised hands-on training (1-1 ratio) for clinical chemistry testing procedures is monitored by certified subject specialists to ensure quality control and to instill professional confidence. Students learn to perform blood chemistry tests on the Cholestech and Ektachem machines, blood glucose on the Glucometer, and cholesterol on the Accu-chek, and Hemoglobin Alc.

Microbiology

The study of organisms that inhabit and cause disease in the human body. The appropriate collection of specimens, the identification of microscopic organisms, and the theory and significance of culture results are covered.

Microbiology Laboratory Practicum

Supervised hands-on training (1-1 ratio) for microbiology testing procedures is monitored by certified subject specialists to ensure quality control and to instill professional confidence. Lab covers proper use of the microscope. Student performs aseptic procedures for the collection of throat and urine cultures.

Urinalysis

The study of urine with emphasis on the theories behind the complete urinalysis and microscopic exam. The appropriate collection of specimens, normal findings in the urine, and identification of abnormal findings are covered. The significance of abnormal results is explained.

Urinalysis Laboratory Practicum

Supervised hands-on training (1-1 ratio) for urinalysis testing procedures is monitored by certified subject specialists to ensure quality control and to instill professional confidence. Dipstick and microscopic exam of urine tests are performed.

ADMINISTRATIVE COURSE DESCRIPTIONS

Medical Law and Ethics

Student learns to apply local, state and federal health care legislation and regulation appropriate to the medical assisting practice environment. This course presents the legal and ethical principles of the Medical Assistant scope of practice. Exploration of the Patient Bill of Rights, confidentiality, implications of HIPAA and the ADA, as well as negligence and malpractice are thoroughly discussed.

Therapeutic Communications

Presents concepts of basic human behavior with emphasis on effective communication with the patient and family, physicians, and staff. Students identify styles and types of verbal and non-verbal communication and differentiate between adaptive and non-adaptive coping mechanisms. Students learn to recognize the role of patient advocacy as it applies to the practice of Medical Assisting. Focus is placed on active listening skills and increasing awareness of how a message is received and the formation of a professional response. Communication skills incorporate respect for cultural diversity and sensitivity.

Medical Office Procedures

Features a lecture/lab format in teaching the administrative responsibilities of the Medical Assistant. It includes patient care management, telephone technique & triage, patient's medical record, filing, mail, banking, time management skills, and billing practices for the medical office. In addition, this course presents the development of office policy related to emergency situations such as fire, environmental safety, and emergency preparedness. Emphasis is placed on the role of the Medical Assistant in emergency preparedness.

Medical Insurance Billing & Coding

This course features a lecture/lab format to familiarize student with each insurance company including Blue Cross-Blue Shield, Medicare, Medicaid, and commercial carriers. Student utilizes guidelines to process

medical claims using ICD-10-CM, CPT, and HCPCS references for procedural and diagnostic coding. Student is exposed to principles of managed care, third-party claims, utilization review, referral process, and workers' compensation.

Business Communications

Focuses on developing students' knowledge and understanding of the elements of fundamental writing skills. Concentration is on proper English usage and grammar, including a review of the parts of speech, subject/verb agreement, appropriate word endings, and fundamentals such as spelling, capitalization, and proper punctuation.

Record Keeping

Lecture/lab format focuses on basic accounting principles applicable to the medical office/clinic setting.

Computer Applications

Comprehensive instruction and hands-on training teach principles and applications of computer operations, Electronic Medical Records (EMR), specialized administrative procedures and Microsoft Word. Student explores electronic processing of patient demographics; i.e., primary physician information, patient information, insurance carrier(s), subscriber information and coverage codes. Appointment scheduling and patient flow management are also presented.

Keyboarding

Class utilizes accuracy development techniques through methods, keyboard drills and speed progression to reinforce the typing proficiency skills of the Medical Assistant.

Professional Standards/Career Readiness

This course emphasizes professional standards required of a Medical Assistant. Students examine job markets, job descriptions, and opportunities for employment at each level of competency. They identify their career options and continue to work toward achieving their goals. Also incorporated in this unit is resume preparation.

A specialist in computerized medical billing, coding and cash flow management

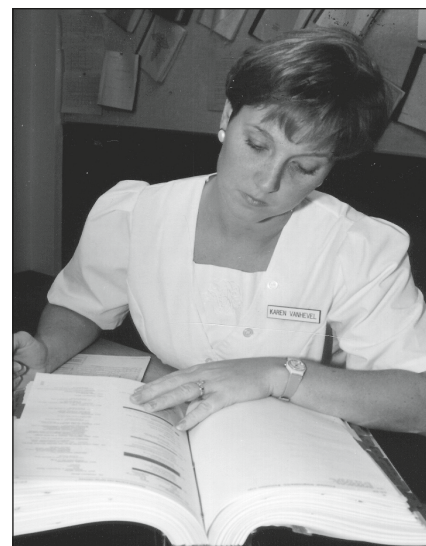
MEDICAL INSURANCE BILLER

Students in our Medical Insurance Biller Program develop a working knowledge of applicable skills for the complete insurance billing cycle used in medical offices, medical clinics, and health care centers. Through the dynamics of lectures and computerized billing labs, students gain confidence early in their training before progressing to more complex insurance procedures. A proficient medical biller is vital to the daily cash flow of a well-managed medical practice, and contributes directly to its financial stability.

Students learn to correctly process medical insurance billing claims for all major insurance plans including BCBS, Medicare, Medicaid, and commercial carriers. They develop competencies in processing claims by utilizing ICD-10-CM, CPT, and HCPCS coding references and apply medical terminology and appropriate insurance language when abstracting patient information related to physician services and medical diagnoses.

Proficiency is gained through application of billing principles. Students develop skills managing patient charges, accounts receivable, uncollectibles, payment posting, electronic medical records (EMR), and daily & month-end balancing practices. The software utilized provides solutions for processing medical insurance claims and reimbursement methodologies such as managing rejected claims, resubmission of claims, and troubleshooting uncollectibles. Internet sites supporting insurance carriers including WebDenis (BCBS), Medicare, and Medicaid are explored.

Students learn the importance of HIPAA guidelines, ethical behavior, and strong verbal and written communication skills, and the influence these skills have on cooperative, professional interaction between the medical biller, physician, patient and insurance carrier. The professional insurance biller adheres to the high standards set for the medical insurance billing profession. Graduates of the Medical Insurance Biller Program are prepared to meet the challenges of career entry positions in private practices, medical clinics, and health care centers.



MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Medical Insurance Biller graduates will be able to:

- Apply knowledge of medical terminology and language skills required to understand services and diagnoses in preparation for processing claims
- Demonstrate understanding of electronic processing of patient demographics; i.e., primary physician information, patient information, insurance carrier(s), subscriber information and coverage codes
- Demonstrate a working knowledge of ICD-10-CM, CPT, and HCPCS coding references and the correct application for billing practices
- Apply knowledge of diagnosis and procedure coding tasks with appropriate use of coding modifiers
- Demonstrate proficiency in processing claims following guidelines of BCBS, Medicare, Medicaid, and commercial carriers
- Apply knowledge in the accurate completion of computerized and manual claims for all insurance types
- Demonstrate proficiency of managing insurance inquiries
- Demonstrate techniques to sequence codes for optimal reimbursement to avoid rejections and claims status
- Manage patient charges, accounts receivable, uncollectibles, payment posting, and daily and month-end balancing practices
- Manage rejected claims and denials and resubmission of corrected claims
- Explore Internet sites supporting insurance carriers including WebDenis, Medicare, and Medicaid
- Adhere to HIPAA rules pertaining to privacy/release of information to ensure patient confidentiality
- Adhere to the principles of medical law and ethics as applied to the role of the Medical Insurance Biller



Course Descriptions

Anatomy and Medical Terminology

An accelerated course provides an understanding of medical terminology, human anatomy and body systems. Emphasis is given to prefixes, suffixes and root words required to understand services and diagnoses in preparation for processing claims. Application of medical terminology is reinforced throughout subsequent quarters.

Computer Applications

Instruction and hands-on training provides student with basic coverage of computer operations. Student is able to perform basic Window commands which include creating documents, formatting documents, editing, proofreading, and retrieving documents. Training covers Microsoft Word and Microsoft Office concepts.

Coding: ICD-10-CM, CPT, and HCPCS

Instruction/lab format focuses on developing a working knowledge of ICD-10-CM, CPT, and HCPCS coding references and correct application for billing practices.

Concepts of Insurance Billing/Coding

Instruction format familiarizes student with each insurance company including Blue Cross-Blue Shield, Medicare, Medicaid and commercial carriers. Student applies knowledge of ICD-10-CM, CPT, and HCPCS coding references through computerized/ EMR for each insurance company.

Computer Applications & Claims Processing I

Instruction/lab format provides hands-on computer training on billing software. Instruction in the application and completion of computerized claims is given for all major insurance carriers. Student builds database with critical billing elements including CPT codes, physician information, and patient demographics. Patient charges are entered and insurance claims are filed with appropriate carriers.

Computer Applications & Claims Processing II

Instruction/lab format provides continued hands-on computer training on billing software. Computer applications consist of daily payment posting, balancing and printing daily collection reports, follow-up on rejected claims and resubmitting claims for reimbursement. HIPAA guidelines are applied to daily billing activities and patient care responsibilities.

Insurance Applications & Claims Processing

Insurance and patient accounts receivable are reviewed for outstanding balances and aged insurance reports are printed for reprocessing. Explores internet sites pertaining to insurance carriers including WebDenix (BCBS), Medicare, Medicaid and local insurance carriers.

Professional Standards/Career Readiness

Throughout the MIB program student is trained to apply principles of medical law and ethics in handling medical billing transactions. Focus is placed on HIPAA guidelines and how this pertains to the role of the Medical Insurance Biller. Career options and opportunities for employment are examined and resume preparation is conducted.

MEDICAL INSURANCE BILLER PROGRAM

QUARTERLY SCHEDULE OF INSTRUCTION

(9 Months)

Three 12 Week Quarters

Evening Classes: Quarter I: Monday, Wednesday & Thursday, 6 PM - 10 PM

Quarters II-III: Monday, Wednesday & Thursday, 6 PM - 9:30 PM

Course	Contact Hours	Credit Hours
QUARTER I		
Anatomy and Medical Terminology	48.0	3.0
Computer Applications	48.0	3.0
Coding: ICD-10-CM, CPT, and HCPCS	48.0	3.0
Work Outside of Class: 36 Hours		
TOTALS:	144.0	9.0
QUARTER II		
Concepts of Insurance Billing/Coding	42.0	2.5
Medicare		
BC/BS		
Medicaid		
Commercial		
Worker's Compensation		
Computer Applications & Claims Processing I	84.0	4.5
Billing Software I		
Medicare		
BC/BS		
Medicaid		
Commercial		
Worker's Compensation		
Computerized Administrative Procedures		
Work Outside of Class: 31.5 Hours		
TOTALS:	126.0	7.0
QUARTER III		
Insurance Applications & Claims Processing	42.0	2.5
Internet Insurance Exploration		
Payment Posting		
Management of Rejections		
Status Claims		
Troubleshooting Uncollectibles		
Month-End Reports		
Computer Applications & Claims Processing II	84.0	5.0
Payment Posting		
Daily Report Balancing		
Management of Rejections		
Resubmit Insurance Claims		
Month-End Reports		
Billing Software II		
Work Outside of Class: 31.5 Hours		
TOTALS:	126.0	7.5
TOTAL CONTACT HOURS/CREDIT HOURS	396.0	23.5
EXTERNSHIP HOURS	140.0	4.5
TOTAL HOURS OF INSTRUCTION	536.0	28.0
TOTAL HOURS OUTSIDE OF CLASS: 99		

Note: Total hours outside of class are approximate.

• **National Credentialing** - The material covered in the MIB program provides an excellent preparation for graduates to take the AAPC** National Examination to become a Certified Professional Biller (CPB) and Certified Professional Coder-Apprentice (CPC-A).

• **Memberships** - In the Michigan Medical Billers Association and the American Academy of Professional Coders are open to you as a student and graduate.

A member of the health care team who combines science and clinical application to provide therapeutic massage

MASSAGE THERAPY

The profession of Massage Therapy and Bodywork offers a variety of career possibilities for the motivated and well-trained individual. Massage therapy is a valuable tool in the treatment of stress related disorders, general relaxation, and injuries to soft tissues.

Therapeutic massage combines the energy of touch with the knowledge of anatomy and physiology, pathology, client assessment, effective communication, general wellness education, and promotion of healthy living. Therefore, the Massage Therapist must be able to integrate fundamental science concepts with practical application in the delivery of quality therapeutic massage.

Principles in anatomy, physiology and kinesiology provide the student with a strong foundation required to be successful in the practice of therapeutic body massage. Clinical pathology explores the most common diseases, symptoms, and alternative medical treatment as they apply to massage therapy. Theory and practical applications of massage therapy and bodywork include the principles of draping, positioning, massage techniques, and complementary bodywork in the performance of therapeutic massage.

The Massage Therapy Program emphasizes the correct application of body mechanics by both client and practitioner, the correct use and care of massage therapy equipment and the importance of creating a safe therapeutic massage environment. The program maintains a low student-teacher ratio during theory and practical application.

Special emphasis is placed on legal and ethical principles, professional standards and business practices required of a Massage Therapist.

Upon successful completion of the program, graduates are eligible to sit for the Massage & Bodywork Licensing Examination (MBLEx) and submit a formal application to the State of Michigan, Department of Licensing and Regulatory Affairs for an official massage therapy license.

Entry level Massage Therapists may be employed under the supervision of a physician or chiropractor, massage therapy clinics, physical therapy, health, wellness and fitness facilities and sports/athletic organizations. Establishing a private massage therapy practice is also a viable option.



MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Massage Therapy graduates will be able to:

- Explain the history and benefits of therapeutic touch
- Apply basic knowledge of the benefits of therapeutic touch
- Utilize various massage methods
- Apply knowledge of physiologic effects of therapeutic massage
- Identify conditions that would contraindicate massage therapy
- Identify conditions that would indicate massage therapy
- Utilize a basic understanding of anatomy, physiology, and medical terminology related to massage therapy
- Utilize a basic understanding of pathology in the development of a care plan
- Recognize conditions requiring referral to a medical professional
- Demonstrate good health and personal hygiene practices
- Demonstrate methods to prevent and control spread of disease
- Establish a safe massage environment
- Utilize safe and effective body mechanics for massage therapy
- Create an appropriate environment for a massage
- Collect the necessary supplies required for a massage therapy practice
- Complete an initial client assessment
- Conduct an efficient client interview
- Develop an appropriate care plan
- Effectively drape and position a client
- Explain the massage procedure to a client
- Perform a complete body massage using appropriate methods and techniques
- Utilize complimentary bodywork systems appropriately
- Apply massage therapy principles to a client with special needs
- Provide general wellness guidelines to a client
- Develop and conduct a business practice for massage therapy
- Identify basic accounting principles and marketing strategies for the massage industry
- Utilize the informed consent process
- Communicate effectively with other health professionals
- Adhere to the legal and ethical guidelines as applied to the role of the Massage Therapist



Course Descriptions

Anatomy, Physiology and Pathophysiology

Students learn the concepts of human anatomy, physiology, and kinesiology from the cellular level to the body systems as it applies to therapeutic massage. Students will learn the normal biomechanics of posture and range of motion. Western and non-western teachings and philosophies are discussed. Medical terminology is integrated to provide a correlation and understanding of medical terms, prefixes, suffixes, and root words, and to provide logic in their appropriate applications. Concepts of pathophysiology are presented with a focus on the most common diseases, symptoms, and medical treatment as they apply to massage therapy and complementary bodywork. Principles are explored and skills are developed to assess for biomechanical dysfunction and orthopedic conditions. Emphasis is placed on understanding pharmacology as it relates to therapeutic massage.

Medical Law and Ethics

Students learn to apply local, state and federal health care legislation and regulation appropriate to the massage therapy practice environment. This course presents the legal and ethical principles of the massage therapy scope of practice. Exploration of the Patient Bill of Rights, confidentiality, implications of HIPAA and the ADA, as well as negligence and malpractice are thoroughly discussed.

Therapeutic Massage - Theory/Practical

Students learn principles of draping, body mechanics, positioning, massage techniques, and complementary bodywork and how to apply these principles in the performance of therapeutic touch. The importance of creating a safe therapeutic massage environment and the correct use and care of massage therapy equipment is emphasized.

Instructor demonstration and student return demonstration of massage therapy techniques are conducted to achieve professional confidence and competence in massage skills. All massage therapy in the classroom is supervised. The Massage Practical course includes massage appointments offered to the public, which provides the student with a unique massage business environment for client interactions.

Students learn how to conduct a client interview, perform an assessment, and use critical thinking skills to develop a professional care plan. Effective communication skills and maintenance of personal and professional boundaries are practiced between the practitioner and client and other health care professionals. Components of the therapeutic relationship are carefully examined. Focus is placed on active listening skills, increasing awareness of how a message is received, and the formation of a professional response. Communication skills incorporate respect for individual diversity and sensitivity.

Basic business principles, accounting guidelines and practices of client record keeping are thoroughly defined. The Professional Standards and Code of Conduct required of a massage therapist is reinforced throughout the educational training program.

Instruction in BLS through American Heart Association is also presented.

MASSAGE THERAPY PROGRAM

QUARTERLY SCHEDULE OF INSTRUCTION (12 Months)

Four 12 Week Quarters

Evening Classes: Monday 6 PM - 10 PM, Tuesday 3:30 PM - 9:30 PM,
Thursday 6 PM - 9 PM

Course	Contact Hours	Credit Hours
FALL QUARTER		
Anatomy, Physiology and Pathophysiology	60	4.0
Kinesiology and Biomechanical Assessment		
Bones, Muscles and Assessment of Head & Neck Regions		
Therapeutic Massage Theory/Practical, Standards of Practice	96.25	5.5
Professional Communication		
Energy Modalities		
Lymph Massage		
Medical Law & Ethics		
Work Outside of Class: 48 Hours		
TOTALS:	156.25	9.5
WINTER QUARTER		
Anatomy, Physiology and Pathophysiology	60	4.0
Kinesiology and Biomechanical Assessment		
Bones, Muscles and Assessment of Rib Cage, Thoracic and Lumbar Spinal Regions		
Therapeutic Massage Theory/Practical, Standards of Practice	96.25	5.5
Professional Communication		
Business Skills		
Pharmacology		
Job Readiness		
Work Outside of Class: 48 Hours		
TOTALS:	156.25	9.5
SPRING QUARTER		
Anatomy, Physiology and Pathophysiology	60	4.0
Kinesiology and Biomechanical Assessment		
Bones, Muscles and Assessment of Upper Extremity		
Therapeutic Massage Theory/Practical, Standards of Practice	96.25	5.5
Professional Communication		
Hydrotherapy		
Work Outside of Class: 48 Hours		
TOTALS:	156.25	9.5
SUMMER QUARTER		
Anatomy, Physiology and Pathophysiology	60	4.0
Kinesiology and Biomechanical Assessment		
Bones, Muscles and Assessment of Lower Extremity		
Therapeutic Massage Theory/Practical, Standards of Practice	96.25	5.5
Professional Communication		
Prenatal Massage		
BLS		
Work Outside of Class: 48 Hours		
TOTALS:	156.25	9.5
TOTAL CONTACT HOURS/CREDIT HOURS	625	38.0

Note: Total hours outside of class are approximate.

• **Credentialing** - Graduates are eligible to sit for the Massage & Bodywork Licensing Examination (MBLEx) and submit a formal application to the State of Michigan, Department of Licensing and Regulatory Affairs for an official massage therapy license.

• **Memberships** - In the American Massage Therapy Association (AMTA) and Associated Bodywork & Massage Professionals (ABMP) are open to you as a student and graduate.

A dedicated specialist in the study and recording of electrical activity of the brain and nervous system utilized in medical evaluations



ELECTRONEURODIAGNOSTIC TECHNOLOGIST

The Electroneurodiagnostic Technologist Program specializes in non-invasive, technical procedures which assess the electrical patterns of the brain in order to determine abnormalities indicative of central nervous system disorders. The Electroneurodiagnostic Technologist (END) is a multi-skilled allied health professional who performs neurologic diagnostic testing procedures. The END Technologist works under the supervision of a physician who is responsible for interpretation and clinical correlation of the results. The physician is generally not present during the diagnostic testing procedure; therefore, the technologist must be able to analyze data during the recording, ensuring the information obtained is valid and interpretable. The minimum expectations of the ENDT program are to prepare competent entry-level neurodiagnostic technologists in the cognitive (knowledge), psychomotor (skills), and affective (behavior) learning domains.



Disorders of the central nervous system that cause abnormal EEGs include various types of seizures, brain tumors, neurologic disorders and congenital abnormalities. These conditions are presented with emphasis on their effect on the EEG pattern and the patient's health and well-being.

Anatomy, physiology and medical terminology with special emphasis on neuroanatomy, neurophysiology, and pathology provide students with a

strong foundation in neurological functions. In addition pharmacology, medical law, and Basic Life Support (CPR) are presented. A working knowledge of the principles behind the EEG studies enables students to demonstrate an understanding of interrelated procedures and concepts.

Program emphasis is placed on fundamentals of EEG, appropriate electrode placement using the International 10-20 System of head measurement, machine operation and instrumentation, EEG pattern recognition and morphology. Instruction is also presented in Evoked Potential testing with emphasis on auditory, visual, and somatosensory modalities. Introduction to advanced neurodiagnostic procedures including Long Term Monitoring (LTM), Electromyogram (EMG), Nerve Conduction Velocity (NCV), Polysomnography (PSG), and Intraoperative Monitoring (IOM) are presented.

The clinical/externship rotation is an integral part of the training program. Eligible students are assigned to school-approved hospital site or medical facility and will maintain this rotation until all required hours have been successfully completed within the duration of eligibility. Refer to Student Handbook.

Due to the technical nature of this program, students must have prior allied health training, recent clinical work experience and college credits in medical terminology, math and science.

The END Technologist is employed in hospital neurodiagnostic departments, out-patient clinics, physician offices or research facilities. Studies may be performed in a laboratory, emergency room, operating room, intensive care unit, special monitoring units or at the patient's bedside. Responsible career entry positions provide opportunities for advancement to competent professionals.

ELECTRONEURODIAGNOSTIC TECHNOLOGIST PROGRAM

QUARTERLY SCHEDULE OF INSTRUCTION

(12 Months)

Four 12 Week Quarters

Monday, Tuesday, 6 PM - 9:30 PM and Wednesday 12:30 PM - 4 PM or

Evening Classes: Monday, Wednesday & Thursday 6PM - 9:30 PM

Course	Contact Hours	Credit Hours
QUARTER I		
Anatomy & Physiology/Medical Terminology	42	2.5
Theory: Introduction to EEG, Recording Concepts I	42	2.5
Laboratory Practicum	<u>42</u>	<u>2.5</u>
International 10-20 Measurement		
Work Outside of Class: 31.5 Hours		
TOTALS:	126	7.5
QUARTER II		
Anatomy & Physiology/Medical Terminology	28	1.5
Theory: Waveform Morphology I, Clinical Correlations I	42	2.5
Laboratory Practicum	42	2.5
Patient Interaction & Documentation		
BLS		
Therapeutic Communications	<u>14</u>	<u>0.5</u>
Work Outside of Class: 31.5 Hours		
TOTALS:	126	7.0
QUARTER III		
Theory: Waveform Morphology II, Clinical Correlations II	42	2.5
Laboratory Practicum	42	2.5
EEG Recording		
Pharmacology, Medical Law & Ethics	42	2.5
Clinical Site Rotation/Externship	<u>117</u>	<u>3.5</u>
Work Outside of Class: 31.5 Hours		
TOTALS:	243	11.0
QUARTER IV		
Theory: Recording Concepts II,	84	5.5
Advanced Neurodiagnostic Specialties		
Laboratory Practicum	42	2.5
Clinical Site Rotation/Externship	<u>117</u>	<u>3.5</u>
Work Outside of Class: 31.5 Hours		
TOTALS:	243	11.5
TOTAL CONTACT HOURS/CREDIT HOURS	738	37.0
EXTERNSHIP HOURS/CLINICAL ROTATION	66	2.0
TOTAL HOURS OF INSTRUCTION	804	39.0
TOTAL HOURS OUTSIDE OF CLASS: 126		

Note: Total hours outside of class are approximate.

- **National Credentialing** - As a graduate of a program accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Committee on Accreditation for Education in Neurodiagnostic Technology (CoA-NDT), you will be eligible to take the national examination **immediately** following completion of your training through the American Board of Registration of Electroencephalographic and Evoked Potential Technologists (ABRET).
- **Memberships** - In The American Society of Electroneurodiagnostic Technologists (ASET) and the Michigan Society of Electroneurodiagnostic Technologists (MSET) are open to you as a student and graduate.

Course Descriptions

Introduction to EEG

Lecture format presents basic principles of EEG theory, history of EEG and the evolution of EEG. The basic techniques for application and recording will be presented as well as explanation of its role in neurology. In addition, patient safety and OSHA guidelines are presented.

EEG Recording Concepts I and II

Student learns the techniques of the international 10-20 system, electronics, instrumentation (analog and digital), montages and polarity, proper use of settings (sensitivity, filters, frequency response curves, paper speed), artifacts, activation procedures, referencing and networking.

Waveform Morphology I and II

Student develops competence in the recognition and description of waveforms. Student will learn clinical correlation with states of consciousness, age and neurological condition through the use of lectures, review of actual EEG recordings and worksheets (i.e., normal awake and sleep, abnormal and drug effects).

Clinical Correlations I and II

Student studies the most common neurological conditions seen by the Electroneurodiagnostic Technologist. Symptoms and treatments will be correlated with the EEG. Emphasis will be placed on epilepsy and the role of the EEG in diagnosis and treatment.

Anatomy and Physiology/Medical Terminology

Student learns the concepts of human anatomy and physiology from the cellular level to the body systems. Special attention is given to the nervous system. Medical terminology is integrated to provide correlation and understanding of medical terms, prefixes and suffixes; student will be able to demonstrate logic in their appropriate applications. Special emphasis will be placed on neuroanatomy, neurophysiology, and the cardiovascular system.

Pharmacology

Student studies the major classifications of medications most frequently encountered during EEG testing. Focus will be placed on the indications, contraindications and mechanism of action of drugs used to treat neurological disorders. Emphasis will be placed on antiepileptic drugs and those that effect the EEG. Selected medications used during neurodiagnostic procedures are examined.

Therapeutic Communications

Presents the concepts of basic human behavior with emphasis on effective communication with the patient and family, physicians, and staff. Student will be able to identify style and types of verbal and non-verbal communication and differentiate between adaptive and non-adaptive coping mechanisms. Student will recognize the role of patient advocacy as it applies to their scope of practice. Focus is placed on active listening skills and increasing awareness of how a message is received and the formation of a professional response. Communication skills incorporate respect for cultural diversity and sensitivity.

Medical Law & Ethics

Presents a study of the ethical principles of the practice of medicine, and the legal aspects of the medical record. Medical-Legal terminology and basic medical laws are covered. Focus is placed on HIPAA guidelines and how this pertains to the role of the allied health professional.

Laboratory Practicum

Extensive hands-on application develops student competencies in areas presented in theory courses. Focus is placed on correct measurement, electrode application and recording. To ensure quality control and professional skill development, student achieves technical ability under the supervision of registered specialists. Performance check-offs are conducted routinely.

International 10-20 Measurement

Presents EEG measurements, marking, adjusting for anatomical deviations, electrode selection, and application methods of the 10-20 system.

EEG Recording

Student demonstrates understanding of ACNS guidelines, activation procedures, artifacts, and normal/abnormal EEG patterns.

Patient Interaction and Documentation

Focus is placed on preparing the patient for the EEG to ensure a quality recording. Proper documentation of patient demographics, clinical history and clinical occurrences during an EEG is presented.

Advanced Neurodiagnostic Specialties

Student is exposed to additional specialties encountered in the END lab with emphasis on intraoperative monitoring, evoked potentials, sleep studies, and long-term epilepsy monitoring.

Healthcare Provider Basic Life Support

This is a programmed course designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

Professional Standards/Career Readiness

This presentation emphasizes professional standards required of an Electroneurodiagnostic Technologist. Student examines job markets, job descriptions, and opportunities for employment at each level of competency. Identify career options and continue to work toward achieving professional goals. Also incorporated in this unit are resume preparation and interview techniques.



MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Electroneurodiagnostic Technologist graduates will be able to:

- Demonstrate an understanding of Anatomy, Physiology, and Medical Terminology with special emphasis on neuroanatomy, neurophysiology and pathology
- Provide a safe recording environment complying with OSHA Universal Precautions
- Accommodate for disabilities or patient's special needs
- Develop effective communication skills to establish a positive rapport with the patient and the patient's family.
- Understand and implement HIPAA guidelines
- Assess patient's mental state and physical condition to choose appropriate recording techniques
- Identify patient, obtain patient history and explain test procedure to patient
- Perform accurate measurement and electrode application utilizing the International 10/20 measurement system
- Adjust electrode placement for anatomic defects or anomalies
- Prepare patient's scalp for electrode placement
- Demonstrate common electrode application techniques
- Describe different types of electrodes and appropriate uses
- Apply electrodes for additional physiologic monitoring such as ECG, respiration, eye movement and EMG
- Maintain consistent, balanced impedances below 10k ohms
- Demonstrate understanding of digital EEG concepts including analog to digital conversion and principles of montage reformatting
- Describe function of differential amplifiers
- Perform computation of voltage and frequency of waveforms
- Explain the polarity of waveforms
- Recognize and correct various types of mechanical, environmental, and physiological artifact
- Maintain equipment in good working order including electrical safety
- Troubleshoot and correct instrument malfunctions
- Properly calibrate all equipment
- Thoroughly clean and disinfect electrodes after each procedure
- Record standard adult, pediatric and neonatal EEG and follow criteria for hyperventilation and photic stimulation as indicated. Demonstrate knowledge of contraindications
- Monitor EEG rhythms for normal and abnormal waveforms
- Document all relevant notations on the EEG recording
- Record at least 20 minutes of technically acceptable recording
- Demonstrate understanding of the medical contraindications to photic stimulation
- Utilize critical thinking and problem solving skills
- Explain standard recording montages with ability to design special montages as clinical findings warrant
- Demonstrate knowledge of techniques utilized to enhance clinical symptoms and EEG abnormalities
- Recognize the importance of encouraging drowsiness and sleep on every recording
- Apply additional scalp electrodes to localize abnormalities
- Select appropriate sensitivity and filter settings during recording and understand how the waveform displays are affected by the changes
- Monitor ECG rhythms for abnormality
- Demonstrate knowledge of pharmacology and its relationship to the EEG
- List and describe CNS disorders, symptoms and the effects on the EEG
- Demonstrate understanding of patient care during a seizure or other event
- Define and describe Psychogenic Non-Epileptic Events
- Demonstrate knowledge of portable recording techniques, including electrocerebral inactivity
- Recognize normal and normal variant awake and asleep patterns, abnormal awake and asleep patterns, clinical seizure patterns and Psychogenic Non-Epileptic Events
- Demonstrate understanding of advanced neurodiagnostic specialties including intraoperative monitoring, evoked potentials, sleep studies, long-term epilepsy monitoring, and EMG and NCV studies
- Demonstrate recording techniques for standard evoked potentials and recognize normal and abnormal waveforms
- Recognize and respond to life threatening situations and determine need for emergency intervention or to medically immobilize patient
- Perform CPR (BLS) through the American Heart Association Healthcare Provider course
- Comply with lab protocol for emergency and disaster situations
- Demonstrate knowledge of current END practices
- Adhere to current ACNS guidelines in EEG and evoked potentials
- Adhere to the principles of medical law & ethics as applied to the role of the END Technologist



A specialist in the recording and interpretation of data used in the detection of various forms of heart disease

CARDIOLOGY TECHNICIAN

Cardiology Technician students are trained in the performance of non-invasive testing procedures which provide valuable recorded data utilized in cardiac medical evaluation.

Training emphasizes basic and advanced electrocardiology and electrocardiography. Ample ECG equipment is utilized to provide extensive hands-on training. Class size is limited to assure close supervision during classroom and practical application of various procedures.

The core curriculum includes the study of human anatomy and physiology, cardiac pharmacology, fundamentals of physics, vital signs and I.V. administration. Diagnostic procedures in ECG, telemetry, Holter monitoring, exercise stress testing, and pacemaker recognition are presented.

Due to the technical nature of this program, students must have prior allied health training, recent clinical work experience and college credits in anatomy & physiology, math, and science.

The knowledge and skills acquired prepare students for responsible career entry level positions as a Cardiology Technician in the areas of telemetry, Holter scanning and assisting in exercise stress testing. There is a widespread demand for competent Cardiology Technicians in hospitals, clinics, diagnostic centers and doctor's offices.

Course Descriptions

Anatomy & Physiology / Pathophysiology I / Therapeutic Communications / HIPAA

This course covers the principles of human anatomy and physiology with emphasis on the cardiovascular system. Topics include cell biology, the blood system, normal blood vessel anatomy and their role in cardiovascular function. The class format includes lecture and class discussion. Emphasis is placed on the physiologic principles underlying the disease processes which the Cardiovascular Technologist is likely to encounter in a clinical environment. **Therapeutic Communications** presents key concepts necessary to effectively communicate information to physicians and staff in daily clinical situations, and skills needed to demonstrate empathy and deliver compassionate patient care. Emphasis is placed on the components of the communication cycle and the role of perception, significance of body language, active listening skills, defense mechanisms, and adaptive and maladaptive coping mechanisms. **Critical Thinking Skills** introduces students to the components of and barriers to critical thinking. Discussion includes assessment and care of the cardiovascular patient, interpreting real-time data without bias, anticipating additional steps and/or complications, and strengthening clinical reasoning. The critical nature of being proactive, using



knowledge, and taking initiative to act in anticipation of needs or complications, rather than simply reacting to events, is emphasized. Also presented are HIPAA guidelines and how they pertain to the role of the allied health professional.

Anatomy & Physiology / Pathophysiology II

This course is designed to continue the principles of human anatomy and physiology introduced in C100a Anatomy & Physiology/Pathophysiology which have a direct relationship to the function of cardiac activity and blood flow. Focus is placed on the autonomic nervous system and renal system roles in regulation of blood pressure and on the feedback mechanisms underlying circulatory physiology. Anatomy and physiology of the heart is discussed with focus placed on myocyte contraction, cardiodynamics, and basic cardiovascular pathology. Discussion

MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Cardiology Technician graduates will be able to:

- Demonstrate understanding of cardiac, vascular, respiratory, and renal anatomy, physiology and pathology
- Demonstrate thorough understanding of ECG and related medical terminology
- Prepare patient for electrocardiogram
- Perform electrocardiogram
- Standardize and operate various types of electrocardiograph instruments
- Recognize and correct various types of artifact
- Perform time/voltage measurements on the ECG
- Perform axis measurement and recognize significance
- Demonstrate understanding of waveform morphology
- Recognize ECG wave patterns and significance
- Recognize and interpret normal vs. abnormal wave patterns on the ECG with emphasis on lethal arrhythmias
- Recognize and interpret arrhythmias and heart block abnormalities
- Assist in the performance of exercise stress testing
- Demonstrate understanding of the indications for pacemakers, mechanisms, normal function, signs of malfunction, and ECG patterns
- Recognize electrocardiographic changes which occur in chamber enlargement and myocardial ischemias/infarction
- Perform intravenous administration, blood pressure and vital sign measurements
- Demonstrate understanding of the principles related to basic and ultrasound physics
- Demonstrate understanding of pharmacology and pharmacokinetics related to cardiac and vascular function
- Demonstrate knowledge of cardiopulmonary resuscitation through American Heart Association Healthcare Provider course
- Adhere to the principles of medical ethics as applied to the role of the Cardiology Technician

also includes nervous, endocrine, respiratory and renal function as it relates to the cardiovascular system.

Physics I - Basic Ultrasound

The student learns the physical properties of ultrasound. Topics include the piezoelectric effect, the parameters of a sound wave, acoustic variables and the concept of direct and inverse relationships among variables. The student performs calculations of frequency, period, wavelength, velocity, amplitude, power, and intensity.

Physics II - Pulsed Ultrasound

Student learns the principles of pulsed ultrasound and the behavior of sound as it propagates through the body. Topics include pulsed ultrasound, attenuation, impedance, reflection and refraction. Student performs calculations of pulse repetition frequency, pulse repetition period, spatial pulse length, pulse duration, duty factor, attenuation coefficient, intensity reflection coefficient, and Snell's Law of Refraction.

ECG I Theory

A study of the basic levels of electrocardiology and electrocardiography. Focus is placed on waveform morphology with emphasis on Einthoven's theory and lead derivation. Student performs ECG measurements of significant diagnostic value. Ancillary ECG methods such as telemetry monitoring and stress testing are also presented. ECG I is a prerequisite for the study of advanced principles offered in ECG II.

ECG I Practical

Hands-on ECG testing procedures utilizing proper electrode placement. Principles of machine operations and troubleshooting to maintain quality of the ECG tracing is thoroughly covered. Technical skills are performed under the supervision of certified specialists to ensure quality control and professional skill development.

Pharmacology

A study of the major categories of medications prescribed for cardiac patients. The student learns the indications, contraindications, and mechanisms of action of drugs used for the control of angina, dysrhythmias, heart failure and hypertension. Adrenergics and anticoagulants are covered. Selected ancillary medications for sedation, analgesia, diuresis, and cardiopulmonary emergencies are also examined.

Vital Signs: Theory & Practical

Prepares the student to perform blood pressure, pulse, and respiration procedures. Hands-on practice is supervised by credentialed subject specialists to ensure quality control and successful development of clinical skills.

IV Administration: Theory & Practical

Trains the student in the proper procedural techniques for IV administration. Special attention is given to sites and equipment which may be used for IV infusion. Supervised hands-on training (1-1 ratio) for all intravenous procedures is closely monitored by credentialed subject specialists to ensure quality control and to instill professional confidence. IV Administration labs are limited in size for the successful development of IV administration skills. Focus is placed on OSHA guidelines and how this pertains to the role of the allied health professional.

CARDIOLOGY TECHNICIAN PROGRAM

QUARTERLY SCHEDULE OF INSTRUCTION

(6 Months)

Two 12 Week Quarters

Evening Classes: Tuesday 6 PM - 9:30 PM & Thursday, 5:30 PM - 9 PM

Saturday, 8 AM - 3 PM

Course	Contact Hours	Credit Hours
QUARTER I		
Anatomy & Physiology/Pathophysiology I	54	3.5
Therapeutic Communications/HIPAA		
Physics I – Basic Ultrasound	12	0.5
Pharmacology	18	1.0
ECG I Theory	36	2.5
ECG I Practical	48	2.5
Telemetry		
Exercise Stress Testing		
Work Outside of Class: 39 Hours		
TOTALS:	168	10.0
QUARTER II		
Anatomy & Physiology/Pathophysiology II	42	2.5
Physics II – Pulsed Ultrasound	12	0.5
Pharmacology	18	1.0
Vital Signs, IV Administration/OSHA	12	0.5
ECG II Theory	36	2.5
ECG II Practical/BLS	48	3.0
12-Lead Analysis		
Arrhythmia Interpretation		
Work Outside of Class: 39 Hours		
TOTALS:	168	10.0
TOTAL CONTACT HOURS/CREDIT HOURS	336	20.0
EXTERNSHIP HOURS/CLINICAL ROTATION	186	6.0
TOTAL HOURS OF INSTRUCTION	522	26.0
TOTAL HOURS OUTSIDE OF CLASS: 78		

Note: Total hours outside of class are approximate.

ECG II Theory

Builds on the basic principles of waveform morphology presented in ECG I. The student develops the ability to recognize and interpret cardiac arrhythmias, heart blocks, chamber enlargement, and 12-lead interpretation as it relates to myocardial infarction, and pacemaker analysis.

ECG II Practical

Student develops expertise in the recognition and interpretation of cardiac arrhythmias, heart blocks and chamber enlargement. Special attention is given to the recognition of pacemaker patterns and ECG changes caused by a myocardial infarction. The student is required to interpret and analyze numerous rhythm strips for each cardiac anomaly.

Healthcare Provider/Basic Life Support

This is a programmed course designed and

supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

Professional Standards/Career Readiness

This presentation emphasizes professional standards required of a Cardiology Technician. Student examines job markets, job descriptions, and opportunities for employment at each level of competency. Identify career options and continue to work toward achieving professional goals. Also incorporated in this unit are resume preparation and interview techniques.

- **National Credentialing** - The material covered in the CT program provides an excellent preparation for graduates to take the national certification examination to become a Certified Cardiographic Technician (CCT) and Certified Rhythm Analysis Technician (CRAT) through the Cardiovascular Credentialing International (CCI).
- **Membership** - In the Alliance of Cardiovascular Professionals (ACVP) is open to you as a student and graduate.

A highly skilled professional in the performance of vascular diagnostic ultrasound and Doppler studies

AOS VASCULAR TECHNOLOGIST

The AOS Vascular Technology students are trained in the performance of noninvasive vascular imaging procedures. These studies provide essential information regarding the blood supply to and from the tissues of the extremities, the brain, and the vital organs of the body. Focus is placed on the degree and character of any obstruction. Non-invasive vascular testing and diagnostic imaging can be a critical element in the diagnosis of peripheral vascular disease, neurological disease/disorders, venous disorders, complications related to diabetes, and in the treatment and prevention of stroke.

The core curriculum includes the study of human anatomy and physiology, pathology, basic electrocardiology, hemodynamics, pharmacology as applied to the cardiac and vascular systems, ultrasound physics, cardiopulmonary resuscitation, vital signs, and IV administration.

Students will be able to demonstrate an understanding of advanced vascular anatomy and physiology and the principles related to diagnostic ultrasound and Doppler testing procedures. Emphasis is placed on obtaining standard views of vascular structures and to accurately provide preliminary interpretation of arterial, venous, carotid, aortic imaging and blood flow dynamics.

The externship rotation is an integral part of the training program. Eligible students are assigned to school-approved hospital site or medical facility and will maintain this rotation until all required hours have been successfully completed within the duration of eligibility. Refer to Student Handbook.

Due to the technical nature of this program, it is preferred that the student have prior allied health training, recent clinical work experience and college credits. Class size is limited to assure close supervision during classroom and externship training.

Upon successful completion of the AOS Vascular Technologist Program, students will be able to perform standard, non-invasive vascular diagnostic testing, demonstrate a working knowledge of the principles and instrumentation of vascular equipment and utilize the appropriate testing protocol.

Vascular Technologists are employed in hospitals, outpatient vascular centers, and specialty clinics. Responsible career entry level positions with opportunities for advancement await the competent, credentialed professional. The minimum expectation is to prepare competent entry-level Vascular Technologists in the cognitive (knowledge), psychomotor (skills) and affective (behavior) learning domains for non-invasive vascular ultrasound.



MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Vascular Technologist graduates will be able to:

- Utilize, communication, critical thinking and mathematic skills in assessment, planning, intervention, and evaluation of patient care.
- Demonstrate understanding of vascular, carotid, cerebral, and cardiac anatomy & physiology, pathology and hemodynamics
- Demonstrate thorough understanding of ECG and related medical terminology
- Perform electrocardiogram and recognize ECG wave patterns and their significance
- Recognize and interpret normal wave patterns on the ECG
- Assist in the performance of exercise stress testing
- Demonstrate understanding of pharmacology and drugs which effect vascular and cardiac function
- Demonstrate knowledge and appropriate indications for non-invasive vascular examinations
- Demonstrate knowledge of instrumentation of vascular equipment
- Demonstrate understanding of the principles related to basic and ultrasound physics and instrumentation
- Demonstrate knowledge and understanding of vascular physiology and pathophysiology
- Demonstrate knowledge of normal vascular flow patterns and waveform morphology
- Perform accurate Doppler scanning techniques; arterial and venous • Perform accurate Doppler scanning techniques; carotid
- Perform accurate imaging scanning techniques; arterial and venous
- Perform accurate imaging scanning techniques; carotid
- Demonstrate understanding of the concepts of color flow Doppler
- Perform basic interpretation of pulsed volume recording, Ankle Brachial Index (ABI), segmental pressures, arterial waveforms, venous Doppler, and imaging
- Demonstrate knowledge of cardiopulmonary resuscitation through American Heart Association Healthcare Provider course
- Adhere to the principles of medical ethics as applied to the role of the Vascular Technologist

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VASCULAR TECHNOLOGIST



AOS VASCULAR TECHNOLOGIST PROGRAM

Twenty-One (21) Months
Seven (7) 12 Week Quarters and 750- Hour Externship

Quarter I: – General Education Asynchronous
Quarters II - III: Tuesday & Thursday, 6 PM - 9:30 PM/5:30-9PM Saturday, 8 AM - 3 PM
Quarters IV - VII: Monday & Tuesday, 6 PM - 9:30 PM Saturday, 8 AM - 2 PM

Externship: 16 hours/week 2 days/week

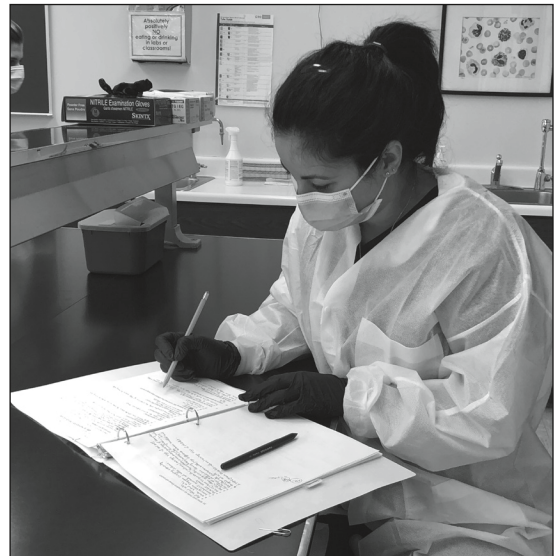
Course	Contact Hours	“Quarter Credit Hours
Quarter I		
GE011: Anatomy & Physiology	45	4.5
GE112: Algebra I	45	4.5
GE130: Written and Oral Communication	45	4.5
Work Outside of Class: 270 Hours		
Total Quarter I:	135	13.5
Quarter II		
C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications / HIPAA	54	3.5
C101a: Physics I - Basic Ultrasound	12	0.5
C115a: Pharmacology	18	1.0
C118a1: ECG I - Theory	36	2.5
C118a2: ECG I, Æi Practical, Æi Telemetry & Exercise Stress Testing	36	2.0
Work Outside of Class: 99 Hours		
Total Quarter II:	156	9.5
Quarter III		
C100b: Anatomy & Physiology / Pathophysiology	42	2.5
C101b: Physics II - Pulsed Ultrasound	12	0.5
C115b: Pharmacology	18	1.0
C110: Vital Signs: Theory & Practical / IV Administration: Theory & Practical	12	0.5
C160: Introduction to Vascular Diagnostic Studies, Æi Theory & Practical Applications; Healthcare Provider Basic Life Support	72	4.5
Work Outside of Class: 40 Hours		
Total Quarter III:	156	9.0
Quarter IV		
C170a: Cerebrovascular Testing	42	2.5
C101c: Physics III - Doppler Physics	18	1.0
C170b: Practical Applications - Cerebrovascular Testing	84	4.5
Work Outside of Class: 37 Hours		
Total Quarter IV:	144	8.0
Quarter V		
C011: Interdisciplinary Survey of Medical Imaging	30	3.0
C180a: Peripheral Venous Testing	42	2.5
C201a: Physics IV - Transducers	18	1.0
C180b: Practical Applications - Peripheral Venous Testing	84	4.5
Work Outside of Class: 37 Hours		
Total Quarter V:	174	11.0
Quarter VI		
C190a: Peripheral Arterial Testing	42	2.5
C201b: Physics V - Instrumentation	18	1.0
C190b: Practical Applications, Æi Peripheral Arterial Testing	84	4.5
C260a: Clinical Site Rotation / Externship	192	6.0
Work Outside of Class: 37 Hours		
Total Quarter VI:	336	14.0
Quarter VII		
C210a: Arterial Evaluation: Abdominal Vasculature	42	2.5
C201c: Physics VI - Quality Assurance & Artifacts	18	1.0
C210b: Practical Applications, Æi Visceral Vascular Testing	84	4.5
C260b: Clinical Site Rotation / Externship	192	6.0
Work Outside of Class: 37 Hours		
Total Quarter VII:	336	14.0
Clinical Site Rotation / Externship		
C260c: Clinical Site Rotation / Externship	366	12.0
Clinical Site Rotation / Externship Total:	366	12.0
PROGRAM TOTAL	1803	91.0
Work Outside of Class: 558 Hours		
<i>Note: Total work outside of class hours are approximate.</i>		

Note: Total hours outside of class are approximate.



• **National Credentialing** - As a graduate of a program accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Joint Review Committee on Education in Cardiovascular Technology, you will be eligible to take the RVT (Registered Vascular Technologist) national examination through the American Registry of Diagnostic Medical Sonography (ARDMS) and the RVS (Registered Vascular Specialist) national examination through the Cardiovascular Credentialing International (CCI) immediately following completion of your training.

• **Memberships** - In the Society of Diagnostic Medical Sonographers (SDMS), the Society for Vascular Ultrasound (SVU) and the Alliance of Cardiovascular Professionals (ACVP), are open to you as a student and graduate.



(Continued on next page)

CARNEGIE INSTITUTE

Course Descriptions

GE011: Anatomy & Physiology

In this course, the essential basics of structures and functions of the human body systems will be discussed. Topics on all individual major organ systems will be examined, while considering them in the state of health versus the state of disease, focusing mainly on structures. Various clinical implications and possible deviations from norm of each organ system will be brought up throughout the course.

GE112: Algebra I

This course is designed to give students the math skills that provide a foundation for more advanced courses. Students will explore writing and solving linear and nonlinear equations, powers and exponents, quadratic equations, polynomials and factoring, graphing and solving linear inequalities, and functions.

GE130: Written and Oral Communication

In this course, students will explore the fundamental analog and digital skills of oral and written communication to help create professional written and oral communication within their career. This is an introduction to a variety of methods used to communicate effectively and create language that articulates information in a way that connects a speaker to an audience.

C011: Interdisciplinary Survey of Medical Imaging

In this course, the student is introduced to basic imaging modalities in medical imaging. Five common imaging modalities will be discussed which include radiography (including fluoroscopy, mammography and computed tomography), magnetic resonance imaging, nuclear medicine, ultrasound and radiation therapy. Clinical applications are discussed throughout the course.

C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications / HIPAA

This course covers the principles of human anatomy and physiology with emphasis on the cardiovascular system. Topics include cell biology, the blood system, normal blood vessel anatomy and their role in cardiovascular function. The class format includes lecture and class discussion. Emphasis is placed on the physiologic principles underlying the disease processes which the Cardiovascular Technologist is likely to encounter in a clinical environment.

Therapeutic Communications presents key concepts necessary to effectively communicate information to physicians and staff in daily clinical situations, and skills needed to demonstrate empathy and deliver compassionate patient care. Emphasis is placed on the components of the communication cycle and the role of perception, significance of body language, active listening skills, defense mechanisms, and adaptive and maladaptive coping mechanisms. **Critical Thinking Skills** introduces students to the components of and barriers to critical thinking. Discussion includes assessment and care of the cardiovascular patient, interpreting real-time data without bias, anticipating additional steps and/or complications, and strengthening clinical reasoning. The critical nature of being proactive, using knowledge, and taking initiative to act in anticipation of needs or complications, rather than simply reacting to events, is emphasized. Also presented are HIPAA guidelines and how they pertain to the role of the allied health professional.

C101a: Physics I - Basic Ultrasound

Student learns the physical properties of ultrasound. Topics include the piezoelectric effect, the parameters of a sound wave, acoustic variables and the concept of direct and inverse relationships among variables. The student performs calculations of frequency, period, wavelength, velocity, amplitude, power, and intensity.

C115a: Pharmacology

A study of the major categories of medications prescribed for cardiac patients. The student learns the indications, contraindications, and mechanisms of action of drugs used for the control of angina, dysrhythmias, heart failure and hypertension. Adrenergics and anticoagulants are covered. Selected ancillary medications for sedation, analgesia, diuresis, and cardiopulmonary emergencies are also examined.

C118a1: ECG I - Theory

A study of the basic levels of electrocardiology and electrocardiography. Focus is placed on waveform morphology with emphasis on Einthoven's theory and lead derivation. Student learns to perform ECG measurements of significant diagnostic value. Ancillary ECG methods such as telemetry monitoring and stress testing are also presented. ECG I is a prerequisite for the study of advanced principles offered in ECG II.

C118a2: ECG I - Practical - Telemetry & Exercise Stress Testing

Hands-on ECG testing procedures and placement of chest electrodes. Principles of machine operations and troubleshooting to maintain quality of ECG tracing is thoroughly covered. Technical skills are performed under the supervision of credentialed specialists to ensure quality control and professional skill development.

C100b: Anatomy & Physiology / Pathophysiology

This course is designed to continue the principles of human anatomy and physiology introduced in C100a Anatomy & Physiology/Pathophysiology which have a direct relationship to the function of cardiac activity and blood flow. Focus is placed on the autonomic nervous system and renal system roles in regulation of blood pressure and on the feedback mechanisms underlying circulatory physiology. Anatomy and physiology of the heart is discussed with focus placed on myocyte contraction, cardiodynamics, and basic cardiovascular pathology. Discussion also includes nervous, endocrine, respiratory and renal function as it relates to the cardiovascular system.

C101b: Physics II - Pulsed Ultrasound

Student learns the principles of pulsed ultrasound and the behavior of sound as it propagates through the body. Topics include pulsed ultrasound, attenuation, impedance reflection and refraction. The student performs calculations of pulse repetition frequency, pulse repetition period, spatial pulse length, pulse duration, duty factor, attenuation coefficient, intensity reflection coefficient and Snell's Law of Refraction.

C115b: Pharmacology

This course is designed to continue the principles of Pharmacology introduced in C115a. This course involves the study of adrenergics, antiarrhythmics, antihypertensives & nitrates. The student will also learn the medications used for each of the above referenced modules, including the mechanism of action, indications, side effects, contraindications and/or interactions.

C110: Vital Signs: Theory & Practical

Prepares student to perform blood pressure, pulse, and respiration procedures. Hands-on practice is supervised by credentialed subject specialists to ensure quality control and successful development of clinical skills. Trains the student in accurate measurement and documentation of vital signs.

C160: Introduction to Vascular Diagnostic Studies - Theory & Practical Applications

Provides the foundation of carotid, venous, and arterial scanning. Emphasis is placed on the specific anatomy of the blood vessels that are routinely examined. In addition, fundamentals of vascular ultrasound and Doppler equipment are thoroughly explored.

C129: Healthcare Provider Basic Life Support

This is a programmed course designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing. In addition, the Healthcare Provider Basic Life Support training is designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

C170a: Cerebrovascular Testing

Lecture format covers anatomy, physiology and pathophysiology of the cerebral vascular system. Emphasis is placed on carotid duplex Doppler studies and other noninvasive testing modalities.

C101c: Physics III - Doppler Physics

Student learns the principles of Doppler ultrasound including: Doppler shift, spectral analysis, the Fast Fourier transform, and the Nyquist Limit. The student performs calculations of the Doppler Equation, the Range Velocity Equation, the Nyquist Limit.

C170b: Practical Applications - Cerebrovascular Testing

Student utilizes vascular ultrasound equipment to develop proper technique in performing carotid duplex testing. Labs are supervised by credentialed subject specialists to assess student's knowledge and development of technical skills.

C180a: Peripheral Venous Testing

Lecture format covers anatomy, physiology and hemodynamics of the venous system. Focus is placed on obtaining patient history, physical assessment and pathological diagnosis. Development of scanning techniques and other diagnostic modalities is emphasized.

C201a: Physics IV - Transducers

Student learns the principles of ultrasound beam formation, transducer array designs and image display. Topics include echo ranging, spatial and temporal resolution, components of the transducer, bandwidth, and real time imaging. The student performs calculations of axial and lateral resolution, focal depth and beam divergence.

C180b: Practical Applications - Peripheral Venous Testing

Student utilizes vascular ultrasound equipment to develop proper technique of venous scanning. Hands-on training focuses on protocols in duplex venous testing. Labs are supervised by credentialed subject specialists to assess student's knowledge and development of technical skills.

C190a: Peripheral Arterial Testing

Lecture format covers anatomy, physiology and hemodynamics of the peripheral arterial system. Emphasis is placed on obtaining patient history, physical assessment and pathological diagnosis. Discussion of non-invasive arterial diagnostic techniques and Doppler is conducted.

C201b: Physics V - Instrumentation

Student learns the principles of ultrasound system components and instrumentation. Topics include output power versus receiver gain, ALARA, analog to digital conversion, display controls and magnification. The student performs calculations of shades of gray given bits of memory and dynamic ranges of system components.

C190b: Practical Applications - Peripheral Arterial Testing

Student utilizes ultrasound and Doppler equipment to develop technical knowledge of equipment, set-up, instrumentation, probe, controls, and general care of equipment. Hands-on training focuses on upper and lower extremity arterial studies. Labs are supervised by credentialed subject specialists to assess student's knowledge and development of technical skills.

C210a: Arterial Evaluation: Abdominal Vasculature

Discussion of renal and abdominal anatomy, physiology and ultrasound techniques is presented. Lecture format includes test validation, i.e. sensitivity and specificity, data review from medical chart, and ultrasound physics and instrumentation.

C201c: Physics VI - Quality Assurance & Artifacts

Student learns the principles of artifacts, bioeffects and quality assurance. Topics include types and causes of image artifacts, quality assurance phantoms, performance measurements, instruments for measuring bioeffects, thermal and cavitation mechanisms and epidemiologic studies. The student performs calculations of Mechanical Index.

C210b: Practical Applications - Visceral Vascular Testing

Student demonstrates knowledge of abdominal vasculature for multiple applications of duplex scanning. Labs are supervised by credentialed subject specialists to assess student's knowledge and development of technical skills.

C260a - C260c: Externship

Externship can take place when the student reaches eligibility and continues until externship requirement is completed. Externship is an opportunity for a learning experience outside school facilities. The off-campus externship is an integral part of the program. The student is assigned to a school-approved facility. Written and verbal contact with externship preceptor is maintained throughout externship experience and communication is routinely performed by the school to monitor student progress.

Maximum number of students in a classroom and laboratory:

Delivery	Faculty	Students
Classroom (Theory) Core Courses	1	25
Laboratory (Practical) Core Courses	2	12
General Education Courses	1	25

Requirements For Graduation:

An Associate of Occupational Science degree, designating the graduate as a vascular technologist is conferred on those students meeting the following requirements:

Satisfactory completion of the course requirements which include stipulated externship hours at a school approved site and an externship evaluation from the medical supervisor.

- A combined average grade of not less than 80%.
- A Minimum Cumulative Completion Rate of 67%.
- Recommendation of the faculty.
- Satisfaction of all indebtedness to the school.
- A satisfactory record of attendance.

A specialist in the initial interpretation of the ECG, and in the performance of cardiac ultrasound and Doppler testing procedures

AOS CARDIOVASCULAR TECHNOLOGIST

The AOS Cardiovascular Technologist students are trained in the performance of non-invasive diagnostic cardiac ultrasound, which provides digital and video image acquisition of normal and abnormal anatomic and physiologic data.

Training in cardiovascular diagnostics emphasizes basic and advanced electrocardiology, electrocardiography, echocardiography, and cardiac Doppler. Color flow and harmonics ultrasound equipment is provided for extensive echocardiography hands-on practice. Class size is limited to assure close supervision during classroom training and practical application of the various procedures.

The core curriculum includes the study of human anatomy and physiology, cardiovascular pharmacology, vital signs, cardiopulmonary resuscitation, IV administration, ultrasound physics, and an introduction to medical electronics and instrumentation. This provides an understanding of diagnostic procedures in ECG, Holter Monitoring, Exercise Stress Testing, Telemetry, Echocardiography and Cardiac Doppler, enabling students to demonstrate accurate performance of these examinations.

The externship rotation is an integral part of the training program. Eligible students are assigned to school-approved hospital site or medical facility and will maintain this rotation until all required hours have been successfully completed within the duration of eligibility. Refer to Student Handbook.

Due to the technical nature of this program, it is preferred that the student have prior allied health training, recent clinical work experience and college credits. Class size is limited to assure close supervision during classroom and externship training.



Upon successful completion of the AOS Cardiovascular Technologist Program, and the knowledge and skills acquired, students are prepared for responsible career entry positions with advancement opportunities in hospitals, specialty clinics, doctor's offices, and non-invasive cardiovascular laboratories. The minimum expectation is to prepare competent entry-level Cardiovascular Technologists in the cognitive (knowledge), psychomotor (skills) and affective (behavior) learning domains for adult echocardiography. There is a widespread demand for competent, credentialed Cardiovascular Technologists.

MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Cardiovascular Technologist graduates will be able to:

- Utilize, communication, critical thinking and mathematic skills in assessment, planning, intervention, and evaluation of patient care.
- Demonstrate understanding of cardiac, vascular, respiratory, and renal anatomy, physiology and pathology
- Demonstrate thorough understanding of ECG and related medical terminology
- Prepare patient for electrocardiogram
- Perform electrocardiogram
- Standardize and operate various types of electrocardiograph instruments
- Recognize and correct various types of artifact
- Perform time/voltage measurements on the ECG
- Demonstrate understanding of waveform morphology
- Recognize ECG wave patterns and significance
- Recognize and interpret normal vs. abnormal wave patterns on the ECG with emphasis on lethal arrhythmias
- Recognize and interpret arrhythmias and heart block abnormalities
- Assist in the performance of exercise stress testing
- Demonstrate understanding of the indications for pacemakers, mechanisms, normal function, signs of malfunction, and ECG patterns
- Recognize electrocardiographic changes which occur in chamber enlargement and myocardial ischemia/infarction
- Perform intravenous administration, blood pressure and vital sign measurements
- Demonstrate understanding of the principles related to basic and ultrasound physics
- Demonstrate understanding of pharmacology and pharmacokinetics related to cardiac and vascular function
- Demonstrate knowledge of cardiopulmonary resuscitation through American Heart Association Healthcare Provider course
- Demonstrate basic understanding of common forms of invasive cardiac diagnostics
- Demonstrate basic understanding of cardiac hemodynamics
- Perform an echocardiogram
- Identify and measure cardiac structures on M-Mode and 2-D echocardiograms
- Evaluate systolic and diastolic heart function
- Recognize most common valvular diseases, cardiomyopathies, cardiac masses, diseases of aorta, and pericardial diseases on the echocardiogram
- Demonstrate understanding of cardiac Doppler equipment
- Perform cardiac Doppler studies
- Demonstrate understanding of color flow Doppler
- Demonstrate understanding of congenital heart disease
- Perform intraoperative interventional echocardiogram
- Assist in Transesophageal Echocardiogram (TEE)
- Use imaging enhancing agents
- Adhere to the principles of medical ethics as applied to the role of the Cardiovascular Technologist



Course Descriptions

GE011: Anatomy & Physiology

In this course, the essential basics of structures and functions of the human body systems will be discussed. Topics on all individual major organ systems will be examined, while considering them in the state of health versus the state of disease, focusing mainly on structures. Various clinical implications and possible deviations from norm of each organ system will be brought up throughout the course.

GE112: Algebra I

This course is designed to give students the math skills that provide a foundation for more advanced courses. Students will explore writing and solving linear and nonlinear equations, powers and exponents, quadratic equations, polynomials and factoring, graphing and solving linear inequalities, and functions.

GE130: Written and Oral Communication

In this course, students will explore the fundamental analog and digital skills of oral and written communication to help create professional written and oral communication within their career. This is an introduction to a variety of methods used to communicate effectively and create language that articulates information in a way that connects a speaker to an audience.

C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications / HIPAA

This course covers the principles of human anatomy and physiology with emphasis on the cardiovascular system. Topics include cell biology, the blood system, normal blood vessel anatomy and their role in cardiovascular function. The class format includes lecture and class discussion. Emphasis is placed on the physiologic principles underlying the disease processes which the Cardiovascular Technologist is likely to encounter in a clinical environment. **Therapeutic Communications** presents key concepts necessary to effectively communicate information to physicians and staff in daily clinical situations, and skills needed to demonstrate empathy and deliver compassionate patient care. Emphasis is placed on the components of the communication cycle and the role of perception, significance of body language, active listening skills, defense mechanisms, and adaptive and maladaptive coping mechanisms. **Critical Thinking Skills** introduces students to the components of and barriers to critical thinking. Discussion includes assessment and

- **National Credentialing** - As a graduate of a program accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Joint Review Committee on Education in Cardiovascular Technology, you will be eligible to take the RDCS (Registered Diagnostic Cardiac Sonographer) national examination through the American Registry of Diagnostic Medical Sonography (ARDMS) and the RCS (Registered Cardiac Sonographer) national examination through the Cardiovascular Credentialing International (CCI) immediately following completion of your training.
- **Memberships** - In the Alliance of Cardiovascular Professionals (ACVP), the American Society of Echocardiography (ASE), the Michigan Society of Echocardiography (MSE) and the Society of Diagnostic Medical Sonographers (SDMS), are open to you as a student and graduate.

AOS CARDIOVASCULAR TECHNOLOGIST PROGRAM

Quarterly Schedule of Instruction:
Twenty-One (21) Months
Seven (7) 12 Week Quarters and 750 Hour Externship

Quarter I: General Education Asynchronous
Quarters II - III: Tuesday & Thursday, 6 PM - 9:30 PM / 5:30PM-9PM Saturday, 8 AM - 3 PM
Quarter IV- V Tuesday, Thursday, Saturday, 6PM – 9:30PM / 8AM-2PM
Quarters VI & VII: Monday & Wednesday, 6 PM - 9:30 PM Saturday, 8 AM - 2 PM
Externship: 16 hours/week

Course	Contact Hours	Quarter Credit Hours
Quarter I		
GE011: Anatomy & Physiology	45	4.5
GE112: Algebra I	45	4.5
GE130: Written and Oral Communication	45	4.5
<i>Work Outside of Class: 67.5 Hours</i>		
Total Quarter I:	135	13.5
Quarter II		
C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications / HIPAA	54	3.5
C101a: Physics I - Basic Ultrasound	12	0.5
C115a: Pharmacology	18	1.0
C118a1: ECG I - Theory	36	2.5
C118a2: ECG I – Practical – Telemetry & Exercise Stress Testing	36	2.0
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter II:	156	9.5
Quarter III:		
C100b: Anatomy & Physiology / Pathophysiology	42	2.5
C101b: Physics II - Pulsed Ultrasound	12	0.5
C115b: Pharmacology	18	1.0
C110: Vital Signs: Theory & Practical / IV Administration: Theory & Practical	12	0.5
C128b1: ECG II - Theory	36	2.5
"C128b2: ECG II - Practical - 12-Lead Analysis, Arrhythmia Interpretation"	32	2.0
C129 Healthcare Provider Basic Life Support	4	0.0
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter III:	156	9.0
Quarter IV		
C130a: Echocardiography I – Theory	42	2.5
C101c: Physics III - Doppler Physics	18	1.0
C130b: Echocardiography I - Practical	96	5.5
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter IV:	156	9.0
Quarter V		
C230a: Echocardiography II – Theory Cardiac Doppler & Pathology	42	2.5
C201a: Physics IV - Transducers	18	1.0
C230b: Echocardiography II – Practical Cardiac Doppler	96	5.5
C260a: Clinical Site Rotation / Externship	96	3.0
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter V:	252	12.0
Quarter VI		
"C240a: Echocardiography III – Theory, Cardiac Valve Pathology"	42	2.5
C201b: Physics V - Instrumentation	18	1.0
"C240b: Echocardiography III – Practical, Cardiac Doppler"	96	5.5
C260b: Clinical Site Rotation / Externship	192	6.0
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter VI:	348	15.5
Quarter VII		
"C250a: Echocardiography IV – Theory, Cardiac Pathology"	42	2.5
C201c: Physics VI - Quality Assurance & Artifacts	18	1.0
"C250b: Echocardiography IV – Practical, Color Flow"	96	5.5
C260c: Clinical Site Rotation / Externship	192	6.0
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter VII:	348	15.0
Clinical Site Rotation / Externship		
C260d: Clinical Site Rotation / Externship	270	9.0
Clinical Site Rotation / Externship Total:	270	9.0
PROGRAM TOTAL	1821	92.0
<i>Work Outside of Class: 301.5 Hours</i>		
<i>Note: Total work outside of class hours are approximate.</i>		

care of the cardiovascular patient, interpreting real-time data without bias, anticipating additional steps and/or complications, and strengthening clinical reasoning. The critical nature of being proactive, using knowledge, and taking initiative to act in anticipation of needs or complications, rather than simply reacting to events, is emphasized. Also presented are HIPAA guidelines and how they pertain to the role of the allied health professional.

C101a: Physics I - Basic Ultrasound

Student learns the physical properties of ultrasound. Topics include the piezoelectric effect, the parameters of a sound wave, acoustic variables and the concept of direct and inverse relationships among variables. The student performs calculations of frequency, period, wavelength, velocity, amplitude, power, and intensity.

C115a: Pharmacology

A study of the major categories of medications prescribed for cardiac patients. The student learns the indications, contraindications, and mechanisms of action of drugs used for the control of angina, dysrhythmias, heart failure and hypertension. Adrenergics and anticoagulants are covered. Selected ancillary medications for sedation, analgesia, diuresis, and cardiopulmonary emergencies are also examined.

C118a1: ECG I - Theory

A study of the basic levels of electrocardiology and electrocardiography. Focus is placed on waveform morphology with emphasis on Einthoven's theory and lead derivation. Student learns to perform ECG measurements of significant diagnostic value. Ancillary ECG methods such as telemetry monitoring and stress testing are also presented. ECG I is a prerequisite for the study of advanced principles offered in ECG II.

C118a2: ECG I - Practical - Telemetry & Exercise Stress Testing

Hands-on ECG testing procedures and placement of chest electrodes. Principles of machine operations and troubleshooting to maintain quality of ECG tracing is thoroughly covered. Technical skills are performed under the supervision of credentialed specialists to ensure quality control and professional skill development.

C100b: Anatomy & Physiology / Pathophysiology

This course is designed to continue the principles of human anatomy and physiology introduced in C100a Anatomy & Physiology/Pathophysiology which have a direct relationship to the function of cardiac activity and blood flow. Focus is placed on the autonomic nervous system and renal system roles in regulation of blood pressure and on the feedback mechanisms underlying circulatory physiology. Anatomy and physiology of the heart is discussed with focus placed on myocyte contraction, cardiodynamics, and basic cardiovascular pathology. Discussion also includes nervous, endocrine, respiratory and renal function as it relates to the cardiovascular system.

C101b: Physics II - Pulsed Ultrasound

Student learns the principles of pulsed ultrasound and the behavior of sound as it propagates through the body. Topics include pulsed ultrasound, attenuation, impedance reflection and refraction. The student performs calculations of pulse repetition frequency, pulse repetition period, spatial pulse length, pulse duration, duty factor, attenuation coefficient, intensity reflection coefficient and Snell's Law of Refraction.

C115b: Pharmacology

This course is designed to continue the principles of Pharmacology introduced in C115a. This course involves the study of adrenergics, antiarrhythmics, antihypertensives & nitrates. The student will also learn the medications used for each of the above referenced modules, including the mechanism of action, indications, side effects, contraindications and/or interactions.

C110: Vital Signs: Theory & Practical / IV

Administration: Theory & Practical
Prepares student to perform blood pressure, pulse, and respiration procedures. Hands-on practice is supervised by credentialed subject specialists to ensure quality control and successful development of clinical skills. Trains the student in the proper procedural techniques for IV administration. Special attention is given to sites and equipment which may be used for IV infusion. Supervised hands-on training (1-1 ratio) for all intravenous procedures is closely monitored by certified subject specialists to ensure quality control and to instill professional confidence. IV administration labs are limited in size for the successful development of IV administration skills. Focus is placed on OSHA guidelines and how this pertains to the role of the allied health professional.

C128b1: ECG II - Theory

Builds on the basic principles of waveform morphology

presented in ECG I. The student develops the ability to recognize and interpret cardiac arrhythmias, heart blocks, chamber enlargement, and 12-lead interpretation as it relates to myocardial infarction, and pacemaker analysis.

C128b2: ECG II Practical - 12-Lead Analysis, Arrhythmia Interpretation

Student develops expertise in the recognition and interpretation of cardiac arrhythmias, heart blocks, and chamber enlargement. Special attention is also given to the recognition of pacemaker patterns and ECG changes caused by a myocardial infarction. The student is required to interpret and analyze numerous rhythm strips for each cardiac anomaly.

C129 Healthcare Provider Basic Life Support

This is a programmed course designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing. In addition, the Healthcare Provider Basic Life Support training is designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

C130a: Echocardiography I - Theory

Provides the basic principles of 2-Dimensional adult echocardiography and M-Mode echocardiography. Basic ultrasound physics and abnormal M-Mode echocardiography are also presented. Utilization of sanitized digital media of echocardiography recordings and case histories from the American College of Cardiology, Mayo Clinic series, assist in reinforcing course principles. Emphasis is placed on integration of theory with practical laboratory performance.

C101c: Physics III - Doppler Physics

Student learns the principles of Doppler ultrasound including: Doppler shift, spectral analysis, the Fast Fourier transform, and the Nyquist Limit. The student performs calculations of the Doppler Equation, the Range Velocity Equation, the Nyquist Limit.

C130b: Echocardiography I - Practical

Extensive hands-on application is designed to develop student competence in views presented in theory courses. Student develops significant skills while performing echocardiograms utilizing ultrasound equipment at the school. Student acquires technical ability under the supervision of credentialed specialists to ensure quality control and professional skill development. Performance check-offs are conducted routinely as each view is practiced and completed.

C230a: Echocardiography II - Theory Cardiac Doppler & Pathology

Provides the principles of Doppler physics, Doppler assessment of the mitral valve, and identification of mitral valve pathology. Doppler assessment of the aortic valve and identification of aortic valve pathology is also presented. Utilization of sanitized digital media of echocardiography recordings and case histories from the American College of Cardiology, Mayo Clinic series, assist in reinforcing course principles. Emphasis is placed on integration of theory with practical laboratory performance.

C201a: Physics IV - Transducers

Student learns the principles of ultrasound beam formation, transducer array designs and image display. Topics include echo ranging, spatial and temporal resolution, components of the transducer, bandwidth, and real time imaging. The student performs calculations of axial and lateral resolution, focal depth and beam divergence.

C230b: Echocardiography II - Practical Cardiac Doppler

Extensive hands-on application is designed to develop student competence in views presented in theory courses. Student develops significant skills while performing echocardiograms utilizing ultrasound equipment at the school. Student acquires technical ability under the supervision of credentialed specialists to ensure quality control and professional skill development. Performance check-offs are conducted routinely as each view is practiced and completed.

C240a: Echocardiography III - Theory, Cardiac Valve Pathology

Presents the principles of left ventricular function, pericardial disease, cardiomyopathies, cardiac tumors and valvular diseases. Special attention is given to their identification in the use of cardiac ultrasound. Utilization of sanitized digital media of echocardiography recordings and case histories from the American College of Cardiology, Mayo Clinic series, assist in reinforcing course principles. Emphasis is placed on integration of theory with practical

laboratory performance.

C201b: Physics V - Instrumentation

Student learns the principles of ultrasound system components and instrumentation. Topics include output power versus receiver gain, ALARA, analog to digital conversion, display controls and magnification. The student performs calculations of shades of gray given bits of memory and dynamic ranges of system components.

C240b: Echocardiography III - Practical Cardiac Doppler

Extensive hands-on application is designed to develop student competence in views presented in theory courses. Student develops significant skills while performing echocardiograms utilizing ultrasound equipment at the school. Student acquires technical ability under the supervision of credentialed specialists to ensure quality control and professional skill development. Performance check-offs are conducted routinely as each view is practiced and completed.

C250a: Echocardiography IV - Theory, Cardiac Pathology

Provides the principles of Doppler assessment of right heart valves, and pulmonary and tricuspid valve pathology. Doppler assessment of prosthetic heart valves and left ventricular pathology is also presented. Emphasis is placed on the integration of all previously presented views and the performance of the complete echo examination and required final reports. Utilization of sanitized digital media of echocardiography recordings and case histories from the American College of Cardiology, Mayo Clinic series, assist in reinforcing course principles. Emphasis is placed on integration of theory with practical laboratory performance.

C201c: Physics VI - Quality Assurance & Artifacts

Student learns the principles of artifacts, bioeffects and quality assurance. Topics include types and causes of image artifacts, quality assurance phantoms, performance measurements, instruments for measuring bioeffects, thermal and cavitation mechanisms and epidemiologic studies. The student performs calculations of Mechanical Index.

250b: Echocardiography IV - Practical Color Flow

Extensive hands-on application is designed to develop student competence in views presented in theory courses. Student develops significant skills while performing echocardiograms utilizing ultrasound equipment at the school. Student acquires technical ability under the supervision of credentialed specialists to ensure quality control and professional skill development. Performance check-offs are conducted routinely as each view is practiced and completed.

C260a - C260d: Externship

Externship can take place when the student reaches eligibility and continues until externship requirement is completed. Externship is an opportunity for a learning experience outside school facilities. The off-campus externship is an integral part of the program. The student is assigned to a school-approved facility. Written and verbal contact with externship preceptor is maintained throughout externship experience and communication is routinely performed by the school to monitor student progress.

Maximum number of students in a classroom and laboratory:

Maximum number of students in a classroom and laboratory:		
Delivery	Faculty	Students
Classroom (Theory) Core Courses	1	25
Laboratory (Practical) Core Courses	2	12
General Education Courses	1	25

Requirements For Graduation:

An Associate of Occupational Science degree, designating the graduate as a Cardiovascular Technologist is conferred on those students meeting the following requirements:

Satisfactory completion of the course requirements which include stipulated externship hours at a school approved site and an externship evaluation from the medical supervisor.

- A combined average grade of not less than 80%.
- A Minimum Cumulative Completion Rate of 67%.
- Recommendation of the faculty.
- Satisfaction of all indebtedness to the school.
- A satisfactory record of attendance.

A specialist assisting in the performance of highly technical invasive procedures utilized in cardiac catheterization or related specialty techniques



Photo taken at hospital rotation site. M. Hacala

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AOS INVASIVE CARDIOVASCULAR TECHNOLOGIST

The AOS Invasive Cardiovascular Technologist student is trained to assist in the performance of invasive testing procedures which provide critical data used in the detection and treatment of diseases of the heart and circulatory system.

Invasive cardiovascular studies include a foundation in anatomy, physiology & pathology, medical terminology, universal precautions, cardiovascular pharmacology, basic and advanced electrocardiography, physics, vital signs, IV administration, diagnostic cardiac catheterization, hemodynamics, and principles of radiology. The recognition of and intervention in lethal arrhythmias are also included. In addition, interventional procedures such as angioplasty, stents, and intra-aortic balloon pumps are presented within the context of this program. Sufficient time is devoted to the concepts of cardiac electrophysiology and pacemakers. Advanced Cardiac Life Support (ACLS) is presented according to the guidelines of the American Heart Association.

Emerging technologies of peripheral vascular intervention are presented and explored. These advances in the treatment of lower arterial and carotid artery disease include endovascular stenting, thrombectomy, and laser and rotational atherectomy.

The externship rotation is an integral part of the training program. Eligible students are assigned to school-approved hospital site or medical facility and will maintain this rotation until all required hours have been successfully completed within the duration of eligibility. Refer to Student Handbook.

The student's performance of program objectives is closely monitored by the school's Education Department, Program Supervisor and hospital preceptors.

Upon successful completion of the AOS Invasive Cardiovascular Technologist Program, and the knowledge and skills acquired, students are prepared for responsible career entry positions with advancement opportunities in hospitals, specialty clinics, doctor's offices, and non-invasive cardiovascular laboratories. The minimum expectation is to prepare competent entry-level Invasive Cardiovascular Technologists in the cognitive (knowledge), psychomotor (skills) and affective (behavior) learning domains for Invasive Cardiovascular. There is a widespread demand for competent, credentialed Invasive Cardiovascular Technologists.

Course Descriptions

GE011: Anatomy & Physiology

In this course, the essential basics of structures and functions of the human body systems will be discussed. Topics on all individual major organ systems will be examined, while considering them in the state of health versus the state of disease, focusing mainly on structures. Various clinical implications and possible deviations from norm of each organ system will be brought up throughout the course.

GE112: Algebra I

This course is designed to give students the math skills that provide a foundation for more advanced courses. Students will explore writing and solving linear and nonlinear equations, powers and exponents, quadratic equations, polynomials and factoring, graphing and solving linear inequalities, and functions.

GE130: Written and Oral Communication

In this course, students will explore the fundamental analog and digital skills of oral and written communication to help create professional written and oral communication within their career. This is an introduction to a variety of methods used to communicate effectively and create language that articulates information in a way that connects a speaker to an audience.

C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications / HIPAA

This course covers the principles of human anatomy and physiology with emphasis on the cardiovascular system. Topics include cell biology, the blood system, normal blood vessel anatomy and their role in cardiovascular function. The class format includes lecture and class discussion. Emphasis is placed on the physiologic principles underlying

the disease processes which the Cardiovascular Technologist is likely to encounter in a clinical environment. **Therapeutic Communications** presents key concepts necessary to effectively communicate information to physicians and staff in daily clinical situations, and skills needed to demonstrate empathy and deliver compassionate patient care. Emphasis is placed on the components of the communication cycle and the role of perception, significance of body language, active listening skills, defense mechanisms, and adaptive and maladaptive coping mechanisms. **Critical Thinking Skills** introduces students to the components of and barriers to critical thinking. Discussion includes assessment and care of the cardiovascular patient, interpreting real-time data without bias, anticipating additional steps and/or complications, and strengthening clinical reasoning. The critical nature of being proactive, using knowledge, and taking initiative to act in anticipation of needs or complications, rather than simply reacting to events, is emphasized. Also presented are HIPAA guidelines and how they pertain to the role of the allied health professional.

C101a: Physics I - Basic Ultrasound

Student learns the physical properties of ultrasound. Topics include the piezoelectric effect, the parameters of a sound wave, acoustic variables and the concept of direct and inverse relationships among variables. The student performs calculations of frequency, period, wavelength, velocity, amplitude, power, and intensity.

C115a: Pharmacology

A study of the major categories of medications prescribed for cardiac patients. The student learns the indications, contraindications, and mechanisms of action of drugs used

for the control of angina, dysrhythmias, heart failure and hypertension. Adrenergics and anticoagulants are covered. Selected ancillary medications for sedation, analgesia, diuresis, and cardiopulmonary emergencies are also examined.

C118a1: ECG I - Theory

A study of the basic levels of electrocardiology and electrocardiography. Focus is placed on waveform morphology with emphasis on Einthoven's theory and lead derivation. Student learns to perform ECG measurements of significant diagnostic value. Ancillary ECG methods such as telemetry monitoring and stress testing are also presented. ECG I is a prerequisite for the study of advanced principles offered in ECG II.

C118a2: ECG I - Practical - Telemetry & Exercise Stress Testing

Hands-on ECG testing procedures and placement of chest electrodes. Principles of machine operations and troubleshooting to maintain quality of ECG tracing is thoroughly covered. Technical skills are performed under the supervision of certified specialists to ensure quality control and professional skill development.

C100b: Anatomy & Physiology / Pathophysiology

This course is designed to continue the principles of human anatomy and physiology introduced in C100a Anatomy & Physiology/Pathophysiology which have a direct relationship to the function of cardiac activity and blood flow. Focus is placed on the autonomic nervous system and renal system roles in regulation of blood pressure and on the feedback mechanisms underlying circulatory physiology. Anatomy and physiology of the heart is discussed with

focus placed on myocyte contraction, cardiodynamics, and basic cardiovascular pathology. Discussion also includes nervous, endocrine, respiratory and renal function as it relates to the cardiovascular system.

C101b: Physics II - Pulsed Ultrasound

Student learns the principles of pulsed ultrasound and the behavior of sound as it propagates through the body. Topics include pulsed ultrasound, attenuation, impedance reflection and refraction. The student performs calculations of pulse repetition frequency, pulse repetition period, spatial pulse length, pulse duration, duty factor, attenuation coefficient, intensity reflection coefficient and Snell's Law of Refraction.

C115b: Pharmacology

This course is designed to continue the principles of Pharmacology introduced in C115a. This course involves the study of adrenergics, antiarrhythmics, antihypertensives & nitrates. The student will also learn the medications used for each of the above referenced modules, including the mechanism of action, indications, side effects, contraindications and/or interactions.

C110: Vital Signs: Theory & Practical / IV Administration: Theory & Practical

Prepares student to perform blood pressure, pulse, and respiration procedures. Hands-on practice is supervised by credentialed subject specialists to ensure quality control and successful development of clinical skills. Trains the student in the proper procedural techniques for IV administration. Special attention is given to sites and equipment which may be used for IV infusion. Supervised hands-on training (1-1 ratio) for all intravenous procedures is closely monitored by credentialed subject specialists to ensure quality control and to instill professional confidence. IV administration labs are limited in size for the successful development of IV administration skills. Focus is placed on OSHA guidelines and how this pertains to the role of the allied health professional.

C128b1: ECG II - Theory

Builds on the basic principles of waveform morphology presented in ECG I. The student develops the ability to recognize and interpret cardiac arrhythmias, heart blocks, chamber enlargement, and 12-lead interpretation as it relates to myocardial infarction, and pacemaker analysis.

C128b2: ECG II Practical / BLS - 12-Lead Analysis, Arrhythmia Interpretation

Student develops expertise in the recognition and interpretation of cardiac arrhythmias, heart blocks, and chamber enlargement. Special attention is also given to the recognition of pacemaker patterns and ECG changes caused by a myocardial infarction. The student is required to interpret and analyze numerous rhythm strips for each cardiac anomaly.

C129 Healthcare Provider Basic Life Support

This is a programmed course designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing. In addition, the Healthcare Provider Basic Life Support training is designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

C150: Advanced Cardiovascular Life Support (ACLS)

This course is designed and supported by the guidelines of the American Heart Association. It provides the knowledge and skills needed to evaluate and manage a potentially life-threatening situation. Providers are required to learn algorithms for bradycardia, tachycardia, cardiac arrest, acute coronary syndrome and stroke. The course consists of a combination of lectures and hands-on skills. Practical skills are evaluated through case scenarios and a written exam is required.

C140: Invasive Cardiac Diagnostics, Diagnostic Catheterization Techniques, Cardiac Pathology, Basic Hemodynamics, Advanced ECG

Includes a brief history of catheterization, radiation safety and patient safety measures, vascular access and catheter and related equipment used by the cardiologist.

Diagnostic Catheterization Techniques

This section of the program describes the different features of Left and Right heart catheterization procedures. The student is familiarized with common arterial and venous catheters used for angiography, pressure sampling and cardiac output measurement. Ancillary equipment including power injectors, oximeters and anticoagulation monitoring devices are introduced.

Cardiac Pathology

Addresses the major cardiac pathologies, both congenital and acquired, which are encountered in an invasive cardiac setting. Emphasis is on coronary artery disease and valvular abnormalities, with special attention to acute myocardial infarction.

Basic Hemodynamics

Introduces the fundamentals of pressure monitoring, waveform recognition and interpretation, basic measurements and derived parameters.

Advanced ECG

Focuses on advanced 12-lead ECG interpretation. Thorough review of various rhythms including sinus, atrial, junctional, and ventricular is conducted. In addition, heart blocks and reentry mechanisms are presented with special emphasis on myocardial infarction criteria.

C245: Interventional Cardiology Part I: Cardiac Pharmacology I, Principles of Radiology, Advanced Hemodynamics

Cardiac Pharmacology I

This is an introduction to the most commonly used medications in the cath lab and a survey of ACLS medications that may be required in the event of a need for CPR in the cath lab.

Principles of Radiology

Covers the basic physics of ionizing radiation, the evolution of fluoroscopic imaging, the generation of x-rays in the cath lab, features of the imaging chain and basic troubleshooting.

Advanced Hemodynamics

Focuses on the calculation of more complex hemodynamic parameters such as shunt ratios, valve areas, regurgitant fractions, special gradients and contractility indices.

C255: Interventional Cardiology Part II: PTCA Mechanisms and Equipment, Management of Complications, Intra-Aortic Balloon Pump, Atherectomy Techniques

PTCA Mechanisms and Equipment

Introduces the mechanisms of Percutaneous Transluminal Coronary Angioplasty and the varieties of balloons, wires, catheters and devices used in this intervention.

Management of Complications

Concentrates on the complications which may occur during cardiac interventions and the range of measures employed in managing complications. Modalities introduced include the Cardiopulmonary Support machine, devices for foreign body retrieval, the use of thrombolytic drugs and emergent coronary artery bypass surgery.

Intra-Aortic Balloon Pumping and Assist Devices

Introduces the theory of counterpulsation, recognition of waveforms, timing, hardware and troubleshooting. Left ventricular assist devices such as the Impella and Tandem Heart are also presented.

Atherectomy Techniques

This section of the program focuses on atherectomy techniques. Devices discussed include mechanical rotational atherectomy, transluminal endarterectomy, thrombectomy, directional atherectomy and laser PTCA.

C265: Interventional Cardiology Part III, Stenting, Ancillary Imaging Techniques, Structural Heart Intervention, Cardiac Pharmacology II

Stenting

Continuing the survey of interventional modalities, this course examines the fundamentals of stenting including drug eluting stents.

Ancillary Imaging Techniques

Introduces intravascular ultrasound and fractional flow reserve measurement. New developments in Optical Coherence Reflectometry and Near Infrared Lipiscan are also presented.

Structural Heart Interventions

Focuses on structural heart interventions such as septal ablation for HOCM, pericardiocentesis, PFO closure, myocardial biopsy, Valvuloplasty, Transcatheter Aortic Valve Implantation and Left Atrial Appendage closure.

Cardiac Pharmacology II

Deepens student knowledge of the range of cardiac medications in common usage including antihypertensives, diuretics, hypolipidemics, ACE inhibitors and medications currently in research trials.

C275: Principles of Cardiac Pacemaker & Defibrillators, Pacemaker and ICD, Introduction to Peripheral Interventions

Principles of Cardiac Pacemakers & Defibrillators

This course introduces artificial pacemakers and implantable defibrillators. Focus is placed on common units of measurement, application of Ohm's Law to

implant thresholds, key steps in the surgical implant and the technologist's roles in assisting the cardiologist during the procedures.

Pacemaker and ICD

Basic Pacemaker and ICD fundamentals are included in this course. Pacemaker concepts are presented including history, indications, pacing components, Mode terminology and hemodynamic effects of pacing. Cardiac Resynchronization Therapy and Loop Recorder technology are also explained. Basic ICD focuses on history, indications, operation of generators, coils and leads. Differentiation of tiered therapies are clarified for student recognition of cardioversion, defibrillation and anti-tachycardia pacing.

Introduction to Peripheral Interventions

Introduces interventions in the peripheral vascular circulation such as lower extremity arterial angioplasty, renal stenting and endovascular aortic aneurysm repair.

C285: Diagnostic & Interventional Concepts - Summary and Review, Advanced Peripheral Interventions

Diagnostic & Interventional Concepts: Summary and Review

Highlights and discusses the primary concepts presented in the Invasive Cardiovascular Technologist segment. Special attention is given to invasive cardiac diagnostics and interventional cardiology as outlined in the program course descriptions.

Advanced Peripheral Interventions

Focuses on advanced vascular interventions such as vena cava filters, stenting of carotids, hemodialysis shunt declotting, laser, atherectomy and rotational ablation devices, PICC lines and other miscellaneous procedures.

C260a - C260g: Externship

Externship can take place when the student reaches eligibility and continues until requirement is completed. Externship is an opportunity for a learning experience outside school facilities. The off-campus externship is an integral part of the program. The student is assigned to a school-approved facility. Written and verbal contact with externship preceptor is maintained throughout externship experience and communication with sites is routinely performed by the school to monitor student progress.

Maximum number of students in a classroom and laboratory:			
Delivery	Faculty	Students	
Classroom (Theory) Core Courses	1	25	
Laboratory (Practical) Core Courses	2	12	
General Education Courses	1	25	

Requirements For Graduation:

An Associate of Occupational Science degree, designating the graduate as a Cardiovascular Technologist is conferred on those students meeting the following requirements:

Satisfactory completion of the course requirements which include stipulated externship hours at a school approved site and an externship evaluation from the medical supervisor.

- A combined average grade of not less than 80%.
- A Minimum Cumulative Completion Rate of 67%.
- Recommendation of the faculty.
- Satisfaction of all indebtedness to the school.
- A satisfactory record of attendance.



MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Invasive Cardiovascular Technologist graduates will be able to:

- Utilize communication, critical thinking and mathematic skills in assessment, planning, intervention, and evaluation of patient care.
- Demonstrate understanding of cardiac, vascular, respiratory, and renal anatomy, physiology and pathology
- Demonstrate thorough understanding of ECG and related medical terminology
- Prepare patient for electrocardiogram
- Perform electrocardiogram
- Standardize and operate various types of electrocardiograph instruments
- Recognize and correct various types of artifact
- Perform time/voltage measurements on the ECG
- Perform axis measurement and recognize significance
- Demonstrate understanding of waveform morphology
- Recognize ECG wave patterns and significance
- Recognize and interpret normal vs. abnormal wave patterns on the ECG with emphasis on lethal arrhythmias
- Recognize and interpret arrhythmias and heart block abnormalities
- Assist in the performance of exercise stress testing
- Demonstrate understanding of the indications for pacemakers, mechanisms, normal function, signs of malfunction, and ECG patterns
- Recognize electrocardiographic changes which occur in chamber enlargement and myocardial ischemia/infarction
- Perform intravenous administration, blood pressure and vital sign measurements
- Demonstrate understanding of the principles related to basic and ultrasound physics
- Demonstrate understanding of pharmacology and pharmacokinetics related to cardiac and vascular function
- Demonstrate knowledge of cardiopulmonary resuscitation through American Heart Association Healthcare Provider course
- Respond to the occurrence of a lethal arrhythmia following ACLS standards
- Identify coronary anatomy in cine angiographic projections
- Identify cardiac pressure waveforms
- Calculate basic hemodynamic parameters using the recording computer
- Record catheterization events in computer database including medications used in the cath lab, and indications for administration, dosages, generic and trade names
- Recognize and alert physicians to abnormalities in clinical laboratory values for arterial blood gases, electrolytes, hemoglobin, BUN, and creatinine
- Describe the fundamental steps in a diagnostic heart catheterization
- Monitor a diagnostic cardiac cath to ensure patient safety
- Provide the physician with the appropriate supplies for a diagnostic cath
- Perform cardiac outputs, oxygen saturations and ACT (activated clotting time) measurements
- Distinguish between the following interventional cardiovascular modalities: PTCA, thrombectomy, laser revascularization and stents
- Identify the benefits of supplementing angiographic imaging with intravascular ultrasound, Optical Coherence Tomography and Fractional Flow Reserve
- Describe the indications for electrophysiologic testing, permanent pacemaker implant, therapeutic ablation of dysrhythmias, tilt table testing, and implantable cardioverter defibrillators
- Identify the main components of the cath lab x-ray system
- Demonstrate radiation safety
- Demonstrate sterile technique in scrubbing and patient prep
- Demonstrate universal precautions around patient body fluids
- Set up a sterile table for a cardiac catheterization procedure
- Drape patient for a cardiac catheterization procedure
- Describe left ventriculography, aortography, peripheral arteriography and coronary arteriography
- Demonstrate understanding of pharmacological effects of drugs used to control lethal arrhythmias and respiratory arrest
- Use wall suction for Yankauer, ET and NG suction
- Use oxygen flow meter with nasal cannula, non-breather mask and ambu bag
- Describe the operation of left ventricular assist devices such as the Impella and intra-aortic balloon pump
- Identify the steps in Trans-catheter Aortic Valve Implantation/replacement (TAVR)
- Assist in obtaining and processing endomyocardial biopsy specimens
- Identify basic concepts of Pacemaker and ICD Technology
- Describe percutaneous intervention techniques for aortic aneurysm, renal artery stenosis, lower extremity peripheral artery disease, deep vein thrombosis, arteriovenous fistula thrombosis, carotid artery stenosis and acute stroke intervention
- Demonstrate the operation of endovascular stents, vena cava filters, excisional atherectomy devices, excimer laser and rheolytic thrombectomy systems
- Adhere to the principles of medical ethics as applied to the role of the Invasive Cardiovascular Technologist

AOS INVASIVE CARDIOVASCULAR TECHNOLOGIST PROGRAM

**Quarterly Schedule of Instruction:
Twenty-Seven (27) Months
Nine (9) 12 Week Quarters and 1000 Hour Externship**

Quarter I: General Education Asynchronous

Quarters: II - III: Tuesday & Thursday, 6 PM - 9:30 PM / 5:30 PM-9 PM Saturday, 8 AM - 3 PM

Quarter IV: Tuesday & Thursday, 8 AM to 4:30 PM Saturday, 8 AM - 2 PM

Quarters V - VII: Tuesday & Thursday, 2:30 PM – 6:30 PM / 6PM-9:30 PM Saturday, 8 AM – 11:30 AM

Quarter VIII: Saturday, 8 AM - 1:30 PM

Quarter IX: Thursday, 10AM -3:30 PM

Course	Contact Hours	Quarter Credit Hours
Quarter I		
GE011: Anatomy & Physiology	45	4.5
GE112: Algebra I	45	4.5
GE130: Written and Oral Communication	45	4.5
<i>Work Outside of Class: 67.5 Hours</i>		
Total Quarter I:	135	13.5
Quarter II		
C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications/HIPAA	54	3.5
C101a: Physics I - Basic Ultrasound	12	0.5
C115a: Pharmacology	18	1.0
C118a1: ECG I - Theory	36	2.5
C118a2: ECG I – Practical – Telemetry & Exercise Stress Testing	36	2.0
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter II:	156	9.5
Quarter III		
C100b: Anatomy & Physiology / Pathophysiology	42	2.5
C101b: Physics II - Pulsed Ultrasound	12	0.5
C115b: Pharmacology	18	1.0
C110: Vital Signs: Theory & Practical / IV Administration: Theory & Practical	12	0.5
C128b1: ECG II - Theory	36	2.5
"C128b2: ECG II - Practical - 12-Lead Analysis, Arrhythmia Interpretation"	32	2.0
C129 Healthcare Provider Basic Life Support	4	0.0
<i>Work Outside of Class: 39 Hours</i>		
Total Quarter III:	156	9.0
Quarter IV		
C130 Clinical Preparation Skills	80	5.0
C150: Advanced Cardiovascular Life Support (ACLS)	40	2.0
"C140: Invasive Cardiac Diagnostics, Diagnostic Catheterization Techniques, Cardiac Pathology, Basic Hemodynamics, Advanced ECG"	132	9.0
<i>Work Outside of Class: 63 Hours</i>		
Total Quarter IV:	252	16.0

Course	Contact Hours	Quarter Credit Hours
Quarter V		
"C245: Interventional Cardiology Part I, Cardiac Pharmacology I, Principles of Radiology, Advanced Hemodynamics"	132	9.0
C260a: Clinical Site Rotation / Externship	120	4.0
<i>Work Outside of Class: 33 Hours</i>		
Total Quarter V:	252	13.0
Quarter VI		
"C255: Interventional Cardiology Part II, PTCA Mechanisms and Equipment, Management of Complications, Intra-Aortic Balloon Pump, Atherectomy Techniques"	132	9.0
C260b: Clinical Site Rotation / Externship	120	4.0
<i>Work Outside of Class: 33 Hours</i>		
Total Quarter VI:	252	13.0
Quarter VII		
"C265: Interventional Cardiology Part III, Stenting, Ancillary Imaging Techniques, Structural Heart Intervention, Cardiac Pharmacology II"	132	9.0
C260c: Clinical Site Rotation / Externship	120	4.0
<i>Work Outside of Class: 33 Hours</i>		
Total Quarter VII:	252	13.0
Quarter VIII		
"C275: Principles of Cardiac Pacemaker & Defibrillators, Pacemaker and ICD, Introduction to Structural Heart"	66	4.5
C260d: Clinical Site Rotation / Externship	120	4.0
<i>Work Outside of Class: 16.5 Hours</i>		
Total Quarter VIII:	186	8.5
Quarter IX		
C285: Diagnostic & Interventional Concepts – Peripheral Interventions	66	4.5
C260e: Clinical Site Rotation / Externship	120	4.0
<i>Work Outside of Class: 16.5 Hours</i>		
Total Quarter IX:	186	8.5
Clinical Site Rotation / Externship		
C260f: Clinical Site Rotation / Externship	400	13.0
Externship Total:	400	13.0
PROGRAM TOTAL	2227	117.0
<i>Work Outside of Class: 340.5 Hours Note: Total work outside of class hours are approximate.</i>		

• **National Credentialing** - As a graduate of a program accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), upon recommendation of the Joint Review Committee on Education in Cardiovascular Technology, you will be eligible to take the RCIS (Registered Cardiovascular Invasive Specialist) national examination through the Cardiovascular Credentialing International (CCI) **immediately** following completion of your training.

• **Memberships** - In the Alliance of Cardiovascular Professionals (ACVP), and the Society of Invasive Cardiovascular Professionals (SICP) are open to you as a student and graduate.

A professional in the interpretation of abnormal cardiac rhythms in order to assist in device therapy and interventional procedures

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Photo taken at hospital rotation site. M. Hacala

AOS CARDIAC ELECTROPHYSIOLOGY TECHNOLOGIST

The AOS Cardiac Electrophysiology Technologist program provides the student the necessary technical skills to work with physicians who diagnose and treat cardiac arrhythmias. Student will learn the standard protocols utilized during an electrophysiology study and the diagnostic and interventional procedures performed in the lab.

The core courses in the AOS Cardiac Electrophysiology Technologist Program include a foundation in anatomy, physiology & pathology, basic and advanced electrocardiography, physics, pharmacology, IV administration, vital signs, and patient assessment.

As the student progresses to the specialized courses in Cardiac EP, focus is placed on sterile technique and radiation safety, cardiac pathology, basic hemodynamics, cardiac pharmacology, and advanced ECG which concentrates on lethal arrhythmia recognition and intervention. In addition, principles of cardiac electrophysiology, pacemakers, and implantable cardioverter defibrillators are thoroughly reviewed to reinforce the understanding of cardiac rhythm and arrhythmias. Special attention is given to monitoring systems, measurement of intervals, mapping and navigational systems, ablation techniques and tilt table testing. Student will learn to identify atrial and ventricular study components, programmed electrical stimulation, sinus node recovery time, measurement of intervals and EP catheter location during this program.

Advanced Cardiac Life Support (ACLS) is presented according to the guidelines of the American Heart Association.

The clinical site rotation/externship is an integral part of the training program. Eligible students are assigned to school-approved hospital site or medical facility and will maintain this rotation until all required hours have been successfully completed within the duration of eligibility. Refer to Student Handbook.

The student's performance of program objectives is closely monitored by the school's Education Department, Program Supervisor, and hospital preceptor. Communication with hospitals is conducted on a regular basis by the school externship coordinator to assess the satisfactory progress of the student.

Due to the technical nature of the AOS Cardiac Electrophysiology Technologist program, it is preferred that the student have prior allied health training, recent clinical work experience and college credits. Class size is limited to assure close supervision during classroom and externship training.

Upon successful completion of the AOS Cardiac Electrophysiology Technologist program and the knowledge and skills acquired, this program prepares students for responsible career entry positions with advancement opportunities in hospitals and other related healthcare facilities. There is a widespread demand for competent AOS Cardiac Electrophysiology Technologists.

Course Descriptions

GE011: Anatomy & Physiology

In this course, the essential basics of structures and functions of the human body systems will be discussed. Topics on all individual major organ systems will be examined, while considering them in the state of health versus the state of disease, focusing mainly on structures. Various clinical implications and possible deviations from norm of each organ system will be brought up throughout the course.

GE112: Algebra I

This course is designed to give students the math skills that provide a foundation for more advanced courses. Students will explore writing and solving linear and nonlinear equations, powers and exponents, quadratic equations, polynomials and factoring, graphing and solving linear inequalities, and functions.

GE130: Written and Oral Communication

In this course, students will explore the fundamental analog and digital skills of oral and written communication to help create professional written and oral communication within their career. This is an introduction to a variety of methods used to communicate effectively and create language that articulates information in a way that connects a speaker to an audience.

C011: Interdisciplinary Survey of Medical Imaging

In this course, the student is introduced to basic imaging modalities in medical imaging. Five common imaging modalities will be discussed which include radiography (including fluoroscopy, mammography and computed tomography), magnetic resonance imaging, nuclear medicine, ultrasound and radiation therapy. Clinical applications are discussed throughout the course.

C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications / HIPAA

This course covers the principles of human anatomy and physiology with emphasis on the cardiovascular system. Topics include cell biology, the blood system, normal blood vessel anatomy and their role in cardiovascular function. The class format includes lecture and class discussion. Emphasis is placed on the physiologic principles underlying the disease processes which the Cardiovascular Technologist is likely to encounter in a clinical environment. **Therapeutic Communications** presents key concepts necessary to effectively communicate information to physicians and staff in daily clinical situations, and skills needed to demonstrate empathy and deliver compassionate patient care. Emphasis is placed on the components of the communication cycle and the role of perception, significance of body language, active listening skills, defense mechanisms, and adaptive and maladaptive coping mechanisms. **Critical Thinking Skills** introduces students to the components of and barriers to critical thinking. Discussion includes assessment and care of the cardiovascular patient, interpreting real-time data without bias, anticipating additional steps and/or complications, and strengthening clinical reasoning. The critical nature of being proactive, using knowledge, and taking initiative to act in anticipation of needs or complications, rather than simply reacting to events, is emphasized. Also presented are HIPAA guidelines and how they pertain to the role of the allied health professional.

C101a: Physics I - Basic Ultrasound
Student learns the physical properties of ultrasound. Topics include the piezoelectric effect, the parameters of a sound wave, acoustic variables and the concept of direct and inverse relationships among variables. The student performs calculations of frequency, period, wavelength, velocity, amplitude, power, and intensity.

C115a: Pharmacology

A study of the major categories of medications prescribed for cardiac patients. The student learns the indications, contraindications, and mechanisms of action of drugs used for the control of angina, dysrhythmias, heart failure and hypertension. Adrenergics and anticoagulants are covered. Selected ancillary medications for sedation, analgesia, diuresis, and cardiopulmonary emergencies are also examined.

C118a1: ECG I - Theory

A study of the basic levels of electrocardiology and electrocardiography. Focus is placed on waveform morphology with emphasis on Einthoven's theory and lead derivation. Student learns to perform ECG measurements of significant diagnostic value. Ancillary ECG methods such as telemetry monitoring and stress testing are also presented. ECG I is a prerequisite for the study of advanced principles offered in ECG II.

C118a2: ECG I - Practical - Telemetry & Exercise Stress Testing

Hands-on ECG testing procedures and placement of chest electrodes. Principles of machine operations and troubleshooting to maintain quality of ECG tracing is thoroughly covered. Technical skills are performed under the supervision of credentialed specialists to ensure quality control and professional skill development.

C100b: Anatomy & Physiology / Pathophysiology

This course is designed to continue the principles of human anatomy and physiology introduced in C100a Anatomy & Physiology/Pathophysiology which have a direct relationship to the function of cardiac activity and blood flow. Focus is placed on the autonomic nervous system and renal system

roles in regulation of blood pressure and on the feedback mechanisms underlying circulatory physiology. Anatomy and physiology of the heart is discussed with focus placed on myocyte contraction, cardiodynamics, and basic cardiovascular pathology. Discussion also includes nervous, endocrine, respiratory and renal function as it relates to the cardiovascular system.

C101b: Physics II - Pulsed Ultrasound

Student learns the principles of pulsed ultrasound and the behavior of sound as it propagates through the body. Topics include pulsed ultrasound, attenuation, impedance reflection and refraction. The student performs calculations of pulse repetition frequency, pulse repetition period, spatial pulse length, pulse duration, duty factor, attenuation coefficient, intensity reflection coefficient and Snell's Law of Refraction.

C115b: Pharmacology

This course is designed to continue the principles of Pharmacology introduced in C115a. This course involves the study of adrenergics, antiarrhythmics, antihypertensives & nitrates. The student will also learn the medications used for each of the above referenced modules, including the mechanism of action, indications, side effects, contraindications and/or interactions.

C110: Vital Signs: Theory & Practical / IV Administration: Theory & Practical

Prepares student to perform blood pressure, pulse, and respiration procedures. Hands-on practice is supervised by credentialed subject specialists to ensure quality control and successful development of clinical skills. Trains the student in the proper procedural techniques for IV administration. Special attention is given to sites and equipment which may be used for IV infusion. Supervised hands-on training (1-1 ratio) for all intravenous procedures is closely monitored by certified subject specialists to ensure quality control and to instill professional confidence. IV administration labs are limited in size for the successful development of IV administration skills. Focus is placed on OSHA guidelines and how this pertains to the role of the allied health professional.

C128b1: ECG II - Theory

Builds on the basic principles of waveform morphology presented in ECG I. The student develops the ability to recognize and interpret cardiac arrhythmias, heart blocks, chamber enlargement, and 12-lead interpretation as it relates to myocardial infarction, and pacemaker analysis.

C128b2: ECG II Practical - 12-Lead Analysis, Arrhythmia Interpretation

Student develops expertise in the recognition and interpretation of cardiac arrhythmias, heart blocks, and chamber enlargement. Special attention is also given to the recognition of pacemaker patterns and ECG changes caused by a myocardial infarction. The student is required to interpret and analyze numerous rhythm strips for each cardiac anomaly.

C129 Healthcare Provider Basic Life Support

This is a programmed course designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing. In addition, the Healthcare Provider Basic Life Support training is designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

C130: Clinical Preparation Skills

Introduces the student to the practical application of aseptic and sterile technique. Student develops proficiency in performing surgical hand scrub, sterile table prep, surgical gowning & gloving and patient sterile prep. Demonstration and practical application of standard equipment used during diagnostic and interventional catheterization and EP cases is presented. ECG review, using a patient monitor and ECG simulator, are utilized to develop proficiency in practical dysrhythmia recognition. Patient assessment skills are also included. Field trips to area hospitals provide student the opportunity to observe clinical skills performed by the technologist in the Cath and EP Lab environment.

C140: Invasive Cardiac Diagnostics, Diagnostic Catheterization Techniques, Cardiac Pathology, Basic Hemodynamics, Advanced ECG

Invasive Cardiac Diagnostics

Includes a brief history of catheterization, radiation safety and patient safety measures, vascular access and catheter and related equipment used by the cardiologist.

Diagnostic Catheterization Techniques

This section of the program describes the different features of Left and Right heart catheterization procedures. The student is familiarized with common arterial and venous catheters used for angiography, pressure sampling and cardiac output measurement. Ancillary equipment including power injectors, oximeters and anticoagulation monitoring devices are introduced.

Cardiac Pathology

Addresses the major cardiac pathologies, both congenital and acquired, which are encountered in an invasive cardiac setting. Emphasis is on coronary artery disease

and valvular abnormalities, with special attention to acute myocardial infarction.

Basic Hemodynamics

Introduces the fundamentals of pressure monitoring, waveform recognition and interpretation, basic measurements and derived parameters.

Advanced ECG

Focuses on advanced 12-lead ECG interpretation.

Thorough review of various rhythms including sinus, atrial, junctional, and ventricular is conducted. In addition, heart blocks and reentry mechanisms are presented with special emphasis on myocardial infarction criteria.

C150: Advanced Cardiovascular Life Support (ACLS)

This course is designed and supported by the guidelines of the American Heart Association. It provides the knowledge and skills needed to evaluate and manage a potentially life-threatening situation. Providers are required to learn algorithms for bradycardia, tachycardia, cardiac arrest, acute coronary syndrome and stroke. The course consists of a combination of lectures and hands on skills. Practical skills are evaluated through case scenarios and a written exam is required.

C220a: Principles of Cardiac Electrophysiology I

This course presents the concepts of electrophysiology, equipment and safety. A thorough review of the cardiac electrical system and relevant cardiac anatomy is included. Normal and abnormal rhythm interpretation continues with rhythm strip interpretation. Focus is placed on catheter placement, and measurement of intervals during a basic EP study. Supraventricular intracardiac recognition and ablation techniques for these rhythms is presented. Pharmacology related to EP studies is also provided.

C220b: Principles of Cardiac Electrophysiology II

This course builds on the Cardiac EP I material with continued interpretation of supraventricular and ablation of SVTs. Ventricular arrhythmias, intracardiac recognition and ablation of these rhythms is included. Studies in mapping systems are provided by manufacturer-specific Clinical Application Specialists. Hospital field trips provide the student with varied exposure of technical applications including tilt table testing.

C270: Principles of Device Technology - Pacemakers, Implantable Cardioverter Defibrillator (ICD), Cardiac Resynchronization Therapy (CRT)

Pacemaker Technology

Basic concepts are presented including history, indications, pacing components, implant/explant procedures, stimulation, capture, sensing, pacing modes, timing cycles for single and dual chamber pacing, upper rate behavior and rate responsive pacing. Loop recorder technology is also presented. A review of basic hemodynamics is provided to help student understand the effects of pacing.

ICD/CRT Technology

Basic concepts are presented including history, indications, ICD components, implant/explant procedures, capacitance, sensing, detection, shock therapy, antitachycardia pacing and bradycardia pacing. Cardiac Resynchronization Therapy is covered. Introduction to basic programming techniques is provided by vendor Clinical Application Specialists.

C260a - C260d: Externship

Externship can take place when the student reaches eligibility and continues until externship requirement is completed. Externship is an opportunity for a learning experience outside school facilities. The off-campus externship is an integral part of the program. The student is assigned to a school-approved facility. Written and verbal contact with externship preceptor is maintained throughout externship experience and communication is routinely performed by the school to monitor student progress.

Maximum number of students in a classroom and laboratory:		
Delivery	Faculty	Students
Classroom (Theory) Core Courses	1	25
Laboratory (Practical) Core Courses	2	12
General Education Courses	1	25

Requirements For Graduation:

An Associate of Occupational Science degree, designating the graduate as a Cardiovascular Technologist is conferred on those students meeting the following requirements:

Satisfactory completion of the course requirements which include stipulated externship hours at a school approved site and an externship evaluation from the medical supervisor.

- A combined average grade of not less than 80%.
- A Minimum Cumulative Completion Rate of 67%.
- Recommendation of the faculty.
- Satisfaction of all indebtedness to the school.
- A satisfactory record of attendance.

CARDIAC ELECTROPHYSIOLOGY TECHNOLOGIST PROGRAM

QUARTERLY SCHEDULE OF INSTRUCTION

Twenty-One (21) Months

Seven (7) 12 Week Quarters and 810- Hour Externship

Quarter I: – General Education Asynchronous

Quarters II – III: Tuesday & Thursday, 6 PM - 9:30 PM, 5:30-9PM Saturday, 8 AM - 3 PM

Quarter IV: Tuesday & Thursday, 8AM - 4:30PM Saturday, 8AM-2PM

Quarters V - VII: Saturday, 8 AM - 1 PM

Externship: 16 hours/week

39

Course	Contact Hours	Quarter Credit Hours
Quarter I		
GE011: Anatomy & Physiology	45	4.5
GE112: Algebra I	45	4.5
GE130: Written and Oral Communication	45	4.5
Work Outside of Class: 67.5 Hours		
Total Quarter I:	135	13.5
Quarter II		
C100a: Anatomy & Physiology / Pathophysiology / Therapeutic Communications / HIPAA	54	3.5
C101a: Physics I - Basic Ultrasound	12	0.5
C115a: Pharmacology	18	1.0
C118a1: ECG I - Theory	36	2.5
C118a2: ECG I – Practical – Telemetry & Exercise Stress Testing	36	2.0
Work Outside of Class: 99 Hours		
Total Quarter II:	156	9.5
Quarter III		
C100b: Anatomy & Physiology / Pathophysiology	42	2.5
C101b: Physics II - Pulsed Ultrasound	12	0.5
C115b: Pharmacology	18	1.0
C110: Vital Signs: Theory & Practical / IV Administration: Theory & Practical	12	0.5
C128b1: ECG II - Theory	36	2.5
C128b2: ECG II - Practical - 12-Lead Analysis, Arrhythmia Interpretation “	32	2.0
C129 Healthcare Provider Basic Life Support	4	0.0
Work Outside of Class: 39 Hours		
Total Quarter III:	156	9.0

Course	Contact Hours	Quarter Credit Hours
Quarter IV		
C130: Clinical Preparation Skills	80	5.0
C140: Invasive Cardiac Diagnostics, Diagnostic Catheterization Techniques, Cardiac Pathology, Basic Hemodynamics, Advanced ECG	132	9.0
C150: Advanced Cardiovascular Life Support (ACLS)	40	2.0
Work Outside of Class: 76 Hours		
Total Quarter IV:	252	16.0
Quarter V		
C011: Interdisciplinary Survey of Medical Imaging	30	3.0
C220a: Principles of Cardiac Electrophysiology I	60	4.0
C260a: Clinical Site Rotation / Externship	180	6.0
Work Outside of Class: 15 Hours		
Total Quarter V:	270	13.0
Quarter VI		
C220b: Principles of Cardiac Electrophysiology II	60	4.0
C260b: Clinical Site Rotation / Externship	180	6.0
Work Outside of Class: 15 Hours		
Total Quarter VI:	240	10.0
Quarter VII		
“C270: Principles of Device Technology - Pacemakers, Implantable Cardioverter Defibrillator (ICD), Cardiac Resynchronization Therapy (CRT) “	60	4.0
C260c: Clinical Site Rotation / Externship	180	6.0
Work Outside of Class: 15 Hours		
Total Quarter VII:	240	10.0
Clinical Site Rotation / Externship		
C260d: Clinical Site Rotation / Externship	270	9.0
Clinical Site Rotation / Externship Total:	270	9.0
PROGRAM TOTAL	1719	90.0
Work Outside of Class: 531 Hours		
<i>Note: Total work outside of class hours are approximate.</i>		

- **National Credentialing** - The material covered in the Cardiac Electrophysiology Technologist program and related work experience provides an excellent preparation for the graduates to take the RCES (Registered Cardiovascular Electrophysiology Specialist) examination through CCI (Cardiovascular Credentialing International).

- **Memberships** - In the Alliance of Cardiovascular Professionals (ACVP), and the Society of Invasive Cardiovascular Professionals (SICP) are open to you as a student and graduate.

MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Cardiac Electrophysiology Technologist graduates will be able to:

- Utilize, communication, critical thinking and mathematic skills in assessment, planning, intervention, and evaluation of patient care.
- Demonstrate understanding of cardiac, vascular, respiratory, and renal anatomy, physiology and pathology
- Demonstrate thorough understanding of ECG and related medical terminology
- Prepare and perform patient for electrocardiogram
- Recognize and correct various types of artifact
- Perform time/voltage measurements on the ECG
- Demonstrate understanding of waveform morphology
- Recognize ECG wave patterns and significance
- Recognize and interpret normal vs. abnormal wave patterns on the ECG with emphasis on lethal arrhythmias
- Recognize and interpret arrhythmias and heart block abnormalities
- Demonstrate understanding of the indications for pacemakers, mechanisms, normal function, signs of malfunction, and ECG patterns
- Perform intravenous administration, blood pressure and vital sign measurements
- Demonstrate understanding of the principles related to ultrasound physics
- Demonstrate understanding of pharmacology and pharmacokinetics related to cardiac and vascular function
- Demonstrate knowledge of cardiopulmonary resuscitation through American Heart Association Healthcare Provider course
- Respond to the occurrence of a lethal arrhythmia following ACLS standards
- Demonstrate sterile technique in scrubbing and patient prep
- List and describe indications/contraindications for EP studies and ablation
- Identify and explain various arrhythmia mechanisms, symptom correlation, resolution of symptoms, and treatment end point
- Demonstrate knowledge of the basic ECG, arrhythmias, action potentials and their relationship to intracardiac electrograms
- Recognize, label and measure intracardiac electrograms
- Identify and explain atrial and ventricular study components, programmed electrical stimulation, sinus node recovery time, measurement of intervals and catheter location
- Demonstrate knowledge of specific tachyarrhythmias, the physiology of specific arrhythmias and treatment of atrial and ventricular tachycardias that can be cured
- Describe the theory and practice of pulsed field ablation
- Demonstrate understanding of electroanatomical mapping.
- List and describe the equipment and catheters needed to perform cardiac ablation.
- Describe the equipment and catheters needed to perform an atrial flutter ablation
- Identify pacemaker components, describe pacing modes and timing cycles and interpret pacing strips
- Identify implantable cardioverter defibrillator components, describe arrhythmia detection and therapies
- Explain indications for CRT systems and the hemodynamic benefit
- Assist with patient prep and equipment needed for pacemaker implantation, ICD implantation and loop recorder implants
- Demonstrate understanding of indications, patient prep and equipment needed for device/lead extraction
- Demonstrate understanding of indications, patient prep and equipment needed for tilt table testing
- Adhere to the principles of medical ethics as applied to the role of the Cardiac Electrophysiology Technologist



Photo taken at hospital rotation site. M. Hacala

A specialist in the maintenance of cardiac implantable electronic devices for optimal patient cardiac function



PACEMAKER/ICD TECHNICIAN

Course Descriptions

Cardiac pacing is a widely accepted treatment for patients with a malfunctioning natural pacemaker, which causes the heartbeat to be too fast, too slow, irregular, or to present a blocked electrical pathway. In addition to being a life-saving procedure, pacemaker implantation restores regular heart rhythm and improves patient quality of life. The Pacemaker/ICD Technician is trained to participate in the care of patients requiring cardiac device therapy.

The core curriculum in the Pacemaker/ICD Technician Program includes a foundation in anatomy and physiology, basic and advanced electrocardiography, cardiac pathology and pharmacology, fundamentals of physics, IV administration, BLS and vital signs. This program provides an understanding of diagnostic and therapeutic procedures in ECG, exercise stress testing, telemetry, and pacemaker analysis.

As students progress, they will gain knowledge of normal and abnormal electrophysiology and the arrhythmias that necessitate the use of implantable devices. Training explores terminology, critical thinking, and decision-making skills related to the use of cardiac devices in the treatment of bradycardias, tachycardias, and as an adjunct in the treatment of congestive heart failure. The student will recognize normal device function and will be prepared to utilize special features to optimize therapy. Student is trained to identify complications of pacing therapy and to evaluate patient's symptoms. Focus is placed on recognition and correction of problems encountered with device therapy.

Specialized classes emphasize the pacing system, the pulse generator, and implantation procedure for permanent pacing. Significance of hemodynamics during single, dual, and biventricular pacing are presented. Concepts related to the implantable cardioverter defibrillator (ICD) are thoroughly studied. Programming fundamentals and parameters are explored in practical application.

The clinical/externship rotation is an integral part of the training program. Eligible students are assigned to school-approved hospital site or medical facility and will maintain this rotation until all required hours have been successfully completed within the duration of eligibility. Refer to Student Handbook.

Due to the technical nature of this program, students must have prior allied health training, recent clinical work experience, and college credits in anatomy & physiology, math, and science.

The knowledge and skills acquired prepare students for responsible career entry level positions as a Pacemaker/ICD Technician in pacemaker clinics, hospitals, and industry.

Anatomy & Physiology/ Pathophysiology I

This course covers the principles of human anatomy and physiology with emphasis on the cardiovascular system. Topics include cell biology, the blood system, normal anatomy and physiology of the blood vessels anatomy, and their role in cardiovascular function. Focus is placed on the autonomic nervous system and renal system roles in regulation of blood pressure. The effect of blood and blood vessel disease and disorders on cardiovascular function is also emphasized. Format includes class discussion and the development of critical thinking skills that can be utilized in the assessment and care of a cardiovascular patient.

Anatomy & Physiology/ Pathophysiology II

This course is designed to continue the principles of human anatomy and physiology introduced in Quarter 1 with blood vessel physiology and blood pressure explored in greater depth. Focus is placed on heart anatomy and physiology with emphasis on myocyte contraction and factors contributing to maintenance and regulation of cardiac output. Discussion also includes the role of the nervous, endocrine, renal and respiratory systems in cardiovascular function. Basic cardiovascular pathology is discussed throughout with emphasis on its effect on cardiac output and overall cardiovascular function. Format includes class discussion and the continued development of critical



PACEMAKER/ICD TECHNICIAN PROGRAM

QUARTERLY SCHEDULE OF INSTRUCTION (12 Months)

Four 12 Week Quarters

Quarters I & II: Evening Classes: Tuesday 6 PM - 9:30 PM & Thursday, 5:30 PM - 9 PM and Saturday, 8 AM - 3 PM
Quarter III & IV: Tuesday and Friday, 6 PM - 9 PM

Course	Contact Hours	Credit Hours
QUARTER I		
Anatomy & Physiology/Pathophysiology I	54	3.5
Therapeutic Communications/HIPAA		
Physics I - Basic Ultrasound	12	0.5
Pharmacology	18	1.0
ECG I Theory	36	2.5
ECG I Practical	<u>36</u>	<u>2.0</u>
Telemetry		
Exercise Stress Testing		
Work Outside of Class: 39 Hours		
TOTALS:	156	9.5
QUARTER II		
Anatomy & Physiology/Pathophysiology II	42	2.5
Physics II - Pulsed Ultrasound	12	0.5
Pharmacology	18	1.0
Vital Signs, IV Administration/OSHA	12	0.5
ECG II Theory	36	2.5
ECG II Practical/BLS	<u>36</u>	<u>2.0</u>
12-Lead Analysis		
Arrhythmia Interpretation		
Work Outside of Class: 39 Hours		
TOTALS:	156	9.0
QUARTER III		
Introduction to Pacing	24	1.5
Pacing System, Electrical Concepts		
Implantation Procedure		
Single Chamber Pacing	18	1.0
Intervals, Modes, Troubleshooting		
ECG Analysis		
Dual Chamber Pacing	18	1.0
Timing Cycles, Upper Rate Behaviors		
Mode Switching, Rate Response		
ECG Analysis		
Basic Hemodynamics	<u>12</u>	<u>0.5</u>
Work Outside of Class: 18 Hours		
TOTALS:	72	4.0
QUARTER IV		
Clinical Preparation	9	0.5
Medical Ethics, Symptom Directed Assessment		
Implantable Cardioverter Defibrillator	36	2.0
ICD System, Implantation Procedure		
Detection and Therapy		
Cardiac Resynchronization Therapy		
Introduction to Programming Concepts	27	1.5
Magnets, Thresholds		
Special Features		
Clinical Site Rotation/Externship	<u>192</u>	<u>6.0</u>
Work Outside of Class: 18 Hours		
TOTALS:	264	10.0
TOTAL CONTACT HOURS/CREDIT HOURS	648	32.5
EXTERNSHIP HOURS/CLINICAL ROTATION	108	3.5
TOTAL HOURS OF INSTRUCTION	<u>756</u>	<u>36.0</u>
TOTAL HOURS OUTSIDE OF CLASS: 114		

Note: Total hours outside of class are approximate.

- **National Credentialing** - The material covered in the Pacemaker/ICD Technician program provides an excellent preparation for graduates to take the national examination to become a Certified Cardiographic Technician (CCT) and Certified Rhythm Analysis Technician (CRAT) through Cardiovascular Credentialing International (CCI).
- **Memberships** - In the Alliance of Cardiovascular Professionals (ACVP) and the Heart Rhythm Society (HRS) are open to you as a student and graduate.

Course Descriptions continued

thinking skills that can be utilized in the assessment and care of a cardiovascular patient.

Therapeutic Communications

Presents the concepts of basic human behavior with emphasis on effective communication with the patient and family, physicians, and staff. Student will be able to identify styles and types of verbal and non-verbal communication and differentiate between adaptive and non-adaptive coping mechanisms. Student will recognize the role of patient advocacy as it applies to their scope of practice. Focus is placed on active listening skills and increasing awareness of how a message is received and the formation of a professional response. Communication skills incorporate respect for cultural diversity and sensitivity. HIPAA guidelines and how they pertain to the role of the allied health professional are also presented.

Physics I - Basic Ultrasound

Physical properties of ultrasound include the piezoelectric effect, the parameters of a sound wave, acoustic variables and the concept of direct and inverse relationships among variables. The student performs calculations of frequency, period, wavelength, velocity, amplitude, power, and intensity.

Physics II - Pulsed Ultrasound

The student learns the principles of pulsed ultrasound and the behavior of sound as it propagates through the body. Topics include pulsed ultrasound, attenuation, impedance reflection and refraction. The student performs calculations of pulse repetition frequency, pulse repetition period, spatial pulse length, pulse duration, duty factor, attenuation coefficient, intensity reflection coefficient and Snell's Law of Refraction.

ECG I Theory

A study of the basic levels of electrocardiology and electrocardiography. Focus is placed on waveform morphology with

emphasis on Einthoven's theory and lead derivation. Student learns to perform ECG measurements of significant diagnostic value. Ancillary ECG methods such as telemetry monitoring and stress testing are also presented. ECG I is a prerequisite for the study of advanced principles offered in ECG II.

ECG I Practical

Student learns hands-on ECG testing procedures and placement of chest electrodes. Principles of machine operations and troubleshooting to maintain quality of ECG tracing is thoroughly covered. Technical skills are performed under the supervision of certified specialists to ensure quality control and professional skill development.

Pharmacology

A study of the major categories of medications prescribed for cardiac patients. The student learns the indications, contraindications, and mechanisms of action of drugs used for the control of angina, dysrhythmias, heart failure, and hypertension. Adrenergics and anticoagulants are covered. Selected ancillary medications for sedation, analgesia, diuresis, and cardio-pulmonary emergencies are also examined.

Vital Signs: Theory & Practical

This course prepares the student to perform blood pressure, pulse, and respiration procedures. Hands-on practice is supervised by credentialed subject specialists to ensure quality control and successful development of clinical skills.

IV Administration: Theory & Practical

Trains the student in the proper procedural techniques for IV administration.

Special attention is given to sites and equipment which may be used for IV infusion. Supervised hands-on training (1-1 ratio) for all intravenous procedures is closely monitored by credentialed subject specialists to ensure quality control and to instill professional confidence. IV Administration labs are limited in size for the successful development of IV administration skills. Focus is placed on OSHA guidelines and how this pertains to the role of the allied health professional.

ECG II Theory

Builds on the basic principles of waveform morphology presented in ECG I. The student develops the ability to recognize cardiac arrhythmias, heart blocks, chamber enlargement, and 12-lead interpretation as it relates to myocardial infarction, and pacemaker analysis.

ECG II Practical

Student develops expertise in the recognition and interpretation of cardiac arrhythmias, heart blocks, and chamber enlargement. Special attention is also given to the recognition of pacemaker patterns and ECG changes caused by a myocardial infarction. Student is required to interpret and analyze numerous



rhythm strips for each cardiac anomaly.

Healthcare Provider Basic Life Support

This is a programmed course designed and supported by the American Heart Association. Student learns to accurately identify an emergency and provide appropriate care for the adult, child, and infant. Emphasis is placed on skill development in CPR, AED and rescue breathing.

Introduction to Pacing

Basic concepts of pacing are presented commencing with history and indications. The student learns the circuit and signal components of a pacing system and the fundamentals of electrical concepts including units of measurement, Ohm's Law, stimulation thresholds, sensing and capture. The student has an opportunity to observe an implant procedure. Student will become familiar with venous access, fluoroscopy imaging, and PSA determination of implant thresholds. Various methods used in emergent temporary pacing are reviewed. The universal pacing code for the various designations of pacemakers and defibrillators is explained.

Single Chamber Pacing

This course presents the basic single chamber pacing modes AOO, AAI, AAT, VOO, VVI, and VVT. Using a systematic approach, the student will analyze single chamber paced ECGs for appropriate interval/period measurements and adequate sensing and capture. Understanding oversensing and undersensing allows the student to recognize inadequate sensing and capture and determine the correct response to pacing problems. Much of this course is the interpretation of paced ECGs. An overview of loop recorders is included.

Dual Chamber Pacing

Student learns terminology and device specific annotations pertinent to dual chamber pacing. The student learns to describe pacing intervals relevant to dual chamber pacing and will recognize upper rate behaviors

and anticipate upper rate behavior related to programmed settings. Emphasis is placed on appropriate programmed settings and special features. The function of DDD, DOO, DVI, DVIR and VDD modes using the five position pacemaker code are presented. Also incorporated in this course is interpretation of dual chamber ECG rhythm strips and demonstration of simple programming functions. In rate responsive pacing, student will explore the types of sensor mechanisms available in the U.S. and the rationale, advantages and disadvantages of each type. General guidelines will be presented for programming rate response. Student will demonstrate simple programming techniques to optimize patient rate response.

Basic Hemodynamics and Electrophysiology Concepts

An overview of basic hemodynamics is presented with emphasis on pressure derivation and waveform recognition and measurement to help the student understand the hemodynamic consequences of pacing. Discussion of the electrophysiology lab provides the student the necessary knowledge of procedures that may occur in this environment.

Clinical Prep

Through system directed assessment, student will identify complications of device therapy by evaluating patient's symptoms and differentiate between problems associated with the acute follow-up period and the chronic follow-up period.

Implantable Cardioverter Defibrillator

This course defines the concepts and terminology of an Implantable Cardioverter Defibrillator and its indications for use. Student will learn to identify ICD components and their functions, specifically pulse generator, single coil, dual coil, and subcutaneous array leads. ICD implant and explant procedure, specific annotations pertinent to ICD therapy, high voltage impedance and defibrillation thresholds are presented. Concepts of sensing and algorithms

for recognition and treatment of arrhythmic events are thoroughly explained. Student will be able to demonstrate simple programming functions and differentiate between tiered therapies, defibrillation, cardioversion and anti-tachycardia pacing. Brady therapy will introduce parameters and programming decisions along with measurement of sensing and stimulation thresholds. Subcutaneous ICDs and management of LVAD patients are discussed. This course also concentrates on Cardiac Resynchronization Therapy (CRT) including indications for implantation and the system for bi-ventricular pacing. Programming special features to decrease RV pacing and increase Bi-V pacing are demonstrated utilizing case studies.

Introduction to Programming Concepts

Critical thinking skills are developed during review of case studies commonly encountered in the device clinic. Appropriate use of programming concepts is discussed. A study of magnet response of implanted pacemaker and ICD, the method of application and magnet mode is presented. Pacemaker follow-up, complications of device therapy, and peri-operative management is presented. Emphasis is placed on product specifications and special features of major device companies to optimize function. Rationale of remote monitoring of pacemaker and ICD patients is explained. Regulatory issues regarding recalls, registry, and research are covered.

Professional Standards/Career Readiness

This presentation emphasizes professional standards required of a Pacemaker/ICD Technician. Student examines job markets, job descriptions, and opportunities for employment at each level of competency. Identify career options and continue to work toward achieving professional goals. Also incorporated in this unit are resume preparation and interview techniques.

MARKETABLE SKILLS

Upon completion of program requirements, Carnegie Pacemaker/ICD Technician graduates will be able to:

- Demonstrate understanding of cardiac, vascular, respiratory, and renal anatomy, physiology and pathology
- Demonstrate thorough understanding of ECG and related medical terminology
- Prepare patient for electrocardiogram
- Perform electrocardiogram
- Standardize and operate various types of electrocardiograph instruments
- Recognize and correct various types of artifact
- Perform time/voltage measurements on the ECG
- Perform axis measurement and recognize significance
- Demonstrate understanding of waveform morphology
- Recognize ECG wave patterns and significance
- Recognize and interpret normal vs. abnormal wave patterns on the ECG with emphasis on lethal arrhythmias
- Recognize and interpret arrhythmias and heart block abnormalities
- Assist in the performance of exercise stress testing
- Demonstrate understanding of the indications for pacemakers, mechanisms, normal function, signs of malfunction, and ECG patterns
- Recognize electrocardiographic changes which occur in chamber enlargement and myocardial ischemias/infarction
- Perform intravenous administration, blood pressure and vital sign measurements
- Demonstrate understanding of the principles related to basic and ultrasound physics
- Demonstrate understanding of pharmacology and pharmacokinetics related to cardiac and vascular function
- Demonstrate knowledge of cardiopulmonary resuscitation through American Heart Association Healthcare Provider course
- Explain various signs, symptoms, and significance observed during clinical assessment
- List and describe most common cardiac pathology, including symptoms and treatment
- Demonstrate understanding of pharmacologic antiarrhythmics which effect cardiac function
- Define terminology related to pacing and ICD
- Discuss historical perspective of pacemakers and ICDs
- Identify indications for permanent cardiac pacing and ICD implant
- Demonstrate understanding of pacemaker and ICD implant/explant procedures
- Demonstrate understanding of electrical concepts of pacing
- Explain sensing and capture
- Determine stimulation thresholds
- Describe the NBG pacing code
- Identify timing cycles for single chamber pacing
- Interpret single chamber ECG rhythm strips
- Demonstrate understanding of derivation of hemodynamic pressures
- Identify left and right heart tracings
- Describe hemodynamic consequences of pacing
- Identify complications of pacemaker therapy by evaluating patient symptoms
- Differentiate between the acute follow-up period and the chronic follow-up period
- Define terms and device specific annotations pertinent to dual chamber pacing
- Describe pacing intervals relevant to DDD pacing
- Recognize upper rate behaviors
- Describe the function of the DDD, DOO, DVI, and DVIC modes using the five position pacemaker code
- Interpret dual chamber ECG rhythm strips
- List the types of sensor devices available in the U. S. and explain the rationale for each type of sensor device
- State general guidelines for programming rate response
- Demonstrate simple programming functions
- Describe ICD implant and explant procedures
- Identify ICD components and their functions
- Describe arrhythmia detection function and detection zones
- Differentiate between tiered therapies: defibrillation, cardioversion and/or antitachycardia pacing
- Utilizing case studies, identify and correct problems related to program parameters
- Define magnet mode
- Describe precautions to be taken before a magnet is applied to the pacemaker generator
- List complications that are more likely to arise during the acute and chronic phase of follow-up
- Discuss final settings: consideration for programming mode, lower rate, upper rate, AV delay, PVARP, amplitude, pulse width, and sensitivity
- Demonstrate understanding of peri-operative management of device patient
- Compare programming operations of several major device companies
- Discuss Cardiac Resynchronization Therapy (CRT) pacing/ICD systems and indications
- Articulate guidelines for remote monitoring/transtelephonic monitoring of pacemakers and ICDs
- Demonstrate understanding of regulatory issues related to recalls, registry, and research
- Adhere to the principles of medical law and ethics as applied to the role of Pacemaker/ICD Technician

EXTERNSHIP/CLINICAL ROTATION TRAINING

Externship is an opportunity for a learning experience outside school facilities. Students are placed by school Externship Supervisors at Medical Offices, Clinics, Hospitals, and Health Care Centers related to Carnegie training. These facilities serve as Medical Affiliates to provide the student valuable patient contact. Here under the supervision of the physician, clinical staff or business manager, student experiences the daily responsibilities in administering patient care and related support services.

Eligibility is determined by the Director of Education in consult with Program Supervisor or Placement Coordinator. Eligibility is based on student's readiness for externship placement as evidenced by general academic, practical performance, professional demeanor and attendance compliance. Externship placement will occur no earlier than the middle of the junior quarter or within 30 days upon completion of classroom training. Externship for all programs is performed without remuneration during normal week-day hours. Refer to pages 13 and 14 in the Student Handbook for complete details.

Students with excessive absenteeism (Refer to page 8A of Student Handbook) will be required to complete one additional hour of externship for each hour of class time missed.

The school requires a satisfactory evaluation of externship performance from the hospital rotation supervisor, the physician, medical business manager, or clinical supervisor before student is considered eligible for a diploma. If the student does not receive a satisfactory evaluation, student's deficiencies are addressed by the Director of Education and a reassignment for externship may be considered. If a second externship/clinical assignment is made and student's performance is unsatisfactory or the student is dismissed by the externship/clinical site for any reason, there will not be any further externship/clinical assignment by the school. In addition, credit will not be awarded for externship/clinical hours if student independently obtains an externship/clinical site which was not assigned by the school.

In order for student to qualify for graduation, he/she must satisfactorily complete externship hour requirements (without remuneration) and school must receive final evaluation from externship/clinical site. If externship evaluation is unsatisfactory, student will not receive a diploma. In compliance with the Department of Veteran Affairs, veteran students will not be certified, and the school will notify the Department of Veteran Affairs of this occurrence.

EXTERNSHIP/CLINICAL ROTATION PROGRAM REQUIREMENTS

Medical Assistant - 160 externship hours.

Medical Insurance Biller - 140 externship hours.

Massage Therapy - Zero externship hours.

Electroneurodiagnostic Technologist - 300 externship hours.

Vascular Technologist - 750 externship hours.

Cardiology Technician - 186 externship hours.

Cardiovascular Technologist - 750 externship hours.

Invasive Cardiovascular Technologist - 1000 externship hours.

Cardiac Electrophysiology Technologist - 810 externship hours.

Pacemaker/ICD Technician - 300 externship hours.

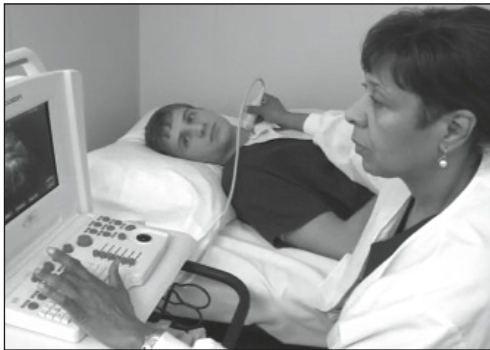
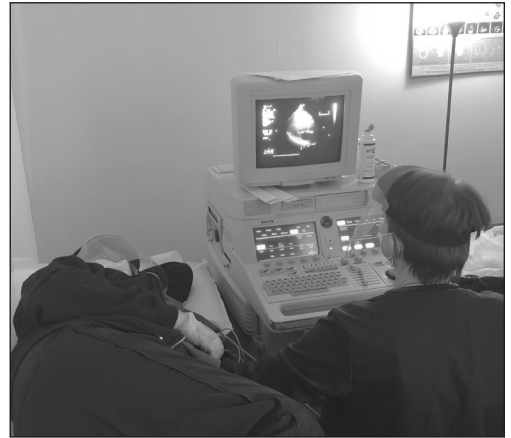
Note: Our graduating students have externship privileges at more than 300 selected medical facilities and rotation privileges at 55 major hospitals in our service areas.



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*Developing
Accredited
Technical
Education
and
Training
for
Careers
in
Allied Health
since
1947*



GRADUATION

Commencement Exercises are held each year at a selected auditorium. The date of graduation is set on the Sunday following the completion of the 4th quarter of the school year. This date ordinarily occurs on the second Sunday of September. Those students who have completed or will complete their training during the same calendar year will participate in the annual graduation ceremonies. One hundred percent attendance at Commencement Exercises is expected of all members of the graduating class.

GRADUATION UNIFORM

The uniform worn for commencement exercises must be white and conform with the professional dress regulations as set forth in the student handbook.

REQUIREMENTS FOR GRADUATION

A diploma, designating the graduate as a Medical Assistant, Medical Insurance Biller, Medical Business Specialist, Cardiology Technician, Cardiovascular Technologist, Invasive Cardiovascular Technologist, Vascular Technologist, Cardiac Electrophysiology Technologist, Pacemaker/ICD Technician, Electroneurodiagnostic Technologist and Massage Therapist is conferred on those students meeting the following requirements:

1. Satisfactory completion of the course requirements which include stipulated externship hours at a school approved site and an externship evaluation from the medical supervisor.
2. A combined average grade of not less than 70% for all ***core programs**.
3. A combined average grade of not less than 80% for all ****advanced programs**.
4. A Minimum Cumulative Completion Rate of 67%.
5. Recommendation of the faculty.
6. Satisfaction of all indebtedness to the school.
7. A satisfactory record of attendance.

* Medical Assistant, Medical Business Specialist, Medical Insurance Biller, Massage Therapy.

** Cardiology Technician, Cardiovascular Technologist, Invasive Cardiovascular Technologist, Vascular Technologist, Electroneurodiagnostic Technologist, Pacemaker/ICD Technician, and Cardiac Electrophysiology Technologist.

DIPLOMA AND OFFICIAL SCHOOL PIN

Students who meet requirements for graduation will be awarded a diploma and official school pin designating the program of study.

AWARDS

The **Carnegie Scholastic Award**, upon recommendation of the faculty, is presented to the Medical Assistant, Medical Insurance Biller, Cardiology Technician, Cardiovascular Technologist, Invasive Cardiovascular Technologist, Vascular Technologist, Pacemaker/ICD Technician, Electroneurodiagnostic Technologist, Cardiac Electrophysiology Technologist and Massage Therapist graduate, who has achieved the highest scholastic average in each program. The **Carnegie Outstanding Alumni Award** is presented to a past graduate for exceptional professional achievement and community service.

HONORS

Students who attain an average of 92% or higher during any particular quarter are placed on the Dean's List. This list is posted at the end of each educational quarter. Those students who have maintained an overall average grade of 95% or higher throughout their training will have the designation "With Honor" inscribed on their diplomas.

TRANSCRIPT OF CREDITS

A transcript of credits showing subjects completed and grades received will be mailed to any educational institution upon written request from the student. Such transcripts are mailed in compliance with Section 438 of the General Provisions Act, TITLE IV of P.L. 90-247, as amended. There is a \$5.00 fee payable in advance for this service. Any student who has not satisfied all indebtedness to the school is not entitled to this service.

TRANSFER OF CREDITS

Full or partial credit for Carnegie courses is subject to the admissions policies of the college or institution of higher learning to which application may be made. Verbal agreements exist for transfer of credits with Western Michigan University, Madonna University, Davenport University and Rochester University as of this publication date.

CREDIT FOR PREVIOUS TRAINING

The technical courses offered by Carnegie Institute are intended to develop and perfect practical skills. If equivalent subject matter has been obtained at Carnegie Institute or another accredited educational facility it will be considered and evaluated. The student must successfully pass an examination in the area of study where credit is requested. Where credit is given, tuition will be adjusted appropriately.

TUITION/TEXTBOOKS

Tuition rates for all programs, together with the various payment plans, can be obtained from the Admissions Office. A tuition schedule is also provided as a *supplement* to this catalog. *All textbooks issued to the student are included in the cost of tuition and remain the property of the student.* If textbooks must be replaced due to loss, etc., they will be replaced at the expense of the student.

LIABILITY DISCLAIMER

Carnegie Institute shall not be liable for any injuries to, or property damage or loss suffered by any student regardless of cause whether in, on, or about the leased facilities provided for student use, or any damage suffered by reason of any act or omission of any school officer, member of the faculty, staff, or student body. Students accepted for enrollment in any of the training programs offered by Carnegie Institute accept the foregoing disclaimer and agree to be bound thereby.

TUITION REFUND

Our tuition refund policy is in conformity with the regulations set forth by the school accrediting commission and the State of Michigan, Department of Labor & Economic Opportunity.

MINIMUM CANCELLATION AND SETTLEMENT POLICY

Cancellation and Refund

Applicant may cancel the Enrollment Agreement at any time before commencement of Applicant's classes by sending the School written notice signed by Applicant or Applicant's guardian, if parent or guardian has signed the Enrollment Agreement. Notice of cancellation must be sent to the School at the address appearing in the Enrollment Agreement by certified mail, return receipt requested, postage prepaid. Cancellation shall be effective on the date notice is received by the School.

- The Institution will refund 100 percent of the tuition charges, less an administrative fee that does not exceed the lesser of \$150 or 15 percent of the tuition, if a student withdraws from the Institution on or before the first day of classes for the period of enrollment for which the student was charged.
- An applicant rejected by the school is entitled to a refund of all monies paid.
- If student cancels registration within three business days after signing the enrollment agreement, all monies paid by the applicant shall be refunded within thirty (30) days of cancellation.
- All monies due an Applicant will be refunded within thirty (30) days of cancellation.

Termination and Refund

- The Enrollment Agreement is subject to termination after commencement of student's classes and student shall be entitled to receive a refund determined as set forth in this paragraph. The date of withdrawal for purposes of calculating any refund due shall be deemed to be the last date of actual attendance by student. Notice of termination must be sent to school at the address appearing in the Enrollment Agreement by certified mail, return receipt requested, postage prepaid. Before any refund is made, any supplies or other materials furnished by school to student are to be returned forthwith to school. The cost of any such materials not returned by student will be deducted from any refund due student. In addition, an administrative fee that does not exceed the lesser of \$150 or 15 percent of the tuition will be charged. For purposes of determining a refund, the Quarter is divided into weeks.
- If a student withdraws while attending the Institute, charges will be based on the following Institutional Refund Policy:
 - (1) If the student withdraws from school during the first week of the quarter, student will be charged 10% of the total quarter.
 - (2) If student withdraws from school after the first week, during weeks two or three, student will be charged 50% of the total quarter.
 - (3) If student withdraws from school during weeks four, five, or six, student will be charged 75% of the total quarter.
 - (4) If student has completed more than 50% of the quarter, student is obligated for the entire balance of the tuition for the quarter and is not entitled to a refund of tuition as a matter of right except if student dies, or becomes permanently disabled, in which event the school will consider a fair and equitable resolution.
- The federal formula, "Return of Title IV Funds" Policy, applies to a student receiving federal aid if that student withdraws on or before the 60% point of the quarter. It requires a return of Title IV aid to the grant or loan source if the student received federal financial assistance in the form of a Pell Grant, Supplemental Education Opportunity Grant, or Federal Direct Loan Programs. The percentage of Title IV aid to be returned is equal to the number of calendar days remaining in the quarter divided by

the total number of calendar days in the quarter. Scheduled breaks of more than four consecutive days are excluded. The student who withdraws after the 60% point of the quarter will have earned 100% of the Title IV funds and no return of funds will be made. Refer to the Student Handbook, a Catalog Supplement, pages 20-30 for federal refund worksheets and supplemental financial aid information.

- For Title IV Financial Aid Recipients: All Federal Financial Aid monies received will be refunded in the following order: Federal Direct Unsubsidized Loan, Federal Direct Subsidized Loan, Federal Direct Plus Loan, Federal Pell Grant, Federal Supplemental Education Opportunity Grant, other financial aid programs, and then to the student.
- Should school terminate student as a result of failure to make sufficient academic progress, non-payment of tuition due, or failure to comply with the rules and regulations set forth in the school catalog, student shall be entitled to a refund or adjustment of tuition as if he/she had voluntarily withdrawn from school.
- All monies due a student will be refunded within thirty (30) days of termination.

COMPLIANCE WITH FEDERAL REGULATIONS

Carnegie Institute, in accordance with Title VI of the Civil Rights Act of 1964, and as required by Title IX of the 1972 Educational Amendments, operates in a non-discriminatory manner with regard to race, religion, color, national origin, age, citizenship, gender, disability, and political affiliation or belief. Carnegie Institute also provides equal opportunity for qualified disabled persons in accordance with the requirements of Section 504 of the Rehabilitation Act of 1990. Auxiliary aids and services are available upon request to individuals with disabilities. The school is in compliance with the Drug Free Schools and Communities Amendments of 1989 (P.L. 101-226) and the Drug-Free Workplace Act of 1988 (P.L. 100-690). The building offers barrier-free access. The confidentiality of student academic records is maintained by Carnegie Institute in accordance with the Family Educational Right and Privacy Act of 1974, as amended.

EQUIPMENT

The following partial equipment list is set forth in compliance with the Accrediting Commission of Career Schools and Colleges (ACCSC).

Binocular microscopes, STAT-SITE M Hgb Meters, Westergren Sedimentation racks, Staining Trays, Adams Micro-Hematocrit readers, Micro-Hematocrit Centrifuges, Standard Centrifuges.

Micro-Automatic Pipets, Burets, Buret Stands and Holders, Blood Drawing Chairs, Refractometers.

Kodak Ektachem, Ascensia Elite Blood Glucose Meters, Accu-Chek Instant Plus Meters.

Cholestech LDX, Spiroscan 2000, Bacteriological Incubator, Transfer Loops and Needles, Culture Tubes, Test Tube Racks, BD GasPak EZ Incubation Containers, Disposable laboratory test kits include but not limited to Quick Strep, hemocult, mononucleosis, hemoglobin Alc, and urine cultures.

Echocardiography/Vascular Ultrasound Equipment: Vivid S6, Philips IE 33, GE Vivid I, (2) Acuson Sequoia, (10) Phillips 5500, (1) GE LogiQ9, Agilent Image Point HX, (2) ATL HDI 5000, HP Sonos 5500, Accuson Cypress CV Ultrasound System, (4) ATL Ultramark 9 Digital Plus, (2) Kovin bi-directional mini-labs, (3) Parks CW Doppler Mini Labs, (11) Sony Printers, Cardiac Transducers, Vascular Transducers, Abnominal Transducers, (7) Pedoff Probes, Pediatric Transducer, Physio Control Lifepak Defibrillator, Vaso Guard Arterial Physiologic machine, cuffs, cart.

Electrocardiography: (3) ECG/EKG Mortara ELI150rx, (2) Burdick EK10, Burdick Atria 3000, Brentwood Cardico-301, Burdick Eclipse LE II, Burdick E350, (2) Welch Allyn ECGs.

Invasive/Cardiac EP:

(2) Angiogram Sams, Medtronic Transvenous Pacemaker Generator, Baxter Edwards Cardiac Output Computer, AED Trainer, Hewlett Packard Defibrillator, CARTO Simulator, St. Jude Medical EnSite Cardiac Mapping System, (2) Volcano IVUS, Mitrachips.

Electroencephalography: Natus EEG/LTM/Sleep, 2 KED Ogituc Stimulators, Dell/Caldwell EEG Machine, (2) Nicolet digital EEG machines, Natus Neurology with Dell Monitor, (2) Cadwell Digital EEG, Amplifier with Oximeter, EEG Head Boxes, Instructional Sam/Kim Heads, Instructional Glass Heads, (3) recliner chairs, (2) recliner tables and related supplies.

ECG and examining tables, instrument cabinets with a wide assortment of medical and surgical instruments, Adult, Child & Infant Resuscitators, AED Trainers, Adult and Pediatric Manual Resuscitators, Resusci-Anne Mannequins and Torsos, Suture Arms, IV insertion arms, phlebotomy needle insertion arms, injection arms, vision testing charts with occluders, crutches/wheelchairs, and peak flow pulmonary function meters. IV Poles and IV fluid, Nasco Life/Form Replicas, Continental-300 Scales, Infant Weighing Scales, Ford, Adams, Littman Stethoscopes, Teaching Stethoscopes, Aneroid Sphgmomanometers (wall and portable) and Basic Care Simulated Mannequin.

PM/ICD: Device Programmers; Guidant, Medtronic, Biotronic, (2) St. Jude Medical.

Disposable needles and syringes, Sharps containers, gloves, gowns, vacutainer equipment and supplies, human skeleton, plastic human torso with removable parts.

3M Overhead Projectors, (2) 19-inch televisions, (2) Dukane LCD Projectors, Dell LCD Projector, Toshiba LCD Projector, Wall screens, (2) Epson Powerlite LCD Projectors, Sharp 75" Interactive White Board, (2) 7ft White Boards.

Computers: Dell computers, laser printers, computer tables and carrels.

Other Instructional Aids: X-ray viewing screens and numerous radiographs, Cannon NP 6551, Cannon NP 6545, Allied Health Science Instructional kits with slides and sound. A collection of various blood and urine slides, colored 2x2 anatomic, pathologic, hematologic, bacteriologic, parasitologic slides, and American College of Cardiology Echocardiography tapes.

Massage Tables & Chairs:

Oakworks massage tables, Oakworks massage chairs, sheets, pillows, lotions, oils, blankets, CD player, CDs, soft lighting lamps, skeleton and anatomy flip chart.



WHY INFORMED STUDENTS CHOOSE CARNEGIE

- Established reputation for leadership and educational excellence since 1947
- Spacious school facilities, modern equipment, and an environment conducive for learning
- Outstanding teaching staff of experienced, credentialed healthcare professionals
- Nationally ACCSC accredited Institute
- Dual accreditation for programs in health services and technologies through CAAHEP

Medical Assistant
Invasive Cardiovascular Technologist
Cardiovascular Technologist
Electroneurodiagnostic Technologist
Vascular Technologist

- Externship privileges at over 300 school-selected medical facilities
- Clinical rotation privileges at 55 major hospitals in our service areas
- Eligibility for national credentialing in professional specialty
- Graduate job placement assistance
- Employer recognition and earning power following graduation
- Tuition budget plans and financial aid programs for qualified students

PROFESSIONAL ORGANIZATIONS STRENGTHEN CAREER ADVANCEMENT

Carnegie graduates are encouraged to take their national certification exams in their individual specialties as soon as possible after completing training. The school also recommends membership in a professional organization to stay current in their specialties. Among organizations of professional interest to Carnegie graduates are:

AMA - American Medical Association
AAMA - American Association of Medical Assistants
ASE - American Society of Echocardiography
MSE - Michigan Society of Echocardiography
SDMS - Society of Diagnostic Medical Sonography
MMBA - Michigan Medical Billers Association
AAPC - American Academy of Professional Coders
AMTA - American Massage Therapy Association
ABMP - Associated Bodywork & Massage Professionals
ASET - American Society of Electroneurodiagnostic Technologists
MSET - Michigan Society of Electroneurodiagnostic Technologists
ACNS - American Clinical Neurophysiology Society
SICP - Society of Invasive Cardiovascular Professionals
SVU - Society for Vascular Ultrasound
ACVP - Alliance of Cardiovascular Professionals
HRS - Heart Rhythm Society
(Student Handbook contains additional information)

CONTINUING EDUCATION:

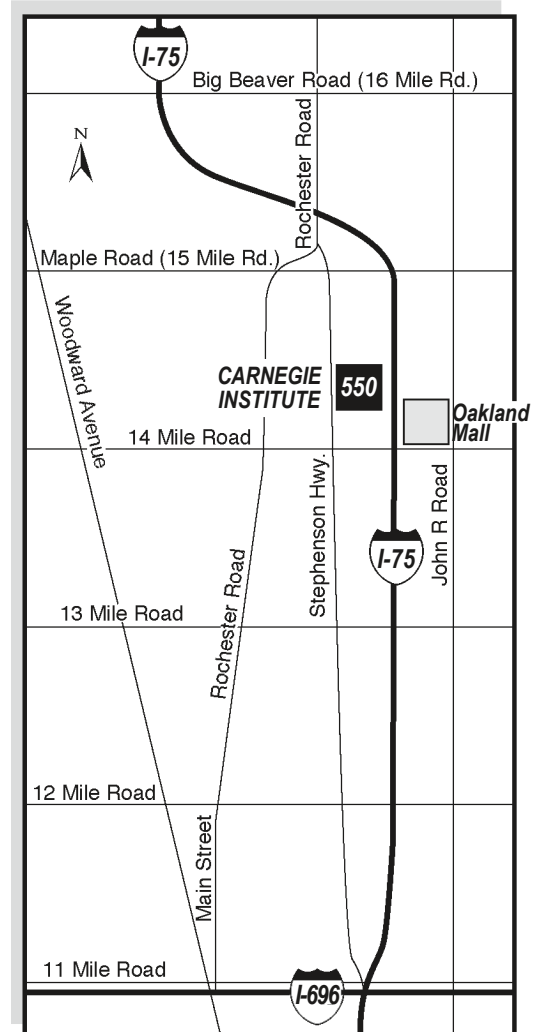
On-site, regularly scheduled seminars are offered for those seeking registry or national credentialing.

Visit our website at www.carnegie-institute.edu for the latest schedule or contact the Continuing Education department.

TRANSPORTATION AND HOUSING

There is no direct bus transportation to the school building. However, see the SMART bus schedule for close bus stops. Students must provide their own means of transportation. The school will assist in setting up car pools for the convenience of students who live in fairly close proximity to each other but all travel arrangements remain the responsibility of the student. The school does not provide housing. All students are responsible for their own housing arrangements.

AREA MAP



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ACADEMIC CALENDAR

2026

Start of Summer Quarter	June 29
Independence Day Holiday	July 4-6
Labor Day Holiday	September 7
Completion of Summer Quarter	September 12
Commencement Exercises	September 13
Fall Recess	September 14-27
Start of Fall Quarter	September 28
Thanksgiving Recess	November 26-29
Completion of Fall Quarter	December 19
Winter Holiday	December 20-Jan.3

2027

Start of Winter Quarter	January 4
Martin Luther King Holiday	January 18
Completion of Winter Quarter	March 25
Spring Recess	March 26-28
Start of Spring Quarter	March 29
Memorial Day Holiday	May 29-31
Completion of Spring Quarter	June 19
Summer Recess	June 20-27
Start of Summer Quarter	June 28
Independence Day Holiday	July 4-5
Labor Day Holiday	September 6
Completion of Summer Quarter	September 11
Commencement Exercises	September 12
Fall Recess	September 13-26
Start of Fall Quarter	September 27
Thanksgiving Recess	November 25-28
Completion of Fall Quarter	December 18
Winter Holiday	December 19-Jan. 2

2028

Start of Winter Quarter	January 3
Martin Luther King Holiday	January 17
Completion of Winter Quarter	March 25
Start of Spring Quarter	March 27
Spring Recess	April 14-16
Memorial Day Holiday	May 27-29
Completion of Spring Quarter	June 17
Summer Recess	June 18-25
Start of Summer Quarter	June 26
Independence Day Holiday	July 4
Labor Day Holiday	September 4
Completion of Summer Quarter	September 9
Commencement Exercises	September 10
Fall Recess	September 11-24
Start of Fall Quarter	September 25
Thanksgiving Recess	November 23-26
Completion of Fall Quarter	December 18
Winter Holiday	December 19-Jan.1

2029

Start of Winter Quarter	January 2
Martin Luther King Holiday	January 15
Completion of Winter Quarter	March 24
Start of Spring Quarter	March 26
Spring Recess	March 30-Apr 1
Memorial Day Holiday	May 26-28
Completion of Spring Quarter	June 16
Summer Recess	June 17-24
Start of Summer Quarter	June 29

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