



## **ADMISSION REQUIREMENTS**

### **• AOS VASCULAR TECHNOLOGIST PROGRAM**

1. All applicants for the AOS degree programs will be ranked using a point system in specific categories. Refer to the Admission Point System form.
2. A letter grade of B, or a minimum GPA of 3.0 is required for all General Education courses in the AOS programs.
3. A high school diploma or its equivalent.
4. Documentation of high school transcript or GED certificate.
5. Documentation of college credits and advanced degree(s) if applicable.
6. Proficiency in keyboarding is preferred.
7. Prior allied health work experience is preferred.
8. A personal interview at the school between applicant and Admissions Officer.
9. A pre-enrollment interview with the Director of Education.
10. Completion of entrance examination.
11. Three (3) Professional references.
12. Resume (one page).
13. Submission of a formal application as provided by the school. Arrangements for high school or college transcripts will be made prior to enrollment.
14. The above factors will determine the applicant's ranking in the point system.

## **PROGRAM: VASCULAR TECHNOLOGIST**

### **Program Description:**

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 / Outcomes:**

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
- Perform IV administration and vital sign measurements
- 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

**Delivery:**

Hybrid – synchronous and asynchronous

- “Distance Education Program” means a program in which all courses are delivered via distance education teaching and learning activities, without the need for any on-campus in person classes/activities.
- “Hybrid” or “Blended” means courses or programs in which some portion of on-campus instruction is replaced by distance education teaching and learning activities.
- “Synchronous” means courses where all students are required to participate at the same time with an instructor; however, the students and the instructor are in separate locations. These courses may be delivered by video conferencing, web conferencing, audio conferencing, etc.
- “Asynchronous” means courses where students are not required to participate in any distance education teaching and learning activities live/in real time with an instructor, but instead engage in such activities based upon teaching materials and assignments compiled and made available by an instructor.

**Quarterly Schedule of Instruction:**

Twenty-One (21) Months

Seven (7) 12 Week Quarters and 750- Hour Externship

Quarter I: – Asynchronous

Quarters II - III:

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

Quarters IV - VII:

- o Monday & Tuesday, 6 PM - 9:30 PM
- o Saturday, 8 AM - 2 PM

Externship: 16 hours/week 2 days/week

| Course  | Contact Hours | Quarter Credit Hours |
|---|---------------|----------------------|
| <b><i>Quarter I</i></b>   |               |                      |
| 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: 270 Hours</i>   |               |                      |
| <b><i>Total Quarter I:</i></b>  | <b>135</b>    | <b>13.5</b>          |
| <b><i>Quarter II</i></b>  |               |                      |
| 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: 99 Hours</i>  |               |                      |
| <b><i>Total Quarter II:</i></b>   | <b>156</b>    | <b>9.5</b>           |
| <b><i>Quarter III</i></b>   |               |                      |
| 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 – Theory & Practical Applications | 68            | 4.5                  |
| Course  | Contact Hours | Quarter Credit       |

|   |            | <b>Hours</b> |
|---|------------|--------------|
| C129: Healthcare Provider Basic Life Support                | 4          | 0.0          |
| <i>Work Outside of Class: 40 Hours</i>                      |            |              |
| <b>Total Quarter III:</b>                                   | <b>156</b> | <b>9.0</b>   |
| <b>Quarter IV</b>   |            |              |
| C170a: Cerebrovascular Testing                              | 42         | 2.5          |
| C101c: Physics III - Doppler Physics                        | 18         | 1.0          |
| C170b: Practical Applications - Cerebrovascular Testing     | 84         | 4.5          |
| <i>Work Outside of Class: 37 Hours</i>                      |            |              |
| <b>Total Quarter IV:</b>                                    | <b>144</b> | <b>8.0</b>   |
| <b>Quarter V</b>  |            |              |
| 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          |
| <i>Work Outside of Class: 37 Hours</i>                      |            |              |
| <b>Total Quarter V:</b>                                     | <b>174</b> | <b>11.0</b>  |
| <b>Quarter VI</b>   |            |              |
| C190a: Peripheral Arterial Testing                          | 42         | 2.5          |
| C201b: Physics V - Instrumentation                          | 18         | 1.0          |
| C190b: Practical Applications – Peripheral Arterial Testing | 84         | 4.5          |
| C260a: Clinical Site Rotation / Externship                  | 192        | 6.0          |
| <i>Work Outside of Class: 37 Hours</i>                      |            |              |
| <b>Total Quarter VI:</b>                                    | <b>336</b> | <b>14.0</b>  |
| <b>Quarter VII</b>  |            |              |
| C210a: Arterial Evaluation: Abdominal Vasculature           | 42         | 2.5          |
| C201c: Physics VI - Quality Assurance & Artifacts           | 18         | 1.0          |
| C210b: Practical Applications – Visceral Vascular Testing   | 84         | 4.5          |
| C260b: Clinical Site Rotation / Externship                  | 192        | 6.0          |
| <i>Work Outside of Class: 37 Hours</i>                      |            |              |
| <b>Total Quarter VII:</b>                                   | <b>336</b> | <b>14.0</b>  |
| <b>Clinical Site Rotation / Externship</b>                  |            |              |
| C260c: Clinical Site Rotation / Externship                  | 366        | 12.0         |
| <b>Clinical Site Rotation / Externship Total:</b>           | <b>366</b> | <b>12.0</b>  |

|   |             |             |
|---|-------------|-------------|
| <b>PROGRAM TOTAL</b>  | <b>1803</b> | <b>91.0</b> |
| Work Outside of Class: 558 Hours                                |             |             |
| <i>Note: Total work outside of class hours are approximate.</i> |             |             |

### Definitions:

- A “didactic learning environment (**theory**)” is one which is led by a qualified faculty member for the intention of teaching and learning and can be in a classroom or laboratory setting of instruction.
- A “supervised laboratory setting of instruction (**practical**)” is one where students engage in discussion and/or the practical application of information presented in the didactic portion of the program or discovered through out-of-class work/preparation.
- “Out-of-class work/preparation” is that which students engage in as a means to prepare for the didactic learning environment or supervised laboratory setting of instruction.
- “Externship” is a component of a program offered in a bona fide occupational setting for which training and education are provided, the externship component occurs during or after coursework is completed. The objectives and goals of an externship must be to allow students to apply the knowledge and skills taught in didactic and laboratory settings of instruction.

### 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** Covers the principles of human anatomy and physiology with emphasis on the cardiovascular system. Topics include cell biology, normal anatomy and physiology of the cardiovascular, respiratory, urinary, nervous, and endocrine systems. The format includes class discussion, and a high degree of student participation on the major pathologies of each organ system presented. Emphasis is placed on the physiologic principles underlying the disease processes which the Cardiovascular Technologist is likely to encounter in a clinical environment. 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.

### **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 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.

**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.