

1 Module Details	
Module Name	Cardiac Technology
Nominal duration	It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 18 to 20 hours.
Module code	NUE919
Discipline code	0703230
2 Module purpose	This module provides students with knowledge of the clinical function, application, hazards and common faults of cardiac medical equipment. In addition, the module provides students with the skills to perform functional verification of the equipment to AS3551.
3 Prerequisites	Biomedical Electronics (NUE913) Common Medical Equipment 1 (NUE915)
4 Relationship to competency standards	This module provides some of the knowledge and skills underpinning competency in the following standards: National Electrotechnology Industry Standards, Units NES304, NES406, NES504 and the relevant specialisation. Metals & Engineering Industry Standards, Units 18.56A, 18.57A, 18.58A, 18.65A, 18.66A.
5 Content	<ol style="list-style-type: none"> 1. Cardiac Catheterisation <ul style="list-style-type: none"> • imaging system • monitoring system <ul style="list-style-type: none"> - transducers – pressure, flow, temperature - signal processing and displays - multi-channel recorders - hard copy devices • hazards <ul style="list-style-type: none"> - patient - operator - standards - microelectrocution protection • common problems <ul style="list-style-type: none"> - patient complication - catheter placement - instrumentation • functional verification to AS3551 and AS3003 2. Electrophysiological Studies <ul style="list-style-type: none"> • clinical application and procedures • equipment <ul style="list-style-type: none"> - electrodes - cardiac stimulators • functional verification of electrophysiological stimulators to AS3551 3. Cardiac Output Measurement <ul style="list-style-type: none"> • clinical conditions and procedures • measurement principles

	<ul style="list-style-type: none"> - flow - dilution – optical, thermal - history • hazards • common faults • functional verification to AS3551 <p>4. Intra-Aortic Balloon Pump (IABP)</p> <ul style="list-style-type: none"> • clinical conditions and procedures • operational principles • common faults • functional verification to AS3551 <p>5. Heart Lung Machine</p> <ul style="list-style-type: none"> • clinical conditions • operating principles • patient connection • pumps • oxygenators • common problems • safety devices <ul style="list-style-type: none"> - alarms - cutouts - power backup - gas backup • functional verification to AS3551 <p>6. Cardiac Pacemakers</p> <ul style="list-style-type: none"> • hazards • maintenance • repair <p>7. Cardiac Defibrillators</p> <ul style="list-style-type: none"> • hazards • maintenance • repair
<p>6 Assessment strategy</p> <p>Assessment methods</p> <p>Conditions of assessment</p>	<p>Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving.</p> <p>Normally learning and assessment will take place in a classroom/laboratory.</p>
<p>7 Learning Outcome Details</p>	

Learning Outcome 1	Describe the operation of a cardiac catheterisation laboratory, with regard to function, application, hazards, common faults and functional verification to AS3551 and AS3003.
Assessment criteria	<p>1.1 Describe the clinical conditions requiring cardiac catheterisation procedures.</p> <p>1.2 Describe the operating principles of the imaging system, and the storage/archiving methods.</p> <p>1.3 Describe the operating principles of and draw a block diagram of, physiological monitoring and recording system.</p> <p>1.4 Describe the hazards to patient and operator associated with cardiac catheterisation procedures.</p> <p>1.5 Describe the common problems associated with catheterisation procedures.</p> <p>1.6 List the essential safety and performance parameters which should be tested and documented, and specify the test equipment required for testing.</p> <p>1.7 Describe the procedure for functional and safety testing to AS3551 and AS3003.</p>
Learning Outcome 2	Describe the implementation of an electrophysiology (ep) study with regard to clinical application, equipment function, hazards, common faults and functional verification of the equipment to AS3551.
Assessment criteria	<p>2.1 Describe the clinical conditions which might require electrophysiological studies.</p> <p>2.2 Describe how a typical electrophysiological study might be undertaken in both an open chest and a closed chest procedure.</p> <p>2.3 Describe the equipment specific to electrophysiological studies and the supporting monitoring and resuscitation equipment required.</p> <p>2.4 Describe the maintenance/sterility requirements of multi-polar electrodes used in electrophysiological studies.</p> <p>2.5 Describe the function and operating parameters of cardiac stimulators specific to electrophysiological studies.</p> <p>2.6 Describe functional verification procedures for electrophysiological stimulators to AS3551.</p>
Learning Outcome 3	Describe the implementation of cardiac output measurements

	with regard to clinical application, equipment function hazards and common faults, and functional verification of the equipment to AS3551.
Assessment criteria	<p>3.1 Describe the clinical conditions which might require cardiac output measurement.</p> <p>3.2 Describe the principles of operation and advantages of the various means of measuring cardiac output.</p> <p>3.3 Describe the clinical procedure of cardiac output measurement and the commonly encountered problems in achieving meaningful results.</p> <p>3.4 List the essential safety and performance parameters which should be tested and documented, and specify the test equipment required for testing.</p> <p>3.6 Describe the procedure for functional and safety testing to AS3551.</p>
Learning Outcome 4	Describe the IABP with regard to function, application, hazards and common faults and functional verification in accordance with AS3551.
Assessment criteria	<p>4.1 Describe the clinical conditions which may require the use of an IABP.</p> <p>4.2 Describe the operational principles of an IABP including safety considerations.</p> <p>4.3 Describe the clinical procedure for insertion of the IABP balloon.</p> <p>4.4 Describe the setup procedures for the IABP console and the various means of triggering.</p> <p>4.5 Describe the clinical problems associated with IABP function.</p> <p>4.6 List the essential safety and performance parameters which should be tested and documented, and specify the test equipment required for testing.</p> <p>4.7 Describe the procedure for functional and safety testing to AS3551.</p>
Learning Outcome 5	Describe the operation of a heart lung machine with regard to function, application, hazards and common faults, and functional verification in accordance with AS3551.
	<p>5.1 Describe the clinical conditions which may require the use of a heart lung machine.</p> <p>5.2 Describe the operating principles of a heart lung</p>

	<p>machine.</p> <p>5.3 Describe the difference between continuous flow and pulsatile flow pumps and list their advantages / disadvantages.</p> <p>5.4 Describe the commonly available oxygenators for use with heart lung machines and list their advantages/disadvantages.</p> <p>5.5 List the common clinical problems associated with the use of the heart lung machine.</p> <p>5.6 List the safety devices integral to a modern heart lung machine.</p> <p>5.7 List the essential safety and performance parameters which should be tested and documented, and specify the test equipment required for testing.</p> <p>5.8 Describe the procedure for functional and safety testing as per AS3551.</p>
Learning Outcome 6	Describe the servicing requirements to be taken when using external and implantable cardiac pacemakers and defibrillators.
Assessment criteria	<p>6.1 Describe the hazards of using a cardiac defibrillator on a patient having an implanted pacemaker.</p> <p>6.2 List hazards associated with cardiac defibrillator servicing and improper defibrillators use.</p> <p>6.3 Describe the maintenance and repair of cardiac pacemakers and defibrillators.</p> <p>6.4 Perform the functional testing of a cardiac pacemaker to AS3551.</p> <p>6.5 Perform functional testing of a cardiac defibrillator to AS3551.</p>
8 Delivery of the module	
Delivery strategy	Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective way to achieve this is by the integration of theory and practice where students learn by experimentation and through research and laboratory reports. It is recommended that learning and assessment be facilitated in a holistic manner, which may require a learning outcome sequence other than that indicated in the module.
Resource requirements	Resources should be sufficient for students to carry out practical exercises in small groups. This will require access to the relevant medical equipment.

Occupational health and safety requirements

Useful references include:

Carr, Joseph J., Brown John M. Introduction to Biomedical Equipment Technology, Third Edition, Prentice Hall, 1998. ISBN 0-13-849431-2

Carr, Joseph J. Biomedical Equipment - Use, Maintenance and Management, Prentice Hall, 1992. ISBN 0-13-257577-9

Useful references include a range of manufacturers operational and maintenance manuals for the relevant medical equipment.

A safe and healthy environment will be provided for students and teachers as well as safety procedures followed with regard to teaching/learning activities.