

## Subject Description Form

<b>Subject Code</b>	BME31150
<b>Subject Title</b>	<b>Medical Instrumentation and Equipment</b>
<b>Credit Value</b>	3
<b>Level</b>	3
<b>Prerequisite</b>	BME21151 Engineering Design & Biomechanics
<b>Objectives</b>	This subject aims to provide students a detailed description of the principles and applications of a number of the most widely used biomedical instrumentation systems and devices found in the modern hospital and clinical environment. Students are expected to understand the diagnostic and research applications of the various instrumentation and related techniques currently available and to appreciate their limitations.
<b>Intended Learning Outcomes</b>	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Describe and explain the working principles and clinical use of a range of common medical equipment, their possible faults/problems and safety precautions that may be countered in clinical settings in the applications of these medical equipment;</li> <li>b. Understand different underlying theories in biomedical engineering and their implications in the operation, safety testing, maintenance, calibration and proper operation of medical equipment;</li> <li>c. Identify and understand the latest developments in medical equipment for better treatment or assessment in the real world;</li> <li>d. Select and use appropriately and safely the techniques, sensors, and medical equipment necessary to conduct experimental / clinical investigations on living systems.</li> </ol>
<b>Contribution to Programme Outcomes (Refer to Part I Section 10)</b>	<ul style="list-style-type: none"> <li>▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline.(Teach and Practice)</li> <li>▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach and Practice)</li> <li>▪ Programme Outcome 3: Demonstrate an ability to design a system, component, or process relevant to BME to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. (Teach and Measure)</li> <li>▪ Programme Outcome 5: Demonstrate an ability to understand the impact of BME solutions in a global and societal context, especially the importance of health, safety, and environmental considerations to both workers and the general public. (Teach, Practice and Measure)</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Teach, Practice and Measure)</li> <li>▪ Programme Outcome 8: Demonstrate an ability to use the computer/IT tools relevant to the BME discipline along with an understanding of their processes and limitations. (Practice and Measure)</li> <li>▪ Programme Outcome 10: Demonstrate an understanding of professional and ethical responsibility. (Teach and Practice)</li> <li>▪ Programme Outcome 11: Demonstrate an ability to communicate effectively and advise clients, professional colleagues, and other members of the community. (Practice)</li> <li>▪ Programme Outcome 12: Demonstrate an ability to recognize the need for, and to engage in life-long learning. (Practice)</li> </ul>
<p><b>Subject Synopsis/ Indicative Syllabus</b></p>	<p>This is a hands-on subject where students are given exposure for specific medical instrumentation. Students are also expected to research on the design of other biomedical devices, understand the latest developments for better treatment or assessment in the real world. Medical device-related standards and protocols, safe clinical practices and troubleshooting techniques are briefly covered in this subject.</p> <p>The subject focuses on medical diagnostic, therapeutic and imaging equipment, including but not limited to:</p> <ul style="list-style-type: none"> <li>▪ Patient monitoring systems; Fetal monitor; Oximeters; Blood Pressure;</li> <li>▪ Cardiac Pacemakers; Defibrillator; Physiotherapy and Electrotherapy Equipment;</li> <li>▪ Instruments for Surgery; Infusion pump; Ventilators;</li> <li>▪ Anesthesia Machine;</li> <li>▪ Ultrasound; X-ray; CT; MRI;</li> </ul>
<p><b>Teaching and Learning Methodology</b></p>	<p>Students will learn in lectures the working principles and clinical use of a range of common medical equipment. Medical device-related standards and protocols, safe clinical practices and troubleshooting techniques are briefly covered in lab/practical sessions, where students will be given the opportunity to calibrate, test and operate the medical equipment. Students will also prepare a presentation to report on their findings on the latest developments in medical equipment for better treatment or assessment in the real world.</p>

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
			a	b	c	d		
	1. Presentation	30%	√	√	√			
	2. Lab performance & reports	40%	√	√	√	√		
	3. Final examination	30%	√	√				
	Total	100%						
<p>Note: To pass this subject, students must obtain grade D or above in both continuous assessment and final examination.</p> <p><i>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</i></p> <p>Continuous assessment during lab/practical sessions ensures that the student can acquire the needed knowledge and skills to safely operate a medical equipment. Lab reports are used to assess the student's ability to analyze and report experimental findings. Final examination is arranged to ensure each individual student has acquired the required knowledge. Oral presentation is arranged to engage students in life-long learning to identify and understand the latest developments in medical equipment for better treatment or assessment in the real world.</p>								
Student Study Effort Expected	Class contact:							
	▪ Lectures		24 Hrs.					
	▪ Labs & Practical		15 Hrs.					
	Other student study effort:							
	▪ Self-study		48 Hrs.					
	▪ Lab/Practical preparation and report writing		30 Hrs.					
	Total student study effort		117 Hrs.					

<b>Reading List and References</b>	<ul style="list-style-type: none"> <li>▪ Webster, J. G., &amp; Nimunkar, A. J. (2020). Medical instrumentation: application and design (J. G. Webster &amp; A. J. Nimunkar, Eds.; Fifth edition.). Wiley.</li> <li>▪ Schreiner, Bronzino, Peterson, Medical Instruments and Devices: Principles and Practices, CRC Press, 1stEdition, 2015</li> <li>▪ Bit, A. (2018). Design and development of affordable healthcare technologies (A. Bit, Ed.). Medical Information Science Reference.</li> <li>▪ Pandey, R., Gupta, A., &amp; Pandey, A. (2023). The internet of medical things (IoMT) and telemedicine frameworks and applications (R. Pandey, A. Gupta, &amp; A. Pandey, Eds.). IGI Global. <a href="https://doi.org/10.4018/978-1-6684-3533-5">https://doi.org/10.4018/978-1-6684-3533-5</a></li> <li>▪ Christe BL. Introduction to Biomedical Instrumentation: The Technology of Patient Care, Cambridge University Press, 2009.</li> </ul>
<b>Date of Last Major Revision</b>	17 July 2023
<b>Date of Last Minor Revision</b>	17 July 2023