Module Specification

Module Summary Information

1	**Module Title**	Human Anatomy and Physiology for Biomedical Engineering
2	**Module Credits**	20
3	**Module Level**	4
4	**Module Code**	ENG4097

5	**Module Overview**

Rationale:
This module is designed to give you a sound understanding of essential human anatomy and physiology, providing a solid foundation for biomedical engineering applications. It is intended that by studying this module you will develop your knowledge and understanding of functions and mechanisms of cells, tissues, organs and organ systems, and appreciate how they interact and communicate to make the human body function optimally in an ever changing environment. It will focus on areas of pathology that provide opportunities and challenges to Biomedical Engineers to intervene and correct with the latest technology where biology alone is insufficient.

Alignment with Programme Philosophy and Aims
The programme aims to develop your level of expertise in various theoretical / practical aspects of education pertaining to biomedical engineering and enable you to work independently or as part of a multidisciplinary team.
This module will provide you with the essential knowledge of biological systems for the evaluation, design, development and application of effective biomedical systems / technologies, that you will undertake as part of other modules at level 5 / 6 / 7 of your studies. It will allow you to evaluate and adapt to a rapidly evolving understanding of human physiology. It will enable you to gain sufficient familiarity with physiological and clinical concepts used in a professional context around the globe. This will allow you to efficiently communicate with clinical colleagues, with real understanding of problems associated with the development of novice medical technologies within a health care setting or a medical device industry.

Learning and Teaching Strategy
You will be taught using a blended approach of interactive lectures (where engagement is facilitated by the use of in-session polling technology), workshops and on-line activities. Most sessions will start with a lecture followed by discussion in a workshop, based on the taught concepts and the pre-session activity. Your learning will be supported by Moodle pages dedicated to prepare yourself for the sessions. You will be expected to have studied the pre-session materials and have tested your understanding in on-line quizzes. This structured self-study is essential to understand the lectures (explaining basic physiological concepts) and engage effectively in the discussions (focussed on biomedical engineering applications). In addition to the session content (lecture notes and summary), post-session advanced reading material will be provided. You will be involved in developing MCQs related to taught sessions using Peer Wise, This collaborative activity facilitates deeper learning and engagement and will also contribute to your summative assessment

Assessment Strategy
Summative assessment will be via an e-portfolio consisting of four patches aligned to the four learning outcomes, with the first patch assessing the whole breadth of the module content and the others focussing on a particular organ system or special organ and pathology of choice. Formative assessment across the width of organ systems and special organs will be through the development and answering of PeerWise MCQs, which will form patch 1 of the e-portfolio.

6	Indicative Content
Session Topic/s (incl. delivery style and indicative formative learning activities)	
Module and assessment launch. Discuss the learning and teaching strategy. Introduction into the use of Mahara.and PeerWise. Brief discussion of principles of human physiology (tutorial).	
Basic biochemistry Structure and function of biologically important molecules (lecture).	
Cells and tissues. Structure and function of organelles and membranes (lecture). Discuss differentiation into different tissue types (workshop).	
Homeostasis and control. Principle of homeostatic control through, bidirectional feedback systems provided by the autonomic nervous system. Apply homeostatic control mechanisms to thermoregulation and blood glucose control (lecture and workshop).	
Nervous System. General organisation of the brain, structure and function of neurons, synaptic communication and reflexes (lecture).	
Endocrine system: function and recovery. General principle and different types of hormones. Discuss development in feed-back-controlled administration systems (lecture and workshop).	
Integumentary system: function and recovery. Structure and function of skin and somatosensory receptors. Discuss wound healing and tissue engineering solutions (lecture and workshop).	
Musculo-skeletal system: basic principles. Structure and function of bones, joints and different muscle types and fractures (lecture).	
Musculo-skeletal system: control and intervention. Discuss the control of movement by the nervous system. Discuss brain-machine interface solutions (lecture and workgroup).	
EMG practical. Record conduction velocity, evoked potentials, reflex arc and voluntary responses (practical)**.**	
Vision: principle and intervention. Structure and function of the optics, photo receptors, retina and brain areas involved in visual information processing. Discuss eye prosthetics and bionic vision (lecture and workshop).	
Hearing: principle and intervention. Structure and function of the hair cells, cochlea and brain areas involved in auditory information processing. Discuss hearing aids and cochlear implant function (lecture and workshop).	
Consolidation tutorial. Revisit the aspects of previous sessions that you struggle with (tutorial).	
Fluid dynamics and gas laws. Discuss the principles of fluid dynamics and gas exchange (workshop).	
Cardiovascular system: basic principles. General organisation of the system, structure and function of the heart and vasculature and explain cardiac contractility (lecture).	
Cardiovascular system: control and intervention. Autonomic control of the cardiovascular system (lecture). Discuss developments in cardiovascular replacement and repair technologies (workshop).	
Cardiovascular practical. Measure pulse, ECG, and blood pressure in response to exercise and position change (practical).	
Respiratory system: basic principles. General organisation of the system, structure and function of the lung, respiration and ventilations and vasculature and explain cardiac contractility (lecture).	

Respiratory system: control and intervention. .Autonomic control of blood gasses (lecture). Discuss artificial lungs and spirometry (workshop).
Urinary system: basic principles. Structure and function of the nephron in the light of renal functions (lecture).
Urinary system: control and intervention. Regulation of kidney function by RAA, ADH and ANS (lecture). Discuss kidney dialysis systems (workshop).
Urinalysis practical. Measure osmolality, conductivity, pH, specific gravity, glucose, urea, protein. Compare dipsticks with proper measurements (practical).
Digestive system: basic principles. General organisation of the digestive system, structure and function of the GIT, and liver, the digestion and absorption of carbohydrates, lipids and proteins (lecture).
Digestive system: control and intervention. Endocrine and ANS control of digestion (lecture). Discuss bioengineering of digestive system elements (workshop).
Consolidation tutorial. Revisit the aspects of previous sessions that you struggle with and module feedback (tutorial).

7	**Module Learning Outcomes** **On successful completion of the module, students will be able to:**	
	1	Describe the structure and function of organ systems and special organs.
	2	Explain how the function of organ systems and special organs is under homeostatic control.
	3	Relate pathology to homeostatic imbalance and special organ dysfunction.
	4	Discuss how medical devices can restore pathological homeostatic imbalance and special organ dysfunction.

8	**Module Assessment**		
Learning Outcome			
	Coursework	**Exam**	**In-Person**
1 – 4	**x**		

9	**Breakdown Learning and Teaching Activities**
Learning Activities	**Hours**
Scheduled Learning (SL) includes lectures, practical classes and workshops, peer group learning, Graduate+, as specified in timetable	54
Directed Learning (DL) includes placements, work-based learning, external visits, on-line activity, Graduate+, peer learning, as directed on VLE	0
Private Study (PS) includes preparation for exams	146
Total Study Hours:	200