UNIVERSITY OF WARWICK

Proposal Form for New or Revised Modules (MA1 - version 7 - April 2014)

Approval information	
Approval Type	☒ New module ☐ Revised module ☐ Discontinue module
Date of Introduction/Change	October 2018
If new, does this module replace another? If so, enter module code and title:	ES173 Biomedical Engineering
If revised/discontinued, please outline the rationale for the changes:	
Confirmation that affected departments have been consulted:	Changes were made in consultations between the School of Engineering and WMG. Computer Science have been consulted via the CSE Steering Group

Module Summary	
1. Module Code (if known)	ES2C1
2. Module Title	Biomedical and Clinical Engineering
3a. Lead department:	School of Engineering
3b. Teaching Split (if known):	100% Engineering
4. Name of module leader	Dr. Leandro Pecchia
5. Level	UG: ☐ Level 4 (Certificate) ☒ Level 5 (Intermediate) ☐ Level 6 (Honours) PG: ☐ Level 7 (Masters) ☐ Level 8 (Doctoral) See Guidance Notes for relationship to years of study
6. Credit value(s) (CATS)	15
7. Principal Module Aims	Provide an introduction to biomedical engineering, its main outcomes (i.e. medical devices) and to clinical engineering as a profession. This module will give an overview of medical technologies for screening, diagnosis, treatment and rehabilitation and an appreciation for the role of Engineers in medicine and biology across the world and in different contexts (i.e. research, innovation, development, manufacturing, NHS, agencies, ONGs).
8. Principal Learning Outcomes	By the end of the module students should be able to: • Identify the large array of biomedical engineering fields. • Explain the basic tenets of fundamental technologies in

Module Summary	
	biomedical engineering (i.e. engineering in biology and medicine) including medical devices for screening, diagnosis, treatment, rehabilitation and end of life. • Analyze trends in technological innovations in the main medical specializations (e.g. cardiovascular, neurology, geriatric, pediatric, ophthalmology) and in the main medical setting (e.g. biological labs, medical wards, imaging units, surgical theaters, outpatient unit, chronic patient home etc.). • Understand Biomedical Engineering as a profession and ethical considerations. • Critically assess the appropriateness of innovative health care technologies by reading a health technology assessment report
9. Timetabled Teaching Activities (summary)	28 x 1hr lectures 2 x 1hr revision lectures 2 x 1 hr examples classes 3 x 1hr seminars **TOTAL 35 Hours**
10. Departmental Web-link	http://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year2
11. Other essential notes	Advice and feedback hours are available for answering questions on the module. must pass 30% coursework component
12. Assessment methods (summary)	The module will be assessed as following: 1. Coursework 3000 words (30%) 2. 2 hr examination (70%)

For use by Strategic Planning and Analytics Office only - Do not fill in this section

Level	JACS3 Code	Teaching Split
		If not provided in 3b above

External Credit Level		Scheme	

Module Context				
13. Please list all departments involved in the teaching of this module. If taught by more than one department, please indicate percentage split.				
School of Engineering 100%				
14. Availability of module				
Degree Code	**Title**	**Study Year**	**C/OC/ A/B/C**	**Credits**
H113	BEng Engineering	2	O	15
H114	MEng Engineering	2	O	15
H216	BEng Civil Engineering	2	O	15
H217	MEng Civil Engineering	2	O	15
H315	BEng Mechanical Engineering	2	O	15
H316	MEng Mechanical Engineering	2	O	15
H335	BEng Automotive Engineering	2	O	15
H336	MEng Automotive Engineering	2	O	15
H605	BEng Electrical and Electronic Engineering	2	O	15
H606	MEng Electrical and Electronic Engineering	2	O	15
H63W	BEng Electronic Engineering	2	O	15
H63X	MEng Electronic Engineering	2	O	15
HH35	BEng Systems Engineering	2	O	15
HH31	MEng Systems Engineering	2	O	15
HH75	BEng Manufacturing and Mechanical Engineering	2	O	15
HH76	MEng Manufacturing and Mechanical Engineering	2	O	15
HN11	BSc Engineering and Business Studies	2	O	15
HN15	BEng Engineering Business Management	2	O	15
G406	BSc/BEng Computer Systems Engineering	2	O	15
G408	MEng Computer Systems Engineering	2	O	15
15. Minimum number of registered students required for module to run				
20				
16. Pre- and Post-Requisite Modules				
None				
Module Content and Teaching				
17. Teaching and Learning Activities *(totals for module – please see guidance)*				
Module duration (weeks)	10			
Lectures	28 x 1hr			
Seminars	3 x 1hr			

Module Context		
Tutorials		
Project Supervision		
Demonstration		
Practical Class/Workshops		
Supervised time in studio/workshop		
Fieldwork		
External visits		
Work based learning		
Placement		
Year abroad		
Other activity *(please describe): e.g. distance-learning, intensive weekend teaching etc.*	2 x 1hr revision classes 2 x 1 hr examples classes 5 x 1hr distance-learning 110 hours guided independent learning	
18. Assessment Method (Standard)		
Type of assessment	**Length**	**% weighting**
Written Examinations	2 Hours	**70%**
Practical Examinations		
Assessed essays/coursework	Coursework 3000 Words	**30%**
18a. Final chronological assessment *(please see guidance*)	Written Examination	

19. Methods for providing feedback on assessment.

- Model solutions to past papers.
- Support through advice and feedback hours.
- Written feedback on marked coursework.
- Cohort-level feedback on final exam.

20. Outline Syllabus

Lecture Topics

Part 1: Principles of Biomedical Engineering and Medical Devices

- Introduction to relevant anatomy and physiology
- Introduction to Biomedical Instrumentation:
- Clinical laboratory instrumentation:
- Active implantable devices
- Major medical devices will be presented, introducing their physical and physiological principles, block diagrams, procurement and ordinary maintenance issues. This will cover medical devices for imaging (e.g. CT/X-RAY, MRI/FMRI, PET/SPECT, Ultrasound etc), surgical (e.g. electrobistury, physiological monitors), non-surgical treatments (e.g. US lithotripsy, electro-chemotherapy etc.), rehabilitation

Module Context

- Information and communication technologies for healthcare
- Block diagrams and ordinary maintenance issues of the following care plants or settings: hospital wards; heating, ventilation and air conditioning; electrical power plant; surgery units, emergency units.

Part 2: Health Technology Assessment and Health Technology Management

- How technology contributed to promote health, prevent and treat disease and improve rehabilitation and long-term care.
- The medical device life cycle
- European legislation for medical devices and comparison with the USA Food and Drugs Administration (FDA) standards
- Introduction to the evidence based medicine, methods for systematic literature reviews and health economy (Cost minimization analysis, Cost-utility, cost-effectiveness and cost-benefit assessment)

Part 3: Biomedical Engineering and Clinical Engineering profession

- Biomedical Engineering as a profession: various roles of the biomedical engineer, career paths, the role of ethics in BME.
- Principles of medical devices and system safety and regulation Instrumentation: physiological effects of electricity; macro- and microshock hazards; electrical safety principles and standards; safe equipment design.
- Medical software as medical device: implications

21. Illustrative Bibliography

- Stefan Silbernagl, Agamemnon Despopoulos, "Color atlas of physiology", 7th edition, Theieme, New York, May 2015, ISBN: 9783135450070
- Frize, Monique. "Health Care Engineering, Part I: Clinical Engineering and Technology Management." *Synthesis Lectures on Biomedical Engineering* 8.2 (2013): 1-97.
- Street, Laurence J. *Introduction to biomedical engineering technology*. CRC Press, 2011
- Enderle, John Denis, and Joseph D. Bronzino. *Introduction to biomedical engineering*. Academic press, 2012.
- Miniati, Roberto, Ernesto Iadanza, and Fabrizio Dori. *Clinical Engineering: From Devices to Systems*. Academic Press, 2015. Tony Easty, "Human Factors for Health Technology Safety: Evaluating and improving the use of health technology in the real world" (June 2014), IFMBE press
- J. F. Dyro "Clinical Engineering Handbook", Elsevier Academic Press, 2004 (Next Edition to be published in 2018: E. Iadanza "Clinical Engineering Handbook", Elsevier Academic Press)
- Selected articles and papers from scientific journals and official bulletins, including:
  - Annals of Biomedical Engineering, ISSN: 1573-9686
  - Annual review of biomedical engineering, ISSN: 1523-9829
  - The Health Technology Assessment Journal, ISSN: 2046-4924 (Online)
  - WHO bulletin
  - European official Journal Euro Lex

22. Learning outcomes

Successful completion of the module leads to the learning outcomes. The learning outcomes identify the knowledge, skills and attributes developed by the module.

Learning Outcomes should be presented in the format "By the end of the module students should be able to..." using the table at the end of the module approval form:

Module Context

Resources
23. List any additional requirements and indicate the outcome of any discussions about these.

Approval	
24. Module leader's signature	Dr Leandro Pecchia
25. Date of approval	Teaching Policy Committee meeting 22 March2017 Minute 308-16/17
26. Name of Approving Committee (include minute reference if applicable)	School of Engineering and WMG Teaching Policy Committee
27. Chair of Committee's signature	Professor Gill Cooke
28. Head of Department(s) signature	Professor Nigel Stocks

Examination Information		
A1. Name of examiner (if different from module leader)		
A2. Indicate all available methods of assessment in the table below		
% Examined	**% Assessed by other methods**	**Length of examination paper**
70	**30% Coursework (3000 words)**	**2 Hours**
A3. Will this module be examined together with any other module (sectioned paper)? If so, please give details below.		
A4. How many papers will the module be examined by?	☒ 1 paper	☐ 2 papers
A5. When would you wish the exam take place (e.g. Jan, April, Summer)?	**Summer**	
A6. Is reading time required?	☐ Yes	☒ No
A7. Please specify any special exam timetable arrangements.		
A8. Stationery requirements		
No. of Answer books?	**1**	
Graph paper?	**Yes**	
Calculator?	**Yes**	
Any other special stationery requirements (e.g. Data books, tables etc)?	**Databook**	
A9. Type of examination paper		
Seen?	☐ Yes	☒ No
Open Book?	☐ Yes	☒ No
Restricted?	☐ Yes	☒ No
If restricted, please provide a list of permitted texts:		

LEARNING OUTCOMES		
(By the end of the module the student should be able to....)	**Which teaching and learning methods enable students to achieve this learning outcome? (reference activities in section 17)**	**Which summative assessment method(s) will measure the achievement of this learning outcome? (reference activities in section 18)**
Identify the large array of biomedical engineering fields.	Formal lectures and example classes	Coursework and final examination
Explain the basic tenets of fundamental technologies in biomedical engineering (i.e. engineering in biology and medicine) including medical devices for screening, diagnosis, treatment, rehabilitation and end of life	Formal lectures and example classes	Coursework and final examination
Analyse trends in technological innovations in the main medical specializations (e.g. cardiovascular, neurology, geriatric, pediatric, ophthalmology) and in the main medical setting (e.g. biological labs, medical wards, imaging units, surgical theaters etc.).	Formal lectures, seminars and example classes	Coursework and final examination
Understand biomedical engineering as a profession and ethical considerations.	Formal lectures, seminars	Coursework and final examination
Critically assess the appropriateness of innovative health care technologies by reading a health technology assessment report	Formal lectures, example classes, seminars, practical sessions	Coursework