

EXTERNAL REVIEW REPORT OF NEW PROGRAMMES

1.	Title of Programme(s):	BEng (Hons) in Biomedical Engineering BEng in Biomedical Engineering (The level 7 award will also act as an embedded exit award within the level 8 programme).				
2.	School / Centre:	School of Engineering				
3.	Duration:	4 years Level 8 3 years Level 7				
4.	NFQ Level:	Level 8 Level 7				
	ISCED:	0715				
5.	Type of Review:	New Programme:	Yes:	X	No:	
		Differential Validation:	Yes:		No:	X
6.	Date of Review:	27 th February 2017				
7.	Delivery Mode:	Full-time	X	Part-time		Blended
8.	Panel Members:	Dr Joe McGarry, retired IOTI, Chair Mr Daithi Fallon, CIT Dr Garrett McGuinness, DCU Mr Michael Loftus, Loftus Consulting Ms Carmel Brennan, GMIT, Secretary				
9.	Proposing Staff:	Mr Gerard MacMichael Dr Carine Gachon Dr Liam Morris Dr Oliver Mulryan Dr John Lohan Mr Padraig Audley Mr Paul Fahy Dr Patrick Delassus Dr Dennis O'Mahony Ms Clare London Mr Gerard O'Donnell Dr Kate Goggin				

10	<p>Programme Rationale:</p>	<p>Ireland has over 29,000 people employed in the MedTech sector according to data release by Enterprise Ireland, and this country is the second largest employer of MedTech professionals in Europe. As many as 18 of the world's top 25 medical technology companies have a base in Ireland, and 50% of the 400 MedTech companies based here are indigenous.</p> <p>The Irish Medtech Association suggests that the MedTech sector needs to urgently develop capabilities and expertise in the areas of innovation, research, development and commercialisation. The Association is proposing that the sector could become a leader in convergence technologies and product development by exploiting the country's unique potential for collaboration between ICT and pharmaceutical companies, clinicians and academics.</p> <p>The investment of Government in R&D through agencies such as Enterprise Ireland and Science Foundation Ireland over the past five years has allowed Ireland to develop significant facilities for MedTech research. In particular, GMIT's Galway Medical Devices Centre of Excellence (GMedTech), funded by Enterprise Ireland, is a leading centre in the following key research areas: aortic arch/abdominal aortic aneurysms; cranial aneurysms; stroke; coronary artery disease and the venous system. The centre also conducts research into the human musculoskeletal system, dentistry, urology and reconstructive surgery. It was staff within the Department of Mechanical and Industrial Engineering who originally established GMedTech in 2005.</p> <p>The proposed programmes have taken into consideration the recommendations of Expert Group on Future Skills Needs (EGFSN) in their report entitled "<i>Future Skills Needs of the Irish Medical Devices Sector</i>" and the report entitled "<i>Guidance for Higher Education Providers on Current and Future Skills Needs of Enterprise</i>" published in 2012. The EGFSN suggested that the MedTech sector has deficiencies in the following engineering skillsets:</p> <ul style="list-style-type: none"> • Better preparation for undergraduate Biomedical and Mechanical Engineers to work as practical engineering designers. • Regulatory Compliance for the medical device sector –NFQ Level 8/9.
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		<ul style="list-style-type: none"> Automation, to address the high costs associated with manual assembly and with a focus on robotics and machine vision. The skills to drive operational excellence which include skills in managing technology, change, strategy, cost control and leadership. Lean manufacturing, to eliminate waste, improve quality and speed logistics. Supervisory soft skills, especially people engagement skills. <p>The proposed programme aims to address some of these skillsets.</p>
11	Potential Demand for Entry:	It is proposed to initially offer 20 places divided between the level 7 and level 8 programmes.
12	Stakeholder Engagement:	<p>The programme board undertook an industrial consultation process which helped establish the need, purpose for the programme. It also has informed the structure and design of the proposed Biomedical Engineering Degree programmes. This consultation process was achieved through an electronic questionnaire which was sent out to biomedical professionals working in the MedTech sector in both SMEs and multinationals.</p> <p>In addition, the team sought the opinions of students. This year, 82% of our current Year 4, Mechanical Engineering (Level 8) students selected the Biomedical Engineering specialisation option which comprises of three biomedical related modules. To assess if this demand for Biomedical Engineering related modules would translate in a demand for a four-year Biomedical Engineering programme, an in-class survey was conducted with current students from Stages 1 to 3 on existing programmes (Mechanical & Energy).</p>
13	Graduate Demand:	<p>The aim of the programmes is to provide learners with the necessary knowledge, skills and competences to find employment in the following areas:</p> <ul style="list-style-type: none"> Medical Technology (MedTech) Industries. Clinical Environment - Bridging the gap between the Clinical and MedTech Sector. Research and Development within the MedTech sector.

14	Entry Requirements:	Students must meet the entry requirements as indicated in GMIT's Academic Code of Practice No. 4 (Access, Transfer and Progression), at any given time. Students will also need a grade C2/O4 or higher in Leaving Certificate ordinary level Mathematics to meet the minimum entry requirements for the programme.
15	Programme Structure:	<p>The modules of the programmes have been designed to address the following thematic streams:</p> <ul style="list-style-type: none"> • Integration of engineering with human physiology • Biomedical product/systems design and automation • Validation, Quality and Regulatory Affairs <p>Students undertake a 20-week work placement in the third year of the programme and a major project in year 4.</p>
16	LTA:	<p>Recent work on education indicates that active learning can be deployed as a pedagogical strategy to better engage students in the learning process when compared with passive learning. Active learning is a mode of instruction, which focuses the responsibility of learning on the learner, the key features of which include: less “chalk and talk”, and more student involvement. Student involvement is accomplished by involving the student in “doing things” and participating in the manner that is best suited to their individual learning styles. The principles of active based learning (ABL) is applied using methodologies known as Problem-Based Learning (PBL), Project Based Learning (PBL) and Work Based Learning (also referred to as Experience Based Learning (EBL)) in which the instructor’s role is to become a learning facilitator. The main reasons to include PBL/EBL in modules within the programme is that such learning methodologies are designed to develop:</p> <ul style="list-style-type: none"> • An integrated, context specific knowledge base • Decision making/critical thinking process and skills • Self-directed, life-long learning skills • Interpersonal, collaboration and communication skills • Constructive self and peer assessment skills • Professional ethics and behaviour

		<p>Where possible, traditional laboratories and tutorials will be replaced with problem based learning, project based learning, and experienced based learning teaching methods.</p> <p>In designing modules for these programmes, the programme board strategically balanced the assessment methodology between continuous assessment, project work, laboratory work and terminal examinations. A wide range of assessment methodologies are used as appropriate in assessing the module learning outcomes, such as:</p> <ul style="list-style-type: none"> • Individual and Group Presentations • Practical and Group Demonstrations • Presentations • Formal Examinations (Oral and Written) • Quizzes
17	ATP:	<p>Students on the Biomedical degrees who successfully complete stage 1 can transfer into year 2 of the existing (i.e. Mechanical and Energy Engineering) degree programmes or proposed programmes (i.e. Agricultural and Manufacturing Engineering) within the department. It will also be possible for students on the other programmes specified to transfer to the BEng in Biomedical Engineering.</p> <p>Graduates from the BEng in Biomedical Engineering may progress to the final year of the BEng (Hons) in Biomedical Engineering. Graduates of the level 8 programme may progress to level 9 and level 10 programmes in biomedical engineering or cognate engineering disciplines in other institutions.</p>
18	Resource Implications:	<ul style="list-style-type: none"> • Total investment: €225,000. • As the intention is to replace one group of Mechanical Engineering entrants (20 students) with a group of Biomedical Engineering students, no additional human resources will be required to deliver this programme. Increasing the number of student groups admitted will increase staff requirements. • €10,000 will be required to upskill existing staff in relevant areas. • Additional specialised software licences will cost €10,000.

		<ul style="list-style-type: none"> Increasing the library stock with biomedical relevant texts will cost €5,000. A Biomedical Design Studio will be required, and the existing CAD laboratories will need to be upgraded to facilitate the specialised software systems associated with medical imaging and processing. Equipment for labs will cost approximately €200,000. Note: It was clarified that it will be possible to deliver this programme initially without the investment specified above for physical resources and equipment.
19	Synergies with existing programmes:	This programme consists of existing modules common with other programmes in the Department of Mechanical and Industrial Engineering, an existing module from the Department of Biopharmaceutical & Medical Science, and a number of newly developed specialist modules for biomedical engineering.
20	Findings and Recommendations:	<p>The panel are recommending approval of the proposed programme, subject to the following conditions and recommendations:</p> <p>Special conditions attaching to approval (if any):</p> <ul style="list-style-type: none"> None <p>Recommendations of the panel in relation to award sought:</p> <ul style="list-style-type: none"> Reconsider the content of modules to ensure that students have an adequate foundation to succeed at the more advanced modules. Reflect on the programme to clarify which modules include design, and ensure that there is a coherent design stream flowing through the programme following the principles of basic design thinking. Keep under review the performance of students in mathematics modules, and review the maths content and/or the entry requirements if necessary. Review module learning outcomes and indicative syllabi for all new modules to ensure that they reflect the content that can be expected to be delivered. Consider renaming the 'Six Sigma Green Belt' module in order not to create expectations of Six Sigma certification. Articulate more explicitly the lean manufacturing content. Consider whether kinematics and kinetics of human motion and the role of the biomedical engineer belong in 'Human Anatomy and Physiology for Engineers'.

		<ul style="list-style-type: none"> While it was noted that it will be possible to deliver this programme initially without the investment specified for physical resources and equipment, the panel strongly recommend that the facilities outlined are provided in a timely fashion. 	
22	FAO: Academic Council:		
		Approved:	
		Approved subject to recommended changes:	X
		Not approved at this time:	
	Signed:		
		Chair	Secretary