

EXTERNAL REVIEW REPORT OF NEW PROGRAMMES

1.	Title of Programme(s):	BEng (Hons) in Agricultural Engineering B Eng in Agricultural Engineering				
2.	School / Centre:	School of Engineering				
3.	Duration:	4 years Level 8				
4.	NFQ Level:	Level 8				
5.	Type of Review:	New Programme:	Yes:	X	No:	
		Differential Validation:	Yes:		No:	X
6.	Date of Review:	3 rd February 2017				
7.	Delivery Mode:	Full-time	X	Part-time		Blended
8.	Panel Members:	Mr Tom Cullivan, Chair Dr Philip Owende, IT Blanchardstown and TU4Dublin Dr Tadhg Brosnan, Pallaskenry Agricultural College, LIT Dr John Daly, Dairymaster, Tralee Ms Carmel Brennan, Secretary				
9.	Proposing Staff:	Mr Gerard MacMichael Dr Carine Gachon Mr Tom Burke, Mountbellew Agricultural College Mr Gerard O'Donnell Ms Clare London Mr Eddie Dunbar Dr Kate Goggin Dr Oliver Mulryan Mr Gabriel Costello Mr Austin Kerrins Dr John Lohan Dr PJ McAllen Mr Pdraig Audley Mr Vlad Teleanca				

		<p>Mr Paul Fahy Mr John Tully, Mountbellew Agricultural College Mr Enda Kennedy, Mountbellew Agricultural College Mr Mike O’Flynn, Mountbellew Agricultural College</p>
10	Programme Rationale:	<p>The proposed programme is based on the importance of the agri-food sector in Ireland, and consequently the agricultural machinery industry.</p> <p>The Department of Agriculture, Food and the Marine (DAFM) Food Harvest 2020 report¹ suggests that the agri-food sector in Ireland contributes a value of €24 billion to the national economy, generates 6.3% of gross value added, almost 10% of Ireland’s exports, and provides 7.7% of national employment. When indirect employment is included from sectors such as inputs, processing and marketing, the agri-food sector accounts for almost 10% of total employment.</p> <p>In relation to Ireland, Enterprise Ireland (EI) have identified Agricultural Machinery as one of the dominant engineering sub sectors within Irish Engineering. Furthermore, EI have identified this area as having significant growth potential in the coming years. EI explains this potential by the fact that “Irish agricultural machinery tends to be more rugged and built to a higher specification than machinery from other European countries”, due to Irish climatic conditions and “wet” land conditions which “result in products that tend to be superior on high quality land in other European countries”.</p> <p>Consequently, third level agricultural engineering courses have begun to spring up over the last few years, as documented via the CAO entry points for agricultural related disciplines. According to the UK based Institution of Agricultural Engineers, there has never been a better time to consider working in the land-based engineering sector. With the coming together (in what has become known as the "perfect storm") of climate change, scarce water, ever increasing world populations and associated food shortages, not to mention insufficient energy resources, the need for the broad range of skills embodied in traditional land-based (or agricultural) engineering has never been more evident. Engineers in the land-based sector get involved in the following:</p> <ul style="list-style-type: none"> • Tractors and tillage machines • Harvesting equipment • Crop processing

¹ Department of Agriculture, Fisheries and Food, 2011, “*Food Harvest 2020: A Vision for Irish Agri food & Fisheries*”, Retrieved April 10th, 2016 from <http://www.agriculture.gov.ie>

		<ul style="list-style-type: none"> • Animal welfare (health, handling and transport) • Irrigation and drainage schemes • Earth moving and other construction equipment • Forestry machines • Horticultural machines <p>Currently there is no third level institution in Ireland offering a Level 8 Bachelor of Engineering degree in Agricultural Engineering. Additionally, the proposed B.Eng will be the only programme of its kind serving the BMW region.</p>
11	Potential Demand for Entry:	It is proposed to initially offer 20 places on the programme.
12	Stakeholder Engagement:	<p>The development of this programme was informed through consultation with various stakeholders, namely:</p> <ul style="list-style-type: none"> • Potential agricultural engineering students of Mountbellew, via a questionnaire • Staff at Mountbellew Agricultural College (MAC) • Survey of Potential employers • Consultation workshop with potential employers <p>The consultation process confirmed the need for a dedicated agricultural engineering degree programme. The employer survey indicates a <i>national</i> annual demand of between 40 to 60 graduates. The need for certified, cost effective and efficient agricultural products that embrace smart technologies and emerging regulations was emphasised by potential employers. Consequently, the programme structure and learning outcomes were designed to meet the demands of potential employers and available teaching resources. The consultation process also highlighted the importance of work placement, with a placement period of 3 to 6 months being the most desired. All employers were willing to support the work placement aspect of the programme.</p>
13	Graduate Demand:	<p>It is envisaged that graduates from the programme will be employed in a wide diversity of agricultural engineering related disciplines both nationally and internationally, namely:</p> <ul style="list-style-type: none"> • Technical/engineering drafting, field technicians, • Agricultural engineering design/systems design, • Agricultural systems (destructive and non-destructive testing), • Agricultural processing, engineering sales, service etc. ,

		<ul style="list-style-type: none"> • Cognate disciplines which involve heavy machinery design – (i.e. Forestry, Peat & Mining), • Bioenergy/biomass sector. <p>Furthermore, some graduates may become self-employed.</p>
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>In Year 1 of the programme, registered learners are given foundation modules, which underpin the engineering discipline. Such modules include <i>Mathematics 1</i>, <i>Engineering Science</i> and <i>Electrical Sciences</i>. Other modules taken have a large practical aspect such as <i>Manufacturing Engineering 1</i>, <i>Computer Aided Drawing (CAD)</i> and <i>Agricultural Technology</i>. Along with the module <i>Learning and Innovation Skills</i>, the year 1 entry student is given a solid preparation for the next 3 years of academic learning.</p> <p>The 2nd Year of the programme draws together important foundation topics for Agricultural Engineering. Such topics include <i>Statics and Dynamics</i>, <i>Power Hydraulics</i>, and <i>Mathematics</i>. The modules <i>Mechanics and Properties of Materials</i> and <i>Mechanics & Dynamics of Machines</i> provide the learner with skills and techniques to design and optimise agricultural and mechanical systems, while other modules furnish the learner with engineering skills in manufacturing, automation and control.</p> <p>An important aspect in Year 2 of the programme is the inclusion of the agricultural science modules, namely <i>Soil Science and Nutrient Management</i> and <i>Animal and Crop Production Sciences 1 and 2</i>. These module provides the students with the theory of agricultural science and further expose the learner to best agricultural practices.</p> <p>Stage 3 serves the dual purpose of enhancing the understanding of core agricultural engineering issues gained during the first two years of the programme. During stage 3, the core issues are presented in mandatory modules in <i>Machine Design</i>, <i>Thermodynamics</i>, <i>Power Hydraulics 2</i>, <i>Power Transmission</i>, <i>Advanced Manufacturing Processes</i>, and <i>Automation and Control 1</i>. The student's agricultural training is continued with <i>Farm Management</i>, <i>Safety and Law</i>.</p> <p>Each learner must take the mandatory 20 credit module on <i>Industrial Work Placement</i>. This module will allow the learner to</p>

		<p>gain invaluable practical experience to complement the knowledge gained during this stage. Having completed stage 3, the learner will possess a strong, balanced agricultural engineering skill-set and will be fully prepared for fourth year.</p> <p>Apart from the Farm Management, Safety and Law module which is a semester long module, the other modules will be stage long. The stage will be 23 weeks followed by a 20-week work placement.</p> <p>The philosophy of the Level 8 Bachelor of Engineering in Agricultural Engineering is to provide the learner with a national and internationally recognised honours degree. The aim and objectives of the 4th year of the programme is to provide learners with an education, which will provide graduates with the skills and competences in areas such as agricultural product design, the latest developments in internet based technologies, and an understanding of the responsibilities and the role of the engineer in society. This course provides graduates with the skills and competences required to obtain further post graduate and/or professional-level opportunities. Graduates will also have the necessary expertise to support and assist in the development of new emerging technologies.</p> <p>A key component of stage 4 is the <i>Major Project</i> module. This module deals with the application of the knowledge accumulated by the learner, over the duration of the programme, to the design, fabrication, testing and analysis of solutions to problems in the field of agricultural engineering.</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

		<ul style="list-style-type: none"> • 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>The Agricultural Engineering programme schedules identifies the allocation of the total marks between the various assessment components for each module of the programme. In designing modules for the programme, 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>Internal Transfers – Figure 1, below, presents the current and future planned programmes within the Department of Mechanical/Industrial Engineering. Candidates on the Mechanical, Energy or the proposed Biomedical programmes are eligible for entry into Year 2 of the Agricultural programme. Candidates of the proposed Manufacturing (L7) and Engineering Common Entry programmes who have chosen the Engineering Science and Mathematics 1 electives, or who obtain a 70% plus mark in the alternative modules are also considered eligible. These internal transfers will be subject to the availability of places on the Agricultural Programme and will adhere with GMITs internal transfer policy.</p>

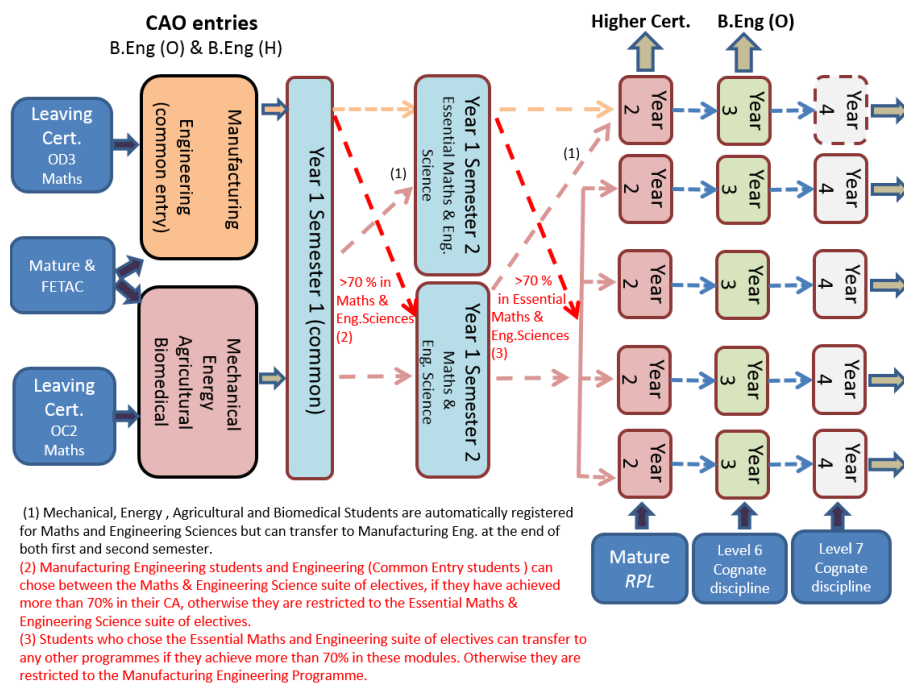


Figure 1. Transfer and Progression across the Mechanical & Industrial Engineering Programmes

External candidates from other Higher Education Institutions (HEIs), or who hold an award in a cognate domain, may apply for advanced entry into the Agricultural Engineering Programme. In advanced entry, the RPL system will be utilised as necessary to give credit to students for prior experiential learning.

All suitably qualified Level 8 graduates, have an opportunity to progress to Masters (Level 9) and PhDs (Level 10) in cognate Engineering disciplines (i.e. Mechanical, Energy etc) in other Institutions (see figure 2 below). However, reflecting the Department's significant track record in research, Mechanical Engineering is one of two disciplines in which GMIT has been awarded delegated authority from QQI to award PhD (Level 10) degrees for postgraduate research. The Department of Mechanical & Industrial Engineering has strong research connections with local industries specifically in the areas of Mechanical, Energy and BioMedical engineering, and some suitable qualified graduates may be able to avail of an opportunity to register on internally funded M.Sc., M. Eng. or PhD research programmes.

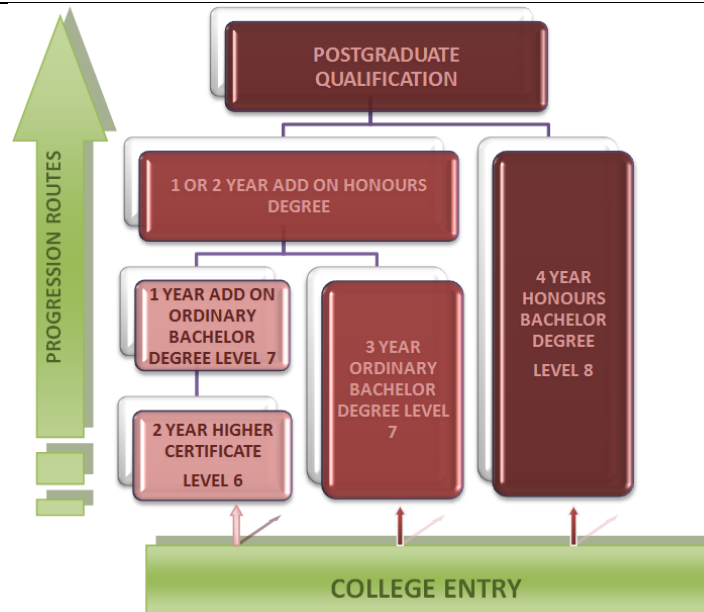


Figure 2. GMIT Progression Routes

18 Resource Implications:

Replacing one group of mechanical engineering students with one group of agricultural engineering student will require a net increase of 9.5 weekly additional teaching hours when all four years of the programme are running. 24 hours weekly will be taught in Mountbellew Agricultural College, when the programme is fully rolled out. Adding students will require additional resources as outlined in the AQA2 document.

The present reference library stock and journal subscriptions will have to be increased to reflect the specific requirements of Agricultural Engineering. The estimated cost of this material is €5000.

It is envisaged that investment will be needed in:

- The workshop (laser sheet cutting and welding equipment).
- The automation laboratory (new control equipment).
- A dedicated project room for stage 4 students which will need to be populated by adequate computer system, printers, plotters and 3-D printers. The anticipated cost of this equipment is €30,000.

Mountbellew Agricultural College will require:

- A new power hydraulics laboratory
- An upgrade of the agricultural technology laboratory

		In total, a budget of approximately €235,000 will be required. The workshop and automation laboratory costs will be covered by funding already obtained.
19	Synergies with existing programmes:	This programme incorporates existing modules from within GMIT and Mountbellew Agricultural College. It is envisaged that the cohort of students on this proposed programme will not only share common modules with existing programmes but will share lecturing, laboratory, workshop and support facilities.
20	Findings and Recommendations:	The panel are recommending approval of the proposed programme, subject to the following conditions and recommendations:
		Special conditions attaching to approval (if any):
		<ul style="list-style-type: none"> • The programme team must engage in further research to clarify and confirm that there is sufficient national demand which is not being met by current supply. This should involve research into the projected demand for agricultural engineers by individual companies, feedback from current mechanical engineering students, and feedback from Engineers Ireland, The Institution of Agricultural Engineers in the UK and the HEA. • The panel felt that the while the articulated aims of the programme were to produce an agricultural engineer, that the programme documentation and presentation suggested a broad agricultural science emphasis and thus the programme title would be BSc in Agricultural Engineering. The programme board need to determine precisely the graduate profile they wish to produce. If the programme is to be titled B Eng (Hons) in Agricultural Engineering (focussed on engineering design), then core engineering design content covering areas such as advanced automation & control, material selection, industrial design, creative design, standards and regulatory environment must be included and strengthened. • Include a detailed description of the resources necessary on both campuses and those currently available to deliver the programme, highlighting any gaps in hours, facilities, equipment etc. The Institute shall give a commitment to provide the resources necessary to deliver this programme. • Individual modules should be reviewed and revised to remediate an apparent disconnect between the appropriate learning outcomes, the syllabi, the teaching and learning strategies, and assessment strategies e.g. Major Project, Smart

		<p>Agri Project, Soil Sciences and Nutrient Management. Modules with 100% CA shall include a detailed assessment strategy.</p> <ul style="list-style-type: none"> • Introduce trouble shooting and maintenance earlier in the programme, as it is an intrinsic part of level 6 and 7 training, rather than level 8. Level 8 content should be highly design weighted. 						
		<p>Recommendations of the panel in relation to award sought:</p> <ul style="list-style-type: none"> • Include a diagram showing the similarities and differences with the existing BEng (Hons) in Mechanical Engineering, illustrating the streams and progression through the modular structure of the programmes. • Revise the module learning outcomes for the major project to include the design, test and build content of the project, and relate those to the teaching, learning and assessment strategies. • Articulate the procedure that will apply in the situation that a student is unable to gain a placement, ensuring that the learner achieves the relevant module learning outcomes. • Consider including a project based on the placement in the work placement module to address the concerns of the panel about level 7 students leaving without completing a substantial project. • Consider 'The Engineer in Society' module in the context of its location in the current programme structure. The programme board should consider whether the content of the module would be better if spread throughout the programme and provided concurrently rather than contained within an individual module, to enhance formation of the graduate. • Consider renaming the module 'An Introduction to Programming for Embedded Controllers'. 						
22	FAO: Academic Council:							
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		Chair	Secretary