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PREPARATION & ACCREDITATION OF LEVEL 7 ENGINEERING PROGRAMMES

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ABSTRACT

Accreditation of 3rd level educational programmes by a suitably recognised professional body is of particular relevance in relation to engineering. The completion of a sequence of modules which leads to the attainment of this professionally recognised award is viewed as integral to the undertaking. The engineering technology fields are developing and expanding rapidly and the third level sector must keep abreast of these changes. This is essential if the third level institutions wish to continue delivering programmes which produce graduates who can successfully complete the transition from 3rd level to the various engineering sectors.

This paper outlines various aspects of the preparation for, and the facilitation of, the accreditation of a Level 7 Bachelor of Engineering Technology programme in DIT by Engineers Ireland (EI). The generation and presentation of modules which satisfy the programme outcome approach to engineering programme development is overviewed. The accreditation process can be simplified if various steps are taken to ensure that all relevant material is presented to the panel in a logical/coherent fashion. Various personal recommendations are discussed in relation to the layout/structure of supporting documentation as well as presentation of evidence during the accreditation visit.

INTRODUCTION

The Bologna declaration was an agreement which focused on 3rd level education across the EU with a view to establishing convergence on the commonality of approaches to programme delivery [1]. The principle benefit of this increased compatibility and comparability would be the ease with which students could access a vast range of programmes across Europe. The success of this increased student mobility hinges on the commonality of standards and approaches being adopted in the 3rd level institutions in the participating nations. The Institutes of Technology in Ireland responded to Bologna by examining existing programmes with a view to facilitating the adoption of this common strategy to engineering education in Europe. It was proposed that existing three year diploma programmes, which included a two year certificate award followed by a further year to diploma level, would be brought in line with that being employed across Europe. Internal audits of these programmes were carried out within the institutes with a view to moving towards a three year Level 7 ‘Ordinary’ degree. The term ‘Ordinary’ is used here only to signify that these are not at honours degree level. These programmes would produce graduates who could perform at a level intermediate of that of a technician and a professional engineer, namely a ‘Technologist’. DIT introduced the title ‘Bachelor of Engineering Technology’ to be allocated to these degrees which ensured sufficient distinction between the original diploma award and the awards made at honours degree level.

Accreditation of these programmes, a process which ensures consistency of standards in programme delivery and therefore, graduates, is carried out on a five yearly basis by a recognised professional body within the sector. In Ireland this endeavour is undertaken by

Engineers Ireland (EI). This accreditation is highly significant if consistent delivery of high quality relevant education in this country is to be continued. The Dublin Institute of Technology (DIT) had a number of Level 7 programmes accredited by EI in February 2008. The Faculty of Engineering within DIT works to a semesterised calendar, each stage of the programme consisting of two semesters each of which consists of 15 weeks. Each stage of the programme constitutes 60 ECTS credits. All modules within all programmes have a 5 ECTS credit rating or a multiple of this. 5 ECTS credits constitute 100 hours of student/learner effort. This is an important consideration during the module development stage. The author of this paper was highly involved in the preparation of one of these programmes and the paper outlines some personal observations/opinion on undertakings which can enhance and streamline this task.

This paper details some aspects of the accreditation process as well as including some personal insights on how best to succeed in the undertaking. Developing modules using the programme outcome approach, preparation of the documentation for the accreditation, and facilitating the actual accreditation panel visit are included. The paper itself is laid out as follows; general introduction to the accreditation of level 7 programmes in Ireland, module development and module descriptors, documentation for accreditation, the accreditation visit, and finishes with some overall conclusions to the work.

ACCREDITATION OF LEVEL 7 ENGINEERING PROGRAMMES IN IRELAND

Programmes which are deemed to be at the appropriate standard for award at Level 7 are considered eligible for accreditation to 'Associate Engineer' level. Engineers Ireland defines an Associate Engineer as follows [2]; 'The Associate Engineer is competent to apply in a responsible manner current engineering technologies in a chosen field. He/she exercises independent technical judgement and works with significant autonomy within his/her allocated responsibility. The performance of his/her engineering technology work requires an understanding of relevant financial, commercial, statutory, safety, management, social and environmental considerations'. EI specify programme outcomes which provide the framework within which the third level institutions may build their engineering programmes. These outcomes, coupled with relevant programme area descriptors, lay the foundations on which to build programmes which may ultimately result in successful accreditation. This ensures that the accredited programmes are of the required high level and that ultimately, and most importantly, graduates are being produced that can perform at Associate Engineer level. The programme outcomes hold the key to successful accreditation. It is essential that the programme team can clearly show that graduates of the programme have the abilities prescribed in the EI programme outcomes. The accreditation process, which includes preparation of documentation followed by a visit by a panel which consists of independent academic and industrial personnel, is as specified by EI [2]. The panel visit ends with the production of a report which outlines detail in relation to the programmes performance under a range of headings as outlined in [2]. It is the responsibility of the participating 3rd level institute to provide the accreditation panel with sufficient information in relation to each of the requirements. Various conditions and/or recommendations can be associated with the decisions made by the panel on completion of the accreditation visit ranging from non-accreditation up to accreditation without any conditions for 5 years. A large proportion of the panel's time during the visit is spent on 'analysis and implementation of programme outcomes'. This aspect of the accreditation process is the major focus of the following sections of this paper. Suggestions which may prove beneficial to those involved in imminent accreditations are included.

MODULE DEVELOPMENT AND MODULE DESCRIPTORS

The programme outcome approach to the development of third level engineering programmes is a significant shift from earlier approaches. Ideally a top-down approach should be taken in the development of the engineering programme [3]. The first question the programme team should ask themselves on commencement of the programme development process should be; "What should a graduate of the programme (or proposed programme) be capable of?" The answer to this question is extremely important as it essentially defines the role of prospective graduates in the workplace. This coupled with the EI programme outcomes should lead to the generation of a listing of 'programme specific outcomes' which are particular to the programme in question.

This should then continue towards the following question; "What modules (suite of modules) are required to ensure adequate learning can be facilitated in the proposed areas/disciplines whilst ensuring that the programme outcomes are being met?" Once provisional titles of modules have been decided upon by the programme team work can begin on the development of the module descriptor. Each module author, in consultation with the programme committee, develops a concise module description. These should overview the module and illustrate clear evidence of conformity to the EI programme outcomes. This module description should be specific to the programme in question and in most cases should not be a generic 'one-for-all' solution. One methodology which can aid in the development of a module which fulfils all requirements is to 'justify the inclusion' of the module throughout development. This essentially means that the author is continuously weighing up the merits of their module against the specifications as laid out by EI and the programme committee/team. This methodology can be adopted at the descriptor stage where the author can discuss the module under the following headings; Knowledge: Breadth & Kind, Know-How & Skill: Range & Selectivity, Competence: Context, Role, Learning-to-learn, & Insight. This discussion forces the module author to identify how their module will contribute to the education of the learner and as such must show how the module performs against the EI programme outcomes. This is a very useful exercise and greatly simplifies the accreditation process as the module author is immersed with the expectations of the module and hence the programme. A short description of the aim of the module is then outlined. This should bring together the description of the module, the skills developed and how the learner/graduate benefits from participating in/completing it.

The required 'learning outcomes' should then be produced. This should be a list of measurable expectations derived from the learner's involvement in the module. Ideally these outcomes should be generated in advance of the syllabus so that due reference is afforded to the EI programme outcomes as well as the specifics developed by the programme committee. Ensuring that these outcomes are measurable is of primary importance and authors should avoid the trap of using words such as understanding, comprehension and appreciation. The number of learning outcomes included in the module descriptor is also significant. Including a large number of learning outcomes restricts flexibility in the module content/delivery. This can result in the lecturer being tied down to very specific material outlined in the learning outcomes, limiting the possibilities of delivering the module to a number of differing class groups simultaneously. However, having too few learning outcomes can give too much freedom and allow too much room for interpretation of required/desired content. The descriptor is then of less benefit to the learner as it doesn't give them an appreciation for the expectations from the module. Allowing the programme specific learning outcomes and the description of the module requirements to

filter down through a list which consists of measurable verbs is the key to success in this task. The module author should also remain focussed on the fact that the learner must be able to successfully fulfil the outcomes within 100 hours of effort (if 5 ECTS Credit module). The module content and the associated modes of delivery should then be considered. The content should be sufficient as to allow the learner to meet all the prescribed learning outcomes for the module. The mode of delivery and the allocation of time to the various elements should be such as to enhance the learning experience of the student and ensure outcomes can be met. Text books (both class texts and reference texts) should be identified and listed within the module descriptor. One of the most critical parts of the module development is module assessment. It is important that the assessment methods chosen for each of the elements are adequate and can measure the learner's performance/abilities in relation to the learning outcomes. Presenting evidence of how the learner meets the learning outcomes is crucial during accreditation.

The top-down approach described ensures that the programme developed delivers graduates who are flexible within, and can adequately engage in, a wide range of roles in the designated industry sector. The layout and presentation of the module descriptor in the programme documentation is of critical significance and should be allocated significant attention. A coherent synchronicity should exist between the modules developed, their accompanying learning outcomes, and the programme outcomes as specified by Engineers Ireland.

DOCUMENTATION FOR ACCREDITATION

Programme documentation includes detail on all aspects of the programme such as programme objectives, module descriptors, facilities available to run the programme as well as other programme specific information. A document must also be produced by the programme committee which includes important detail specific to the accreditation procedure, and in particular, how the programme performs in relation to the EI programme outcomes. The general structure of this report is as specified by EI [1] but the layout/presentation of the information is at the discretion of the programme committee. The area most worthy of consideration/debate is in relation to section f) Analysis & Implementation of Programme Outcomes. This section must detail how the programme committee believe that the programme is satisfying the EI programme outcomes. This should also detail the manner in which compliance with the outcomes manifests itself as well as identifying the location of the relevant evidence. Some suggestions on how best to negotiate this aspect of the accreditation are summarised in this section and are based upon personal observation/opinion and feedback from the process.

Keating et al [3] introduce a matrix format for identifying and presenting evidence of EI programme outcome compliance. A modified version of this was utilised in this Level 7 programme accreditation (Table 1). The matrix has the potential to easily illustrate a programmes' performance in relation to programme areas and outcomes. The cells of this matrix are populated with the learning outcomes which are considered by the lecturer/module author delivering the module to be contributing towards learning under the particular programme outcome in a specific programme area. For example cell (a)(1) could be populated as follows, **MECT 2103 L.O. 1-4, 6;** where MECT 2103 is the module code. This suggests that learning outcomes 1, 2, 3, 4 & 6 are contributing to programme outcome (a) in programme area (1). A programme matrix can then be generated which is populated with all contributing learning outcomes in the appropriate cells. This is a useful means of identifying potential 'gaps in

learning' in a programme. This is highlighted by a sparsely populated matrix or cells containing very few or no learning outcomes.

	Engineers Ireland Programme Outcomes							
Programme Areas	MECT 2103	(a)	(b)	(c)	(d)	(e)	(f)	(g)
	(1)							
	(2)							
	(3)							
	(4)							
	(5)							
	(6)							

Table 1: *Programme Outcomes/Areas Matrix Format for an Individual Module*

Overall performance* of the programme w.r.t. to programme outcomes could be as in Table 2;

Module Code	Module Title	% a	% b	% c	% d	% e	% f	% g
MATH 1103	Mathematics 1							
MECH 1103	Mechanical Systems 1							
Etc..	Etc.							
	Stage One Averages							
	Stage Two Averages							
	Stage Three Averages							
	Programme Averages							

Table 2: *Summary of Programme Performance w.r.t. EI Programme Outcomes*

*The percentage performance is gained from the ratio of the number of learning outcomes which are specifically satisfying the prescribed programme outcome to the total number of learning outcomes for that module.

It is worthy of noting that this method does not identify the extent or quality of the contribution as each learning outcome is assigned equal value. Section f) could begin with this table as a means of an introduction to the evaluation. This table can then be followed by an essay-type evaluation of the performance of the programme under the heading of each EI programme outcome individually. This involves examination of the module matrices produced by the individual delivering the module and reading through the module descriptors for the programme. This should include detail on how the modules and ultimately the programme satisfy the EI programme outcome requirements. The particular matrix column pertaining to the specific EI programme outcome should be contained within this section for reference and cross-checking by the panel member. The realisation of the suggested format can be quite time consuming but can be rewarded by the increased clarity achieved during the accreditation visit.

THE ACCREDITATION VISIT

The objective of the accreditation panel is to ensure that the programme in question is of sufficient standard for the allocation of the status of Associate Engineer of EI. The most

important aspect of this is that they identify evidence of the programme's (and ultimately the graduate's) performance in relation to the EI programme outcomes. Therefore, the onus is on the programme committee to ensure that there is sufficient evidence of the satisfaction of each of the seven programme outcomes within the programme areas. The matrix methodology introduced in the previous section is of enormous benefit in streamlining the information pertaining to the EI programme outcomes/areas. Various approaches can be taken to simplify the task of the accreditation panel as far as is possible. The method adopted (in presenting the evidence) during the accreditation of the programme in DIT was closely tied to the matrix illustrated in Table 1. 42 boxes (one for each cell of the matrix) were laid out in a fashion similar to shape of the matrix. These boxes each contained the information/evidence 'backing up' each learning outcome contained within the cell location. The evidence was presented as follows;

- A copy of the module descriptor (just the relevant page(s)) with the particular learning outcome(s) identified using a highlighter pen.
- The examination paper/student instruction/project outline, relevant part highlighted.
- The exam script/laboratory report/thesis or other with the relevant detail highlighted.

Paper clips were used to hold the material together and this was then placed in the relevant box. This method worked fairly well with the information being easily accessible/available to the panel. However, on the basis of both being involved in this process and from feedback from the panel, an alternative strategy is now suggested. The process would be simplified if 21 boxes (7 boxes per stage of the 3 stage programme) only were used which contained information pertaining to each of the 7 EI programme outcomes. This, in conjunction with reference to the programme matrix, should suffice.

CONCLUSIONS

Professional accreditation of engineering programmes is the only means of ensuring that consistently high quality programmes are being delivered to the learners engaging on our 3rd level programmes. The EI programme outcome approach to programme development greatly enhances the prospects of developing programmes which can make a real contribution to the various existing and emerging sectors in the modern world. This paper outlined some approaches which can be adopted during the module development stage within the programme outcome framework/structure. These approaches can be very helpful in generating a suite of module descriptors which are consistent in terms of layout and quality. This is useful to both learner and lecturer and can enhance the 'student-centred-learning' approach to education. Based on experienced gained during the accreditation of our programme some suggestions have been outlined which can aid in the preparation for, and facilitation of, accreditation of Level 7 programmes (or other) using the programme outcome approach. This may be particularly beneficial to those in the third-level sector involved in similar accreditations in the near future.

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