Innovative Curriculum Design for Electrical Engineering at Unisa

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Abstract

All diplomas and BTech degrees offered by the School of Engineering at Unisa, an open and distance learning institution, contain a theoretical as well as a practical component within each module, and a compulsory period of work-integrated learning in industry. An increase in students, a proposed new tuition model and the new qualifications framework have necessitated a search for innovative ways of offering our courses, especially the practical experiments that are required. All first-year students receive a kit with the required components to do the required experiments. They also receive their own copies of Multisim and Ultiboard, which they can use throughout their studies. Students enrolled for our courses in Digital Systems, Process Instrumentation, Control Systems and Industrial Electronics now receive PLC simulation software in addition to the theoretical package. In addition to providing students with study guides and software, satellite broadcasts also enable staff to interact with their students. Students unable to attend a satellite broadcast are able to purchase the recording for a nominal fee. Students learn about the theoretical aspects and then apply the knowledge gained in the practical projects. At the end of their studies, students apply their knowledge in a design project for the diploma and an industrial project for the BTech.

Keywords: Electrical Engineering and Open Distance learning

CONTEXT

All diplomas and BTech degrees offered by the School of Engineering at Unisa, an open and distance learning institution, contain a theoretical as well as a practical component within each module, compulsory project work and a period of work-integrated learning in industry. The work-integrated learning component consists of one year's training at an approved company. Monitoring takes place by means of a logbook, a mentor system and visits to industry by a Unisa academic.

A National Diploma in Electrical Engineering comprises 360 credits. The student must pass 20 subjects, each consisting of a theoretical and a practical component, as well as completing a year's appropriate work experience, namely, work-integrated learning (WIL). The BTech degree requires an additional 120 credits, comprising an additional seven subjects, each consisting of a theoretical and a practical component, and an industrial project, which contributes 30% towards the degree.

The purpose of the National Diploma and BTech Engineering qualifications is to develop the necessary knowledge, understanding and skills required for learners' further learning towards becoming competent practising engineering technicians and technologists. It is intended, subsequently, to empower candidate engineering technicians and technologists to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in their working environment in South Africa.

FRAMEWORK

To ensure that Unisa's engineering programmes are relevant, keep abreast with the latest technology, meet local and international standards and fall within the University's strategic plan, the Engineering Department must work closely with industry, accrediting bodies and other stakeholders. Forming partnerships with industry enables us to improve our courses, overcome the challenges of open and distance learning and, thereby, ensures that the theoretical and practical skills learnt are in line with the needs of industry. This is to the advantage of university, industry and, above all, the student - the academic institution builds up a reputation of having quality courses, students are exposed to industry's products, which they will make use of in future and, lastly but most importantly, students are well prepared for joining the workforce.

INTERNATIONAL BEST PRACTICE

The Engineering Council of South Africa (ECSA), the accrediting body for all engineering courses in South Africa, has several worldwide accords, ensuring that our qualifications meet international standards.

ECSA carries out accreditation of programmes offered by universities of technology and comprehensive universities for the following reasons:

- To establish whether the qualifications awarded from the programmes meet the educational requirements leading towards registration as Professional Engineering Technologists, Professional Certificated Engineers, Professional Engineering Technicians.

- To establish whether the diplomates or graduates from the respective programmes are ready for employment and are equipped to continue learning throughout their careers.

- To establish international comparability of the programmes.

Currently ECSA accredits only the National Diploma: Engineering and B Tech Degree Engineering qualifications that are offered by Unisa. All disciplines in Unisa's School of Engineering have been fully accredited to offer the National Diploma and BTech degree. The next accreditation visit will take place in 2013.

OPEN AND DISTANCE LEARNING IN ELECTRICAL ENGINEERING

As our modules are offered by open and distance learning, students receive their study material by post or download it from the university website. Unisa's strategic plan includes positioning Unisa as a world-class, quality university through an academic product range that responds to Africanisation as well as social and economic priorities. This has resulted in students from throughout Africa enrolling for

our courses and has made it necessary to adapt from offering practicals at local venues to employing more flexible methods.

All first-year students receive a kit with the necessary components to do the required experiments. They also receive their own copies of Multisim and Ultiboard, which they can use throughout their studies. Students enrolled for our courses in Digital Systems, Process Instrumentation, Control Systems and Industrial Electronics now receive PLC simulation software in addition to the theoretical work. In addition to the study guides and software that are provided for students, satellite broadcasts also enable staff to interact with their students. Students unable to attend a satellite broadcast are able to purchase the recording for a nominal fee. Students learn about the theoretical aspects and then apply the knowledge gained in the practical projects.

Students can solve typical design problems from industry by writing, debugging, testing and running their program at home with the simulation software. Students then submit their work to the lecturer for assessment. This can be downloaded to our laboratory equipment and tested. To ensure that it is the student's own work, sections of the work may be retested in the final examination.

DISCUSSION

An increase in students, a proposed new tuition model and the new qualifications framework have necessitated that we find innovative ways of offering our courses, especially the practical experiments that are required. By supplying each student with study material, the necessary experiments, a kit, all the required components, simulation software and often a satellite broadcast explaining how the systems work, we have accommodated the increase in students this year.

This paper addresses how we implemented the first-year kits, simulation software, examples of the actual experiments from first- to final-year studies, how students do design projects and industrial projects, with examples. Successes, unexpected problems and changes we have implemented, make this a successful model to offer in our courses through open and distance learning.