UNIVERSITY OF TECHNOLOGY, JAMAICA
School of Engineering
Electrical Programmes Unit
99:10:06 mod. 19

B.ENG (ELECTRICAL) PROGRAMME OVERVIEW, 1.0.1

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1. **Programme Title:** Bachelor of Engineering (Electrical); Abbreviation: B.Eng (Electrical).

   Programme Level: Professional Engineer (First Degree level).

2. **Philosophy/Vision:** The new B. Eng Programme is designed to provide cost-effective, praxis-oriented, world-class Engineering Education at the first degree level, in Jamaica.

   It therefore targets Jamaica's industrial needs and opportunities in the emerging Information and Communications Technologies-focussed global era, and so seeks to exploit the power of the Mechatronics Paradigm and Sociotechnical Systems for engineering design practice. That is, it emphasises team-oriented design based on the synergistic performance of products, systems and processes that integrate precision mechanisms and intelligent electronics.

   The B.Eng will therefore:

   - Provide for the development of appropriate Scientific, Mathematical and Computational skills, as a foundation for engineering science and design.
   - Foster the perspectives, creativity, teamwork, and synthesis skills that lead to successful team-oriented invention, design and innovation.
   - Emphasise current and emerging techniques, technologies and equipment used in world-class Engineering Praxis.

   The general and professional education components of the B.Eng will promote a culture of high ethical standards, love of learning, constructive dialogue and deliberation, critical thinking and respect for diversity in the university and in the wider community.

   The B.Eng's integrated Enterprise Incubation initiative, and associated Staff and Student research, development and consultancies will lead to the discovery and exploitation of emerging market opportunities for Jamaica.

   Thus, the programme will attract high-quality students and staff, and will contribute significantly to Jamaica's national renewal, industrial transformation and development.

3. **Programme Rationale:** Engineers apply their knowledge of Mathematical, Natural, Engineering and Social Sciences, with professional judgement, to economically harness the materials and forces of nature for the benefit of society. Electrical Engineers are

concerned with systems that produce, process and propagate intelligent signals in electromagnetic forms, and with those that generate, transmit, distribute and apply electrical energy. Typically, they pursue technical, entrepreneurial and managerial careers in fields across the Industry Spectrum -- research, design and development, manufacturing, distribution, operations and maintenance.

Thus, Electrical Engineers are a critical human resource for the efficient development, operation and prosperity of our community, its institutions and industries — as is implied by the 1996 National Industrial Policy for Jamaica. It is therefore reasonable for us to devote adequate resources to developing well-qualified Electrical Engineers through this B.Eng programme.

The requisite portfolio of knowledge, judgement and skills to function as an effective Electrical Engineer depends on appropriate study, experience and practice. Qualification for Professional Status is assessed by the relevant Professional Societies and Accrediting Bodies. The B.Eng Programme is therefore designed to develop Engineers of world-class standard, in light of the Accreditation Requirements of the UCJ and the JIE/PERB, with intent to eventually attain Substantial Equivalency status under the Washington Accord.

In accordance with the university's shift to a four-year/eight-semester programme framework, the B.Eng is designed around an eight-semester course sequence, with five courses per semester. Intake, in light of a comparison with international practices, is based on at least one year of studies beyond the CXC CSEC baseline, so that students will normally complete a B.Eng in five years of study beyond the fifth form level. (This is comparable with the present situation with the UWI St. Augustine BSc. in Engineering.) An associated bridging programme, the Pre-Requisite Course of Studies [PCS], is specifically designed to supply the one-year bridge, but the intake is also flexible enough to also accept students with A levels, N1's (or, N2's), CXC CAPE units and other similar post-CXC achievements.

In the first year, students will be primarily exposed to basic mathematics and science, but will also begin an engineering praxis course sequence that is designed to orient them to engineering in the mechatronic paradigm. This year is common with the Mechanical B.Eng programme. Over the next three years, students branch out into options that target relevant, marketable specialisations in engineering. Initially, these include: power, instrumentation and control, electronics and telecommunications, and industrial electronics (a flexible option). Eventually, we hope to develop options in areas such as: computer systems & networks; audio, music, recording and multimedia; biomedical electronics & instrumentation.

The integral industrial experience component (1,000 hours), the management and entrepreneurship three-course sequence, the major project and an alliance with the university's enterprise incubation initiative form the framework for the industrial renewal strategy. It is envisioned that staff and students, exploiting the power of concepts such as: mechatronics, mass customisation, sociotechnical work systems and associated information and communications technologies, will undertake research, development,

consultancy and en-/intrapreneurship, towards the transformation of Jamaica's industrial base.

Thus, the B.Eng (Electrical) programme has great strategic potential to help foster that industrial renewal which must form a key component of any future national development policy for Jamaica.

4. Key Driving Trends: The underlying trend, that of a National University as a key component of national renewal and transformation, is aptly summed up by Peter Drucker:

> The modern university as we know it started out as the invention of a German diplomat . . . Wilhelm von Humboldt, who in 1809 conceived and founded the University of Berlin with two clear objectives: to take intellectual and scientific leadership away from the French and give it to the Germans; and to capture the energies released by the French Revolution and turn them against the French themselves. . . .
>
> Prussia had just been defeated by Napoleon and had barely escaped total dismemberment. It was bankrupt, politically, militarily, and, above all, financially . . . Yet Humboldt went out to build the largest university the Western World had ever seen or heard of — three to four times as large as anything then in existence. He went out to hire the leading scholars in every single discipline, beginning with the foremost Philosopher of the time, Georg W. F. Hegel. And he paid his professors up to ten times as much as professors had ever been paid before, at a period when first-class scholars were going begging since the Napoleonic wars had forced many old and famous universities to disband. . . . After the total defeat of the Prussian monarchy by Napoleon in 1806, the collapse paralysed all the forces that would otherwise have stopped Humboldt . . . He ran with the opportunity . . . .
>
> Sixty years later . . . Humboldt's idea of the university as a change agent was picked up across the Atlantic, in the United States. There, by the end of the Civil War, the old "colleges" of the colonial period were dying of senility. . . in the next thirty years a galaxy of American university presidents created and built a new "American university" — both distinctly new and distinctly American — which then, after World War I, soon gained for the United States worldwide leadership in scholarship and research, just as Humboldt's university had gained worldwide leadership in scholarship and research for Germany a century earlier. [*Innovation and Entrepreneurship* (NY: Harper and Row, 1993), pp. 23, 212 - 214, 24.]

Overlaying this trend, several other factors have been important:

4.1 The decisive input to the structure of the new B.Eng is the breakthrough 1991-1995 **Carnegie Mellon University ECE Curriculum**; for example, the Engineering Praxis course sequence derives from CMU's Lower Division *Introduction to Engineering* courses. The **proposed options** in Electrical Technologies have been structured in light of a point emphasised by CMU:

> *. . . the disciplines of electrical and computer engineering are expanding rapidly as new technical discoveries are made and applied.* Likewise, society is placing increasing demands on our graduates to apply their skills in new contexts, and to appreciate and manage intelligently the consequences of their technical decisions. *Consequently, the number of "critical' topics to which ECE students could profitably be exposed is also*

> *expanding.* What is not expanding is the time [i.e., four years/eight semesters at 4 - 6 courses per semester] we have to educate someone to the level of the bachelor's degree.
>
> [CMU's traditional EE Curriculum] required a large number of core classes . . . *After a great deal of argument and discussion, we came to believe that this approach, which implicitly assumes that all students need exposure to (almost) all areas was no longer credible as the core of a curriculum for the 21st century. Such a strategy mandates that we compress ever more material into the same number of classes* . . . A 12-unit [i.e. 3.3.4 4-credit] class is nominally intended to require 12 hours of effort per week. In the 1991 curriculum, many of our courses had already fallen victim to "units creep," i.e. challenging classes meant to require 12 hours of effort per week had inflated to require 15 or 18 hours of work from even the best of students. . . . [Emphases added]

In short, Electrical and Computer Engineering are undergoing the same sort of content and depth explosion that in the nineteenth century led to the separating out of specific Mathematical, Physical and Chemical Sciences from what had started out as Natural Philosophy in the days of the Scientific Revolution. Thus, while our programme proposal — given resource constraints — cannot go as far as the CMU did, it can reflect the above trend to some extent, by using a core-and-branch strategy to implement options. [Cf. Briefing Note on *Student Workload.*] As a result, we have a common first year (which is also common for the Mechanical Programme), leading to options which begin to diverge in the second and third years, and to market-targetted specialisation clusters in the upper division, which include [subject to resource constraints]:

- Energy, **Power** Systems and the Environment [for the PCS year class entering U.Tech in Sept. '99]
- **Instrumentation & Controls**, with electives in Avionics, Robotics & Mechatronics, DCS & Process Industries, Automotive I & C, Industrial Safety & Security Systems, and Biomedical Instrumentation [PCS '99]
- **Electronics and Telecommunications** [PCS '99]
- **Industrial Electronics** (a general/flexible option) [PCS '99]

. . . to be followed, as soon as is practicable, by:

- Computer Systems Engineering
- Audio and Recording Technologies & New Media/Multimedia Technologies
- Biomedical Electronics and Instrumentation

4.2 **The Mechatronics Paradigm** -- systems integrating electrical, electronics, mechanical, sensor, instrumentation, control and computer elements -- is viewed as the context in which engineering systems will develop in the next century, that is such systems will now be built using bits plus atoms in intelligent systems/networks. [Cf. Nicholas Negroponte.] Thus, robotics-oriented systems were selected as key case

studies for these courses. [Cf. Briefing Note on ICTs, Mechatronics & Sociotechnical Systems.]

4.3 A recent European Union White Paper on ICT's observes,

> "[a] new **'information society'** is emerging in which the services provided by information and communications technologies (ICT's) underpin human activities. . . . The means available to create, process, access and transfer information are remodelling relationships in our societies. One of the most important aspects of current developments is the breathtaking expansion in the means available to us to communicate and process information (sound, text, images) in digital form." Consequently, "[t]he job situation has generally remained more favourable in companies which have introduced microelectronics than in those companies that have not . . . The main effects have been job substitutions on the basis of different qualifications. The spread of ICT's within the Community has generated increases in productivity and in GDP [Gross Domestic Product, a measure of national Income], and a lower rate of inflation."

If we are to reap these fruit, we must play a leading role in adopting, using and developing ICTs in Jamaican Industry. Therefore, a dominant focus for the programme must be "the era of bits plus atoms [in intelligent systems and networks]," with the rule of thumb that bits tend to be cheaper, and more flexible. This leads to a natural emphasis on ICTs in programme design, operation, facilities and infrastructure. Computer networks, heavy use of software and New Media, telenetworked staff and student interaction (and course delivery . . .), the use of Computer-based instrumentation and Labs, and more, are natural outcomes.

4.4 The emerging Information Society is described in the EU White Paper as being "as important as the first industrial revolution," which catapulted Europe to a position of global dominance for nearly 200 years. And it adds, "the economies which are the first to succeed in completing this change satisfactorily will have major competitive advantages." This underscores the vital importance of our **programmes in Information/Computer and Telecommunications Technologies**, with a balance between technical and strategic business and community issues.

4.5 Our **industrial focus** led to the proposed 1,000 hour industrial experience component, and the management course sequence. The desperate need for technology-driven innovation in Jamaica has led to the proposed *link to Enterprise Incubation and consultancies.*

4.6 The emergence of **inexpensive, powerful PC's and Engineering software** leads to the concept of *the software-assisted practitioner* as a context for education.

4.7 Given the emerging CAPE programmes, with their one-year sixth form modules, the gap between the four-year effective maximum for a marketable first degree and the typical level of attainment of a fifth-form graduate can be bridged by defining a ***Preliminary Standing* profile.** [Cf. the attached note.] This will enable us to articulate with trends in High Schools and Community Colleges — including

GNVQ's at level 3, taking advantage of the principle that programme delivery at the "CXC + 1" level is significantly less expensive in such institutions. [Nb. Our present proposals for updated Diploma and PET Programmes envision a CXC entry level, and bridging modules to open ways for their graduates to advance along the road to full professional status through the B.Eng Programme.]

4.8 New developments in ***Accreditation*** at local, regional and international levels have significantly impacted our **Quality Assurance** strategy. The work of our national Engineering Programmes Accreditation Committee and ABET's *Criteria 2000* have been especially important, especially in light of the need for **Substantial Equivalency** under the **Washington Accord**. Inter alia, programme structure, academic staffing policy, support facilities and equipment, technical support staff, industrial linkages and partnerships, Research, Development and Consultancy, and Professional Society involvement have been impacted by these constraints, and will have to become aspects of a continuous quality improvement process, similar to those espoused by Deming, Crosby, and the ISO 9000 standard. Initial aspects of this process are outlined in the School's 1998 report to the UCJ on the present B.Eng Programme.

5. Programme Goals:

1. A growing number of qualified Jamaican (and Caribbean) Engineers who are competitive in the emerging global age, defined in the first instance by:
    - **design competence in the Mechatronics Paradigm**
    - **facility with Information & Communications Technologies**
    - **manufacturing industry en/intrapreneurship**
    - good **project management skills**
    - general **effectiveness**
    - **produc*tivity* in work teams**
    - **good professional ethics**

2. A significant contribution to industrial renewal in Jamaica, through the impact of graduates in the workplace, through integrated enterprise incubation, and through associated research, design, development and consultancy.

3. The development of courses for Engineering specialisations in areas with emerging and potential industrial opportunities for Jamaica, such as are listed above, in general alignment with national (and regional) industrial policy objectives; with regional and global trends in Engineering Education and its Accreditation; and with global trends for the Professional Registration of Engineers (*inter alia*, EPAC-JIE-UCJ, ABET Criteria 2000, SARTOR, Washington Accord).

4. The deepening and extension of present industrial links, leading to cooperative Engineering education, and to entrepreneurial initiatives related to the above opportunities.

6. **Programme Objectives:** In accord with UCJ & JIE/PERB accreditation mandates, the B.Eng Programme will seek to educate students who, when they graduate, should:

1. Have an understanding of engineering science and engineering design.

2. Be able to use relevant scientific/engineering knowledge to make appropriate decisions.

3. Have a sound foundation in mathematics and other requisite sciences.

4. Be able to creatively utilise and manage resources through effective analysis and interpretation.

5. Have an understanding of the application of computers to engineering.

6. Be able to develop the most economic solutions to problems.

7. Be able to respond to technological changes.

8. Be aware of the impact that engineering has on society from environmental, economic, social and cultural points of view.

9. Apply knowledge and skills to the development and improvement of society.

10. Be aware of the role and responsibilities of the professional engineer.

11. Display at all times highest ethical principles.

12. Display skills for carrying out day to day responsibilities.

13. Recognise the need for lifetime learning and development.

14. Be able to work in teams.

15. Be able to communicate effectively, orally and in writing, within the profession and within the community at large.

16. Desirably have competence in a second language.

[UCJ: *Draft Standards for a Bachelors Degree in Engineering*.]

7. **Programme Design:** Straight 4-year/8-semester, full-time, with five courses per semester, covering 15 - 18 Credits in each semester. Provision is to be made for Credit Banking. All major Engineering courses are in a **3.3.4 format**, i.e. three lecture/theory hours and three laboratory hours, yielding four credits on completing a fifteen week semester. A three-course Management depth sequence is included, to prepare graduates for technical management and/or entrepreneurship. B.Eng award, on successful completion of the Academic programme and a 1,000 hour industrial experience component. [Cf. Section 8 below, Programme Structure.]

7.1 The B.Eng Programme Intake will be at CXC + 1 standard, normally requiring at least one year of study beyond fifth form level. Programme entry therefore requires:

- **Matriculation into the School:** CXC CSEC ["O Level"] passes at Grade II (new scale) — or the equivalent — in Mathematics and Physics, with a pass in CXC CSEC English A and two other subjects, Science or Technology preferred.

- **"CXC + 1" studies in Mathematics, Physics, Chemistry, Communication and Technology.** These may be pursued in several modes: PCS, Sixth Form/A Levels, CXC CAPE I's, Community Colleges, UWI N1's (Franchised or on-campus), possibly AS Levels and GNVQ's, Summer Semester programmes, etc. These modes may also be used to cover technical skill requirements, such as IT, TD or Workshop. Diploma First year students with high academic standard may also be considered. *(However, A Level students are only to be considered for Comms 1 and 3 exemptions with B or better in the GP; this may cause a block on A Level entrants to the B.Eng, as they will now have to do one to two further pickup courses in the freshman year. To resolve this, it is proposed that A level entrants with passes in GP and a Science be given exemptions from the Freshman Seminars I and II, so they may then do Comms 1 & 2.)*

- Those applicants who have successfully completed **A Levels** and/or other similarly advanced courses will be considered for course exemptions via transfer credits. **Articulation** agreements are also anticipated.

- Timely submission of a standard form **profile** of Academic and Technical *breadth* at secondary education standard; *core* cognitive, communications, numeracy, IT and psychomotor *skills and aptitudes*; targetted *depth* at CXC + 1 level in Mathematics, Physics and Chemistry [Cf. Attached/Available Briefing Note on the Preliminary Profile.]

- Success in an intake **interview** (which will incorporate some testing). Portfolios of evidence for the above profiles are to be submitted at the interview, for validation and to help in the interview process.

7.2 Flexibility and Onward Development: the programme is divided into blocks starting from a common core first year and then branching out into the options. There are three engineering option blocks in the second year, four in the third, and five in the fourth. Thus, future options may be easily developed with this **3-4-5 structure**.

7.3 Structure & Options: the programme has a common first year (which is also common for the Mechanical Programme), which must be ready for implementation in AY 2000/2001. Thereafter, it leads to options which begin to diverge in the second and third years, culminating in market-targetted specialisations in the upper division, which include [subject to resource constraints]:

- **Power**
- **Instrumentation & Control**
- **Electronics & Telecommunications**
- **Industrial Electronics & Automation**

. . . to be followed, as soon as is practicable, by:

- Computer Systems & Networks Engineering
- Audio and Recording Technologies/New Media Technologies
- Biomedical Electronics and Instrumentation and related disciplines.

7.4 Implementation therefore requires a *phased rollout* of courses and support structures so that in each succeeding year after 2000/2001, facilities will be in place for the students as they are promoted. In particular, by 2003/2004, the proposed integrated **Enterprise Incubator** will need to be in place. There will also be the need **to upgrade the present labs**: the basic electrical and electronics labs, the power lab, the servo lab, the instrumentation (and control, i.e. I & C) lab and the computer lab. As was outlined in the European Union proposal of October 1998, there is the need to create **several new labs**: a mechatronics lab; an I & C, robotics and automation lab [possibly, integrated with the CAD/CAM Lab, unit operations lab and Kaiser lab using the Plantscape PLC system]; a telecommunications lab; a school test and development/research lab.

7.5 Delivery Modes: Lectures & Labs, Tutorials, Seminars, Dialogues and Debates, Assignments, Projects, Readings, Research, Simulations and Work Experiences, Field Trips, Multimedia, Internet and any other effective — and especially innovative — means. [Courses are expected to have Instructor's and possibly student's Manuals.]

7.6 Educational Materials: These will include text and reference books; audiovisuals and multimedia support; internet access (including course web sites with hot links); demonstration aids and apparatus; magazines, journals, CD-ROMs and videos from the Library.

7.7 Assessment will be by a combination of coursework, tests, written and/or oral theory exams, reports, presentations, portfolios and other valid instruments, leading to Grades, GPA's, profiles and other appropriate forms of recording and reporting achievement at university standard, for formative and summative purposes, and towards **quality control metrics**. (N.B. Several aspects of the assessment process are subject to Accreditation Body requirements and/or University policy. Cf. ABET's *Criteria 2000* for the importance of quality metrics in accreditation.)

7.8 Management: The programme will be managed by the Programme Leader, who reports to the Director, Electrical Programmes. Subject-related and professional matters will be managed in consultation with the relevant Subject Leaders. Labs and related facilities and equipment fall under the responsibility of the Technical Supervisor, Electrical.

7.9 Estimated Budget: The income per student will be determined by the office of the Chief Business Officer. It is anticipated that this will be some J$ 40,000/ US $ 1,000 per semester. Other sums are also estimates, and are subject to change.

Contact Time (4 years):
Lectures/theory 1665 hrs
Lab/Workshop 990 hrs

Student Intake (three options/streams):	60	80	100
Lecturer Costs at J$ 1,800/hr	14 337 000	14 337 000	14 337 000
Administrative Support	2 000 000	2 700 000	3 300 000
Equipment (Recurrent)	3 500 000	4 700 000	5 800 000
RECURRENT EXPENDITURE	19 837 000	21 737 000	23 437 000
Students (10% attrition/yr)			
Freshman/first	60	80	100
Sophomore/second	54	72	90
Junior/third	49	65	81
Senior/fourth	44	59	73
POPULATION	207	276	344
INCOME	16 560 000	22 080 000	27 520 000
ESTIMATED SURPLUS/(DEFICIT)	(3 277 000)	343 000	4 083 000

7.10 Advisory Committee: The B.Eng, Electrical will be subject to ongoing assessment and development that will in part be based on the advice of the School of Engineering Advisory Committee. This Committee will consist of members of the engineering industry, the JIE and other relevant stakeholders.

8. Programme Structure:

General Objectives: As outlined in Sections 5 and 6 above.

Courses offered by Year: ***[Cf. Attached Appendix A for details of Options.]***

Freshman/First: This year is the School Core year, and aims to:

1. Substantially provide the necessary base in basic science, mathematics, and computing for proper understanding and practice of Engineering.
2. Introduce students to real-world Engineering science, design and praxis in the mechatronics paradigm.
3. Satisfy several aspects of the University Core Requirements in Communications, Mathematics, and Science and Technology.

SEMESTER 1	lec/wk	lab/wk	cr	SEMESTER 2	lec/wk	lab/wk	cr
SOE Seminars I	2	0	2	SOE Seminars II	2	0	2
EP I: Intro to Engg Syss	3	3	4	EP II: Structs. & Mats.	3	3	4
Computers in Engg	3	3	4	Physics I	3	3	4
Math. I	3	0	3	Math. II: Calculus II	3	3	4
Engg Graphics I	1	3	2	Chem I	2	3	3
Pickup Elective 1				Pickup Elective 2			
TOTALS:	12	9	15	TOTALS:	13	12	17

Sophomore/Second: Completes the Lower Division, and aims to:

1. Continue providing the base in science, mathematics, computing and Engineering Praxis.
2. Begin the process of specialisation.
3. Continue the process of satisfying university Gen. Ed. Core requirements, specifically in Communications.
4. Meet Accreditation Body requirements for Professionalism and related issues.

SEMESTER 3	lec/wk	lab/wk	cr	SEMESTER 4	lec/wk	lab/wk	cr
Comms 3	2	0	2	Comms 4	2	0	2
EP III: Mecha. Syss	3	3	4	EP IV: Profess'l Conduct	3	0	3
Physics II	3	3	4	Spec. Core III	3	3	4
Math 3: Algebra Topics	3	0	3	M 4: Diff. Eqns. & Apps.	3	0	3
Spec. Core I	3	3	4	Spec Core II	3	3	4
TOTALS:	14	9	17	TOTALS:	14	6	16

Junior/Third year: Begins the Upper Division, and aims to:

1. Meet Engineering Depth, Breadth & Coverage requirements.
2. Complete the math course sequence, and cover adjunct math/science/computing requirements.
3. Introduce Management and Engineering Economics, towards both General Education and Accreditation requirements.

SEMESTER 5	lec/wk	lab/wk	cr	SEMESTER 6	lec/wk	lab/wk	cr
Intro. M'gt for Engineers	3	0	3	Engg Econ	3	0	3
Engg	3	3	4	Engg	3	3	4
Engg	3	3	4	Engg	3	3	4
M/S/C* Elective 1	3	0	3	M/S/C* Elective 2	3	0	3
M5: Prob., Stat. & Quality	3	0	3	Math 6: Num. Anal.	3	0	3
TOTALS:	15	6	17	TOTALS:	15	6	17

Part of 1,000 hour industrial Experience requirement

* Math/Science/Computing Electives

Senior/Fourth year: Completes the programme, and aims to:

1. Complete Professional Engineering requirements, in a market-targetted context.
2. Provide an integrating capstone experience via a major project.
3. Develop Enterprise Management know-how.
4. Provide three free electives.

SEMESTER 7	lec/wk	lab/wk	cr	SEMESTER 8	lec/wk	lab/wk	cr
Engg Enterprise M'gt	3	0	3	Elective	3	0	3
Eng'g	3	3	4	Major Project	2*	3	3
Engg	3	3	4	Engg	3	3	4
Engg	3	3	4	Engg	3	3	4
Elective	3	0	3	Elective	3	0	3
TOTALS:	15	9	18	TOTALS:	14	9	17

Rest of 1,000 hour industrial experience requirement.
* Seminars, Workshops & Presentations.

9. **Analysis of Curriculum:** [Cf. Attached Table of Courses.]

COMPONENTS		**CREDITS**	**PERCENTAGE**
Gen. Ed.:	Comms 1 - 4	8	
	Professional Conduct	3	
	Soc. Sci.: M'gt 1 - 3	9	
		20	15
	"Double-Counted" Gen Ed:		
	Physics I [Sci.]	(4)	
	Eng. Praxis I [Tech.]	(4)	
	Math. I [Math]	(3)	
	Math 5 [Stats]	(3)	
	Comp's in Engg [IT]	(3)	
	Major Project [Capstone]	(3)	
		(20)	(15)
OVERALL Gen. Ed., inclusive of Double-Counted Credits			**(30)**
Adjunct:	Basic Science:		
	Physics I	4	
	Physics II	4	
	Engg Chem I	3	
	Computers in Engg	4	
	M/S/C Elec. 1, 2 (Yr. 3)	6	
		21	**15.8**
"Specialisation":			
	Spec. Core 1 - 3	12	
	Eng'g: Yr 3: 1 - 4	16	
	Engg: Yr 4: 1 - 5	20	
	Major Project:	3	
	Eng'g Praxis I - III	12	
	Engg Graphics	2	

COMPONENTS	CREDITS	PERCENTAGE
"Specialisation," Cont'd:		
Mathematics 1 - 6	18	
	83	**62.4**
General Electives: 1 - 3 (Yr. 4)	9	**6.8**
TOTAL (40 Courses)	**133**	**100%**

Component Weightings: cf. attached tables showing breakdown by year into Gen. Ed., Faculty Core, Programme Core, Specialisation, Adjunct Courses, and Elective Courses.

Attached/Available on Request:

1. Appendix A, Summarising the B.Eng by Years and by Options.
2. Table Illustrating B.Eng Electrical Breakdown by year and Aspect.
3. Summary matrix for B.Eng Electrical Programme. (Version 5E or later).
4. Briefing Note on Mechatronics, ICTs and Sociotechnical Systems.
5. European Union White Paper on ICTs and the emerging Information Society.
6. Collection of concept sheets on programme design-related topics.
7. The EPECE Programme proposal (July 1997), coordinated by Dr. J. Bridge and Mr. R. E. Sutherland, which sets the context for the work that led to this proposal.
8. Various Staff submissions on proposed programmes, Entry Level, SWOT analysis of the proposed structure [staff workshop feedback], etc.
9. Gardner's Multiple Intelligences may be researched in various sources, such as: Robert Owens' *Organisational Behavior in Education* (Needham heights, MA: Allyn & Bacon, 1995), p. 34 f; Henry Gardner's *Frames of Mind: the Theory of Multiple Intelligences* (NY: Basic Books, 1983); and his *Multiple Intelligences: the Theory in Praxis* (NY: Basic Books, 1993).
10. The CMU ECE Programme (from their Website), notification of NEEDHA 1998 Award for ECE Curriculum Innovation, and *Vision* Paper. This last summarises CMU's perspective on trends in Engineering and Technology.
11. Briefing Note: The Proposed Programme Entry Profile & Preliminary Standing Concepts

12. Briefing Note on Insight-Oriented Learning.

13. Briefing Note: Credit Hours, Student Workloads and Curriculum Restructuring.

14. Briefing Note: On A Model for Academic Staff Workloads in the U.Tech, Jamaica.

15. Notes on Proposed LES Courses, and on Communication and General Studies Courses.

16. 1998 Engineering School Report to the UCJ.

17. ABET Criteria 2000, with support documents for Self-Studies and Assessor Teams. (Local Accreditation materials will be available as soon as they become public.)

18. Washington Accord, with support materials from the USA (ABET), Britain (including SARTOR), Canada, etc.

19. Dearing Report on Higher Education in Britain.

APPENDIX A: B.Eng (Electrical) Courses by Year and by Option

INSTRUMENTATION AND CONTROL OPTION

Freshman/First: This year is the School Core year, and aims to:

4. Substantially provide the necessary base in basic science, mathematics, and computing for proper understanding and practice of Engineering.
5. Introduce students to real-world Engineering science, design and praxis in the mechatronics paradigm.
6. Satisfy several aspects of the University Core Requirements in Mathematics, and Science and Technology, Communications 1 and 2 already being satisfied in the PCS for those who pursued that intake route (but cf. point 6 above for A Level students).

SEMESTER 1:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars I	2	0	2
Engineering Praxis I: Introduction to Engineering Systems	3	3	4
Computers in Engineering	3	3	4
Mathematics I: Calculus I	3	0	3
Chemistry I	2	3	3
Pickup Elective 1	____	____	____
TOTALS:	13	9	16

SEMESTER 2:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars II	2	0	2
Engineering Praxis II: Structures and Materials	3	3	4
Physics I	3	3	4
Mathematics II: Calculus II	3	0	3
Engineering Graphics I	2	3	3
Pickup Elective 2	____	____	____
TOTALS:	11	12	16

Sophomore/Second: Completes the Lower Division, and aims to:

5. Continue providing the base in science, mathematics, computing and Engineering Praxis.
6. Begin the process of specialisation.
7. Continue the process of satisfying university Gen. Ed. Core requirements, specifically in Communications.
8. Meet Accreditation Body requirements for Professionalism and related issues.

SEMESTER 3:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 3	2	0	2
Engineering Praxis III: Mechatronic Systems	3	3	4
Physics II	3	3	4
Mathematics III: Algebra Topics	3	0	3
Specialisation Core I: Introduction to Electrical & Computer Engineering II	3	3	4
TOTALS:	14	9	17

SEMESTER 4:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 4	2	0	2
Engineering Praxis IV: Engineer in Society	3	0	3
Specialisation Core II: Electronic Devices, Circuits, Models & Signals	3	3	4
Mathematics IV: Differential Equations and Applications	3	0	3
Specialisation Core III: Digital Electronics I	3	3	4
TOTALS:	14	6	16

Junior/Third year: Begins the Upper Division, and aims to:

4. Meet Engineering Depth, Breadth & Coverage requirements.
5. Complete the math course sequence, and cover adjunct math/science/computing requirements.
6. Introduce Management and Engineering Economics, towards both General Education and Accreditation requirements.

SEMESTER 5:	Lec./wk	Lab/wk	Credits
Introduction to Management for Engineers	3	0	3
Engineering: Networks, Signals, Systems & Transforms	3	3	4
Engineering: Digital Electronics II, OR Industrial Electronics	3	3	4
Mathematics V: Probability, Statistics & Quality	3	0	3
Math/Science/Computing Elective I: C++ Programming	3	0	3
TOTALS:	15	6	17

SEMESTER 6:	Lec./wk	Lab/wk	Credits
Engineering Economics, Project Appraisal & Planning	3	0	3
Engineering: Instrumentation Systems	3	3	4
Engineering: Control Systems	3	3	4
Mathematics VI: Numerical Analysis	3	0	3
Math/Science/Computing Elective II: Digital Signal Processing	3	0	3
TOTALS:	15	6	17

Part of 1,000 hour industrial Experience requirement

Senior/Fourth year: Completes the programme, and aims to:

5. Complete Professional Engineering requirements, in a market-targetted context.
6. Provide an integrating capstone experience via a major project.
7. Develop Enterprise Management know-how.
8. Provide three free electives.

SEMESTER 7:	Lec./wk	Lab/wk	Credits
Engineering Enterprise Management	3	0	3
Engineering: Industrial Instrumentation & Control Systems	3	3	4
Engineering: Computer-Based Control Systems	3	3	4
Engineering: Robotics & Mechatronics	3	3	4
Elective	3	0	3
TOTALS:	15	9	18

SEMESTER 8:	Lec./wk	Lab/wk	Credits
Elective	3	0	3
Elective	3	0	3
Engineering: Major Project	2*	3	3
Engineering: TWO Electives from:			
Biomedical Instrumentation	)		
Advanced Robotics & Mechatronics	) 3	3	4
Distributed Control Systems in Process Industries	)	+	
Test & Measurement Instrumentation & Control Systems	) 3	3	4
Avionics Systems	)		
Automotive instrumentation & Control Systems	)		
Industrial Safety & Security Systems	)		
Free Choices, Subject to Approval	)____	____	____
TOTALS:	14	9	17

Rest of 1,000 hour industrial experience requirement.
* Seminars, Workshops & Presentations.

POWER OPTION

Freshman/First: This year is the School Core year, and aims to:

1. Substantially provide the necessary base in basic science, mathematics, and computing for proper understanding and practice of Engineering.
2. Introduce students to real-world Engineering science, design and praxis in the mechatronics paradigm.
3. Satisfy several aspects of the University Core Requirements in Mathematics, and Science and Technology, Communications 1 and 2 already being satisfied in the PCS for those who pursued that intake route (but cf. point 6 above for A Level students).

SEMESTER 1:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars I	2	0	2
Engineering Praxis I: Introduction to Engineering Systems	3	3	4
Computers in Engineering	3	3	4
Mathematics I: Calculus I	3	0	3
Chemistry I	2	3	3
Pickup Elective 1	____	____	____
TOTALS:	13	9	16

SEMESTER 2:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars II	2	0	2
Engineering Praxis II: Structures and Materials	3	3	4
Physics I	3	3	4
Mathematics II: Calculus II	3	0	3
Engineering Graphics I	2	3	3
Pickup Elective 2	____	____	____
TOTALS:	11	12	16

Sophomore/Second: Completes the Lower Division, and aims to:

1. Continue providing the base in science, mathematics, computing and Engineering Praxis.
2. Begin the process of specialisation.
3. Continue the process of satisfying university Gen. Ed. Core requirements, specifically in Communications.
4. Meet Accreditation Body requirements for Professionalism and related issues.

SEMESTER 3:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 3	2	0	2
Engineering Praxis III: Mechatronic Systems	3	3	4
Physics II	3	3	4
Mathematics III: Algebra Topics	3	0	3
Specialisation Core I: Introduction to Electrical & Computer Engineering II, OR Introduction to Electrical Engineering	3	3	4
TOTALS:	14	9	17

SEMESTER 4:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 4	2	0	2
Engineering Praxis IV: Engineer in Society	3	0	3
Specialisation Core II: Electronic Devices, Circuits, Models & Signals	3	3	4
Mathematics IV: Differential Equations and Applications	3	0	3
Specialisation Core III: Digital Electronics I	3	3	4
TOTALS:	14	6	16

Junior/Third year: Begins the Upper Division, and aims to:

1. Meet Engineering Depth, Breadth & Coverage requirements.
2. Complete the math course sequence, and cover adjunct math/science/computing requirements.
3. Introduce Management and Engineering Economics, towards both General Education and Accreditation requirements.

SEMESTER 5:	Lec./wk	Lab/wk	Credits
Introduction to Management for Engineers	3	0	3
Engineering: Networks, Signals, Systems & Transforms	3	3	4
Engineering: Engineering Electromagnetics	3	3	4
Mathematics V: Probability, Statistics & Quality	3	0	3
Math/Science/Computing Elective I: C++ Programming	3	0	3
TOTALS:	15	6	17

SEMESTER 6:	Lec./wk	Lab/wk	Credits
Engineering Economics, Project Appraisal & Planning	3	0	3
Engineering: Energy Conversion & Machines	3	3	4
Engineering: Control Systems	3	3	4
Mathematics VI: Numerical Analysis	3	0	3
Math/Science/Computing Elective II: Microprocessors & Microcontrollers	3	0	3
TOTALS:	15	6	17

Part of 1,000 hour industrial Experience requirement

Senior/Fourth year: Completes the programme, and aims to:

1. Complete Professional Engineering requirements, in a market-targetted context.
2. Provide an integrating capstone experience via a major project.
3. Develop Enterprise Management know-how.
4. Provide three free electives.

SEMESTER 7:	Lec./wk	Lab/wk	Credits
Engineering Enterprise Management	3	0	3
Engineering: Power System Analysis	3	3	4
Engineering: Industrial Power Electronics & Electrical Systems	3	3	4
Engineering: First Engineering Elective, from:	) 3	3	4
Alternative & Renewable Energy & Power Systems	)		
Power Systems Protection	)		
Heating, Ventilation & Air Conditioning Systems	)		
Free Choice, Subject to Approval	)		
Elective	3	0	3
TOTALS:	15	9	18

SEMESTER 8:	Lec./wk	Lab/wk	Credits
Elective	3	0	3
Elective	3	0	3
Engineering: Major Project	2*	3	3
Engineering: SECOND Elective from above list	3	3	4
Engineering: Advanced Power Circuits & Networks Analysis & Modelling	3	3	4
TOTALS:	14	9	17

Rest of 1,000 hour industrial experience requirement.
* Seminars, Workshops & Presentations.

ELECTRONICS AND TELECOMMUNICATIONS OPTION

Freshman/First: This year is the School Core year, and aims to:

1. Substantially provide the necessary base in basic science, mathematics, and computing for proper understanding and practice of Engineering.
2. Introduce students to real-world Engineering science, design and praxis in the mechatronics paradigm.
3. Satisfy several aspects of the University Core Requirements in Mathematics, and Science and Technology, Communications 1 and 2 already being satisfied in the PCS for those who pursued that intake route (but cf. point 6 above for A Level students).

SEMESTER 1:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars I	2	0	2
Engineering Praxis I: Introduction to Engineering Systems	3	3	4
Computers in Engineering	3	3	4
Mathematics I: Calculus I	3	0	3
Chemistry I	2	3	3
Pickup Elective 1			
TOTALS:	13	9	16

SEMESTER 2:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars II	2	0	2
Engineering Praxis II: Structures and Materials	3	3	4
Physics I	3	3	4
Mathematics II: Calculus II	3	0	3
Engineering Graphics I	2	3	3
Pickup Elective 2	____	____	____
TOTALS:	11	12	16

Sophomore/Second: Completes the Lower Division, and aims to:

1. Continue providing the base in science, mathematics, computing and Engineering Praxis.
2. Begin the process of specialisation.
3. Continue the process of satisfying university Gen. Ed. Core requirements, specifically in Communications.
4. Meet Accreditation Body requirements for Professionalism and related issues.

SEMESTER 3:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 3	2	0	2
Engineering Praxis III: Mechatronic Systems	3	3	4
Physics II	3	3	4
Mathematics III: Algebra Topics	3	0	3
Specialisation Core I: Introduction to Electrical & Computer Engineering II	3	3	4
TOTALS:	14	9	17

SEMESTER 4:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 4	2	0	2
Engineering Praxis IV: Engineer in Society	3	0	3
Mathematics IV: Differential Equations and Applications	3	0	3
Specialisation Core II: Electronic Devices, Circuits, Models & Signals	3	3	4
Specialisation Core III: Digital Electronics I	3	3	4
TOTALS:	14	6	16

Junior/Third year: Begins the Upper Division, and aims to:

1. Meet Engineering Depth, Breadth & Coverage requirements.
2. Complete the math course sequence, and cover adjunct math/science/computing requirements.
3. Introduce Management and Engineering Economics, towards both General Education and Accreditation requirements.

SEMESTER 5:	Lec./wk	Lab/wk	Credits
Introduction to Management for Engineers	3	0	3
Engineering: Networks, Signals, Systems & Transforms	3	3	4
Engineering: Digital Electronics II, OR Industrial Electronics	3	3	4
Mathematics V: Probability, Statistics & Quality	3	0	3
Math/Science/Computing Elective I: C++ Programming	3	0	3
TOTALS:	15	6	17

SEMESTER 6:	Lec./wk	Lab/wk	Credits
Engineering Economics, Project Appraisal & Planning	3	0	3
Engineering: Analogue & Digital Telecommunications Systems	3	3	4
Engineering: Electromagnetics & Propagation	3	3	4
Mathematics VI: Numerical Analysis	3	0	3
Math/Science/Computing Elective II: Digital Signal Processing	3	0	3
TOTALS:	15	6	17

Part of 1,000 hour industrial Experience requirement

Senior/Fourth year: Completes the programme, and aims to:

1. Complete Professional Engineering requirements, in a market-targetted context.
2. Provide an integrating capstone experience via a major project.
3. Develop Enterprise Management know-how.
4. Provide three free electives.

SEMESTER 7:	Lec./wk	Lab/wk	Credits
Engineering Enterprise Management	3	0	3
Engineering: Wireless Transmission Systems & networks	3	3	4
Engineering: Microwave Components & Systems I	3	3	4
Engineering: Digital Telephony Systems & Networks	3	3	4
Elective	3	0	3
TOTALS:	15	9	18

SEMESTER 8:	Lec./wk	Lab/wk	Credits
Elective	3	0	3
Elective	3	0	3
Engineering: Major Project	2*	3	3
Engineering: TWO Electives from:			
Broadcast, Cable & Satellite TV Systems Computer network Systems & Protocols Microwave Components & Systems II Convergence & Mulimedia Telecommunications Systems Free Choice, Subject to Approval	3 3	3 3	4 4
TOTALS:	14	9	17

Rest of 1,000 hour industrial experience requirement.
* Seminars, Workshops & Presentations.

INDUSTRIAL ELECTRONICS & AUTOMATION OPTION

Freshman/First: This year is the School Core year, and aims to:

1. Substantially provide the necessary base in basic science, mathematics, and computing for proper understanding and practice of Engineering.
2. Introduce students to real-world Engineering science, design and praxis in the mechatronics paradigm.
3. Satisfy several aspects of the University Core Requirements in Mathematics, and Science and Technology, Communications 1 and 2 already being satisfied in the PCS for those who pursued that intake route (but cf. point 6 above for A Level students)

SEMESTER 1:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars I	2	0	2
Engineering Praxis I: Introduction to Engineering Systems	3	3	4
Computers in Engineering	3	3	4
Mathematics I: Calculus I	3	0	3
Chemistry I	2	3	3
Pickup Elective 1			
TOTALS:	13	9	16

SEMESTER 2:	Lec./wk	Lab/wk	Credits
School of Engineering Seminars II	2	0	2
Engineering Praxis II: Structures and Materials	3	3	4
Physics I	3	3	4
Mathematics II: Calculus II	3	0	3
Engineering Graphics I	2	3	3
Pickup Elective 2			
TOTALS:	11	12	16

Sophomore/Second: Completes the Lower Division, and aims to:

1. Continue providing the base in science, mathematics, computing and Engineering Praxis.
2. Begin the process of specialisation.
3. Continue the process of satisfying university Gen. Ed. Core requirements, specifically in Communications.
4. Meet Accreditation Body requirements for Professionalism and related issues.

SEMESTER 3:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 3	2	0	2
Engineering Praxis III: Mechatronic Systems	3	3	4
Physics II	3	3	4
Mathematics III: Algebra Topics	3	0	3
Specialisation Core I: Introduction to Electrical & Computer Engineering	3	3	4
TOTALS:	14	9	17

SEMESTER 4:	Lec./wk	Lab/wk	Credits
U.Tech Core Communication Course # 4	2	0	2
Engineering Praxis IV: Engineer in Society	3	0	3
Specialisation Core II: Electronic Devices, Circuits, Models & Signals	3	3	4
Mathematics IV: Differential Equations and Applications	3	0	3
Specialisation Core III: Digital Electronics I	3	3	4
TOTALS:	14	6	16

Junior/Third year: Begins the Upper Division, and aims to:

1. Meet Engineering Depth, Breadth & Coverage requirements.
2. Complete the math course sequence, and cover adjunct math/science/computing requirements.
3. Introduce Management and Engineering Economics, towards both General Education and Accreditation requirements.

SEMESTER 5:	Lec./wk	Lab/wk	Credits
Introduction to Management for Engineers	3	0	3
Engineering: Networks, Signals, Systems & Transforms	3	3	4
Engineering: Digital Electronics II, OR Industrial Electronics	3	3	4
Mathematics V: Probability, Statistics & Quality	3	0	3
Math/Science/Computing Elective I: C++ Programming	3	0	3
TOTALS:	15	6	17

SEMESTER 6:	Lec./wk	Lab/wk	Credits
Engineering Economics, Project Appraisal & Planning	3	0	3
Engineering: Analogue & Digital Telecommunications Systems	3	3	4
Engineering: Instrumentation Systems	3	3	4
Mathematics VI: Numerical Analysis	3	0	3
Math/Science/Computing Elective II: Digital Signal Processing	3	0	3
TOTALS:	15	6	17

Part of 1,000 hour industrial Experience requirement

Senior/Fourth year: Completes the programme, and aims to:

1. Complete Professional Engineering requirements, in a market-targetted context.
2. Provide an integrating capstone experience via a major project.
3. Develop Enterprise Management know-how.
4. Provide three free electives.

SEMESTER 7:	Lec./wk	Lab/wk	Credits
Engineering Enterprise Management	3	0	3
Engineering: Systems Engineering	3	3	4
Engineering: Control Systems	3	3	4
Engineering: Computer Network Systems & Protocols	3	3	4
Elective	3	0	3
TOTALS:	15	9	18

SEMESTER 8:	Lec./wk	Lab/wk	Credits
Elective	3	0	3
Elective	3	0	3
Engineering: Major Project	2	3	3
Engineering: TWO Electives from the range offered, Subject to approval:	) 3)) 3	3 + 3	4 4
TOTALS:	14	9	17

Rest of 1,000 hour industrial experience requirement.
* Seminars, Workshops & Presentations.