PHEE Annual Conference
January 2006

IEE Accreditation and Output Standards

Peter Hicks
University of Manchester

Overview

- IEE Degree Accreditation
  - Aims and Objectives
  - Documents, Forms and Procedures
- UK-SPEC Output Standards
  - Incorporating output standards into the degree accreditation process
  - Outcomes of consultation
- Conclusions.

Aims of Accreditation

- To identify undergraduate degrees that meet the requirements of UK-SPEC
- To promote best practice across the UK higher education sector
- To assist departments to deliver degrees to a standard that is acceptable to universities and industry

Qualifications Board Review

- Review prompted by changes resulting from the introduction of UK-SPEC
- New committee structure

IEE Degree Accreditation

The Academic Accreditation Committee

- 18 Members drawn from academia and industry including observers from the EC^{UK}, BCS, IIE and Qualifications Assessment Committee.

The Academic Accreditation Team

- 55 members from academia and industry, both new members and ex-Committee members.

The Staff

- Dan Canty, Accreditation Manager
- Jane Black, Senior Accreditation Coordinator
- Marilyn Comparetto, Accreditation Coordinator
- Martina Mullan, Accreditation Coordinator

Accreditation Visits

Types of visits:

- Full visits
- Visits aligned with internal periodic review
- Joint visits
- DABCE (EAB) visits
- Monitoring visits
- Advisory visits

Overview of the Process

Typical constitution of visiting panels

- Chair
- Two members from academia
- One member from industry
- One member of IEE staff

The constitution may vary depending on the number and range of degrees being accredited.

Accreditation Process I

- Visits extend over 1½ - 2 days
- The Panel reviews many aspects associated with the programmes:
  - Curriculum
  - Teaching & Learning Methods
  - Projects and Practical Work
  - Industrial Inputs
  - Assessment Procedures and Outcomes

Accreditation Process II

- Student Admissions and Progression
- Employment Patterns
- Staffing and Resources
- Quality Assurance Procedures

- A much greater emphasis is now being placed on whether students are achieving the desired **Learning Outcomes**.

Why the Change?

- In 2003 the EC^{UK} reviewed the criteria for accrediting engineering programmes in the UK, moving from focusing on input standards to output standards.
- This resulted in the publication of UK-SPEC, Accreditation of Higher Education Programmes in 2004.

Implications for the IEE

- The IEE has had to re-examine the criteria used to accredit programmes to ensure that they are compliant with UK-SPEC, and establish its own discipline-specific exemplars
- It has given us the chance to completely review all related documentation and procedures.

Forms & Documents

- All visit documents have been reviewed. The amount of information requested has been reduced and a significant effort has been made to use the information already available in departments
- A complete set of guidance notes, documents and forms can be downloaded from:

http://www.iee.org/ProfessionalRegistration/Accreditation/

Submission for Accreditation

- Departments are required to complete Form A parts 1 & 2
  - 11 sections; 46 criteria assessed
- A matrix of Learning Outcomes is prepared, showing where in the degree programmes students are given the opportunity to acquire the knowledge and skills necessary to achieve the UK-SPEC learning outcomes.

UK-SPEC Learning Outcomes

- IEE Handbook of Learning Outcomes
  - Based on UK-SPEC learning outcomes
  - Structured around 8 subject themes
  - Provides discipline-based exemplars
  - Balance between over- & under prescription
- Learning Outcomes Matrix
  - Maps module/unit outcomes for each programme onto UK-SPEC learning outcomes

UK-SPEC Learning Outcomes

- All Engineering graduates must be able to demonstrate the following General Learning Outcomes:
  - Knowledge and Understanding.
  - Intellectual Abilities.
  - Practical Skills.
  - General Transferable Skills.

UK-SPEC Learning Outcomes

- They must also possess the following Specific Learning Outcomes:
  - Underpinning Science & Mathematics.
  - Engineering Analysis.
  - Design.
  - Economic, Social & Environmental Context.
  - Engineering Practice.

IEE Discipline Specific Learning Outcomes

Taking each of the five main EC^{UK} specific learning outcomes and their associated statements, the IEE Output Standards Working Party has produced the IEE discipline-specific learning outcomes handbook, which includes discipline-specific exemplars for each statement in UK-SPEC

Key Issues

- Range of degrees accredited by IEE is very broad – learning outcomes will vary according to the nature of the subjects studied.
- Identified the need to strike a balance between over-prescription (which inhibits diversity) and lack of definition (which inhibits objective decision making).

IEE Approach

- A wide range of programmes can be assembled by combining topics drawn from eight **Subject Themes**.
- Using the UK-SPEC engineering-specific learning outcomes as a template, identify typical outcomes that graduates should be expected to achieve (exemplars).
- Where necessary the exemplars are differentiated according to the various subject themes.

IEE Subject Themes

Group	Subject Theme
A	Electrical Engineering
B	Electronic Eng (Analogue/Digital)
C	Control and Instrumentation Eng
D	Communication Engineering
E	Manufacturing Systems Engineering
F	Digital Systems Engineering
G	Computer Systems Engineering
H	Software Eng/Computer Science

Joint Degrees

- A need was identified for a ninth theme (Theme I) to account for those subjects that can be combined with Electrical & Electronic Engineering and related disciplines (examples include Music Technology, Biophysics, Business Studies etc.).

UK-SPEC Learning Outcomes - Underpinning Science & Mathematics

Students must be able to demonstrate:

B1 Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of historical, current, and future developments and technologies;

IEE Learning Outcomes – All Themes

Discipline-Specific Exemplars

With reference to learning outcome **B1** (and, in the case of MEng students, **M1** and **M2**), the underpinning scientific principles and methodologies that relate to Themes A – H in Table 1 are:

- Electricity and magnetism
- AC electric circuits
- DC electric circuits
- Basic optics, properties of materials and quantum physics
- Thermal analysis including heat transfer
- Measurement of flow, pressure, temperature, position, force, velocity and acceleration
- Circular motion
- Forces, energy and work, Newton's laws of motion
- Vibrations and waves

UK-SPEC Learning Outcomes - Engineering Analysis

Students must be able to demonstrate:

B4 Understanding of engineering principles and the ability to apply them to analyse key engineering processes;

In addition, MEng graduates may be characterised by the following attributes:

M5 An ability to use fundamental knowledge to investigate new and emerging technologies;

IEE Learning Outcomes – Theme B

Discipline-Specific Exemplars

To establish whether learning outcome **B4** (and, in the case of MEng students, **M5**) is being achieved, accreditors will seek to determine whether students can demonstrate competence in areas that are substantially equivalent to those listed below:

Theme B: Electronic Engineering (Analogue/Digital)
Apply physical principles and quantitative methods to the development of abstract models for electronic components including

- Passive components (e.g. resistors, capacitors and inductors)
- Semiconductor devices (e.g. diodes, bipolar junction transistors
- Field effect transistors and operational amplifiers).

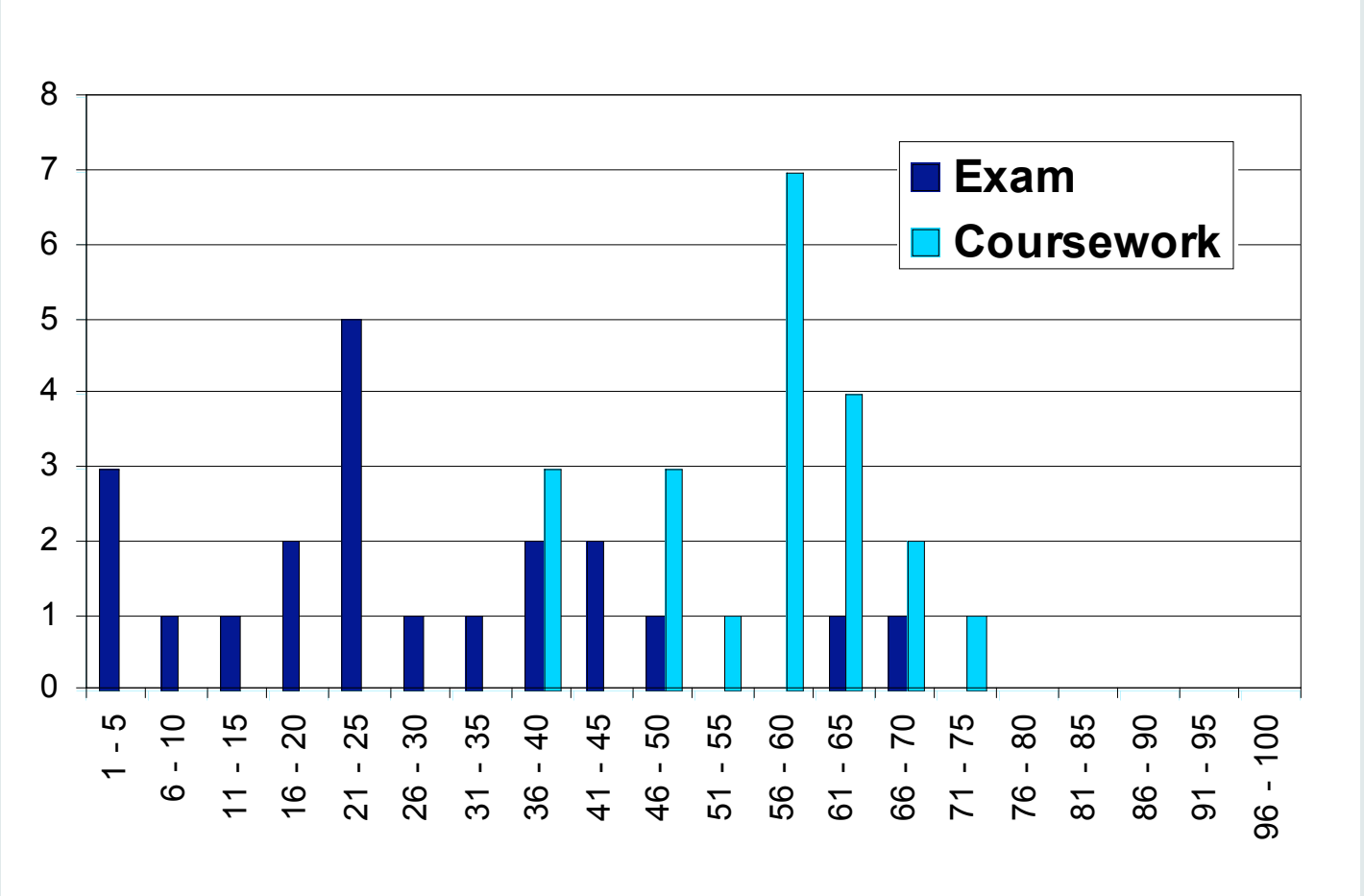
Demonstrate an understanding of the trade-off between the complexity of the abstract model and its ability to accurately predict device behaviour.

Demonstrate a knowledge and understanding of the range of applicability of abstract models of electronic components and their fundamental limitations in linear and non-linear circuit applications.

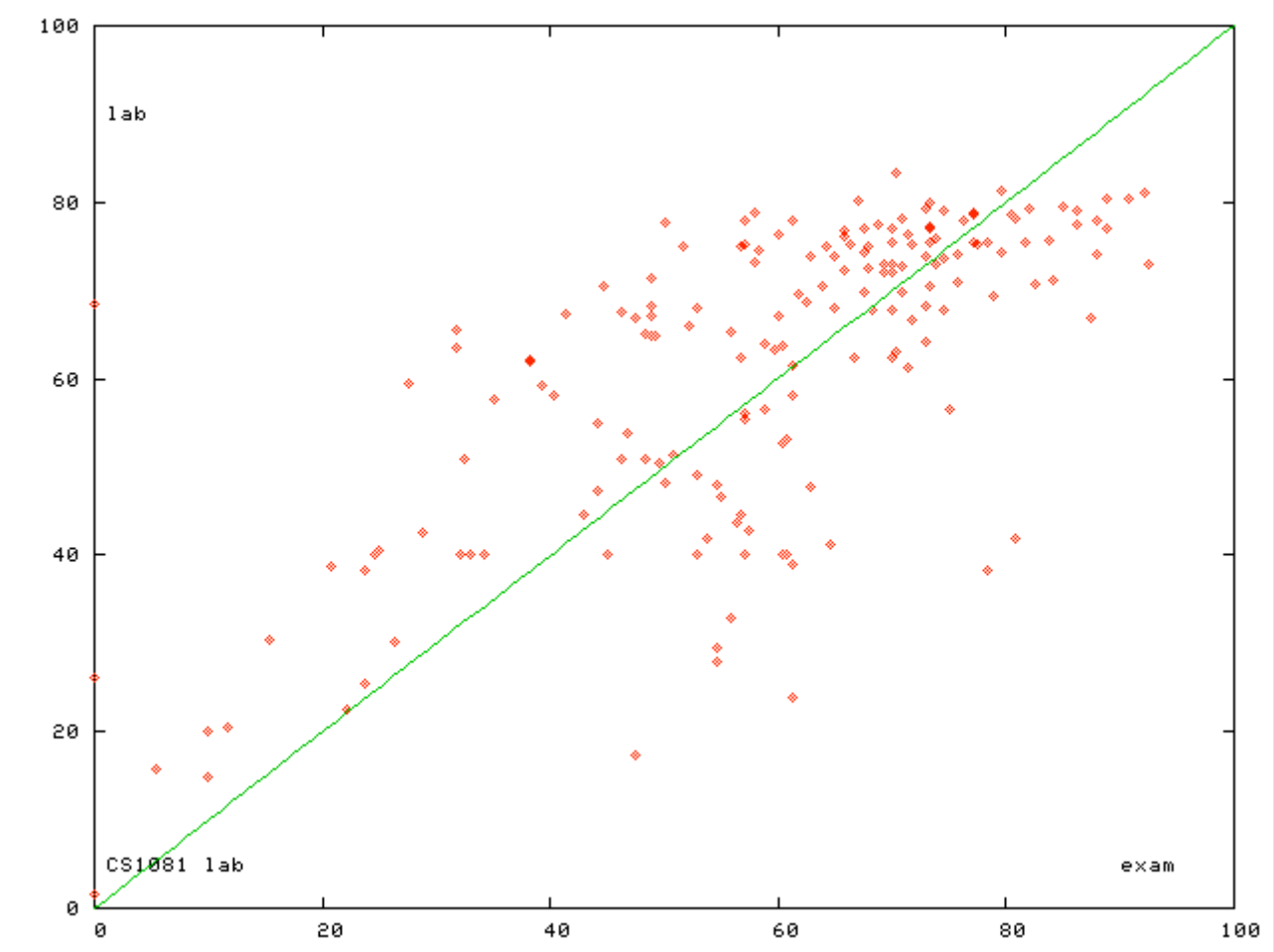
Evidence of Outcomes

- Accreditors require access to samples of student work – examination scripts, coursework and projects.
- Further evidence can be provided by results histograms or scatter diagrams showing the distribution of examination and coursework marks.

Histogram


8
7
6
5
4
3
2
1
0
Exam
Coursework
1 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 30
31 - 35
36 - 40
41 - 45
46 - 50
51 - 55
56 - 60
61 - 65
66 - 70
71 - 75
76 - 80
81 - 85
86 - 90
91 - 95
96 - 100

Scatter Diagram



Competence Threshold

- What is the minimum level of achievement that corresponds to the UK-SPEC competence requirements for CEng registration?
- One view is that on average across the UK the minimum level of competence should be considered as equivalent to a 2.II BEng/MEng (Hons) degree.

Consultation Exercise

"In your own institution, what class of degree would graduates need to obtain to achieve the UK-SPEC learning outcomes."

Level	Responses
2.1	2
2.2	5
3	3
No level indicated	5

Would it be appropriate to vary the level?

Consultation Exercise

- Of the 17 universities that responded to the questionnaire:
  - 75% were generally satisfied with the IEE approach – use of exemplars and matrix;
  - Some concerns regarding Computer Systems Eng. / Software Eng.
  - 44% thought that the Handbook ".. clearly defined the standard that graduates must achieve."

Conclusions

- The IEE has incorporated the UK-SPEC output standards into its procedures for the accreditation of degree programmes.
- The accreditation process has been substantially modified to take account of these developments.
- The ‘competence threshold’ question has yet to be resolved. Should it be 2.II? Should it be variable?

Acknowledgements

Output Standards WP

- Erik Dagless
- Malcolm McCormick
- Tom Ridgman
- David Young
- Mike Cunningham

IEE Staff

- Jane Black
- Dan Canty
- Derek Shields
- Marilyn Comparetto
- Martina Mullan

URL for IEE Accreditation documents, forms and guidelines:

http://www.iee.org/ProfessionalRegistration/Accreditation/