

BTEC Higher Nationals in Aerospace Engineering

Teaching Resources

This **Course Guidance** document includes the annexes to the syllabus document as well as a list of other relevant publications.

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1.0 ANNEXES TO GUIDANCE INFORMATION

1.1 Standards and Routes to Registration (SARTOR)

The Third Edition of the Engineering Council's policy statement 'Standards and Routes to Registration' was published in September 1997. Whilst not affecting students in mid-course at the time of change, the third edition criteria become effective on 1 September 1999.

The educational base requirement for Incorporated Engineer registration is:

a 3-year programme comprising either an engineering, technology or science bachelor degree (not necessarily honours), which has been accredited for IEng registration under the criteria given in SARTOR 3rd Edition Part 2 Section 4.1.2

OR

an Edexcel BTEC Higher National Diploma in Engineering, based on the 1997 (or later) BTEC Guidelines, and complemented by a Matching Section of further learning. The Higher National Certificate can be part of the route; however, the student will need to achieve the breadth of the 16 unit HND as well as the Matching Section. Although the unit details will differ, the SQA-SCOTVEC Higher Nationals may also be used.

The requirements of the **Matching Section**, the further learning equivalent to one academic year of study beyond HND, could be met through:

- Edexcel BTEC Professional Development Qualification programmes (full-time, part-time or modular), particularly those which integrate technology and engineering business management, or which lead to a specialist sub-discipline
- programmes designed by a university or college as a bridge between its accredited HND and its own degree programmes which are accredited for IEng. Ideally, the total package of such provisions should be accredited together
- Edexcel BTEC programmes which provide for progression from the 10 unit HNC to the 16 unit HND, as the first stage of this process for those progressing from an HNC base
- equivalent schemes appropriate to SQA-SCOTVEC Higher National and Professional Development Awards
- education, training and development programmes operated by private and public sector employers such as consultants, industrial companies, the civil service and armed forces. These schemes often include the equivalent of an academic year of 'educational development' in technology, management, personal skills etc in addition to 'training and experience'
- Integrated Development Schemes and College-Business Partnerships (Teaching Company Schemes for FE)
- distance learning packages aimed at particular graduate employment opportunities in specialist fields or at those in remote locations or mobile jobs
- employment-based or institution-based schemes leading to a particular form of employment. Whilst statutory or NVQ/SVQ certification of competent performance may be involved, it is the development of the knowledge, understanding and transferable skills which is key to matching sections. An NVQ/SVQ used for this purpose would have been recognised by the institution concerned, in accordance with the Engineering Council's

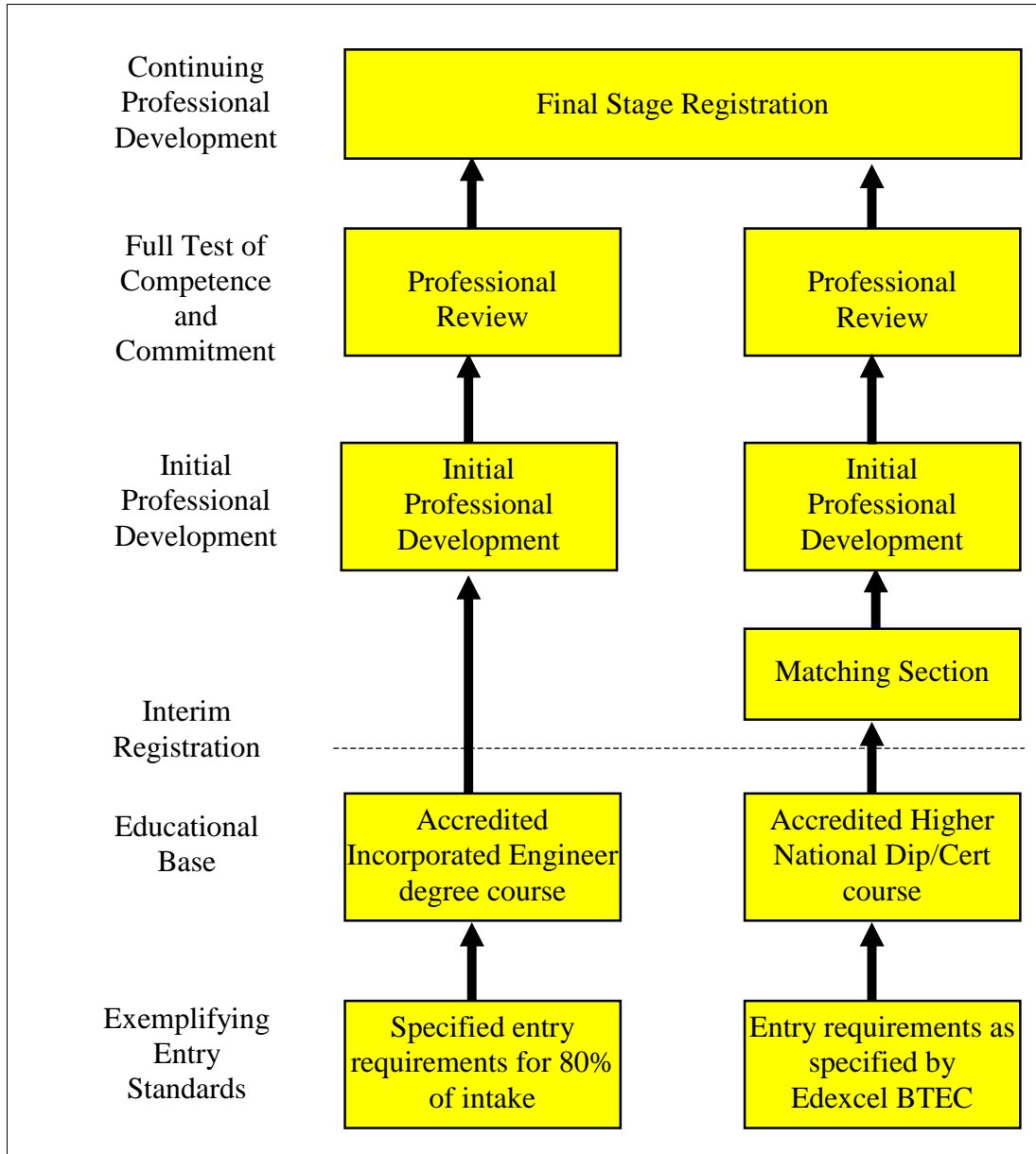
Guidance to Institutions and Awarding Bodies on Occupational Standards, N/SVQs and Registration.

Higher National students, who are already registered on an HNC or HND course on 1 September 1999, will be considered to be on the route to the educational base qualification at the time of change. Provided that they achieve the award by 31 August 2003, they will be permitted to register for Incorporated Engineer at Stage 1 under the SARTOR Second Edition criteria. However, they must subsequently complete their Initial Professional Development under the new criteria.

The SARTOR Second Edition educational criteria for IEng, applicable to this transitional group of students, are a BTEC Higher National Certificate or Diploma which meets the following specification:

- *8 H level units* relevant to engineering, normally completed as an integral part of a Higher National programme. This requirement is automatically met by any engineering HNC/D programme which started after September 1987. These units:
 - must include an engineering project of at least 1.0 unit value, that integrates work within the course and demonstrates the student's ability in areas of application of engineering theory. The project may be done in groups or individually, but it must be individually assessed
 - may include appropriate specialised mathematics, quantitative techniques, management or other professional studies relevant to particular engineering disciplines.
- N level units, as follows:
 - mathematics related to engineering applications of at least 1.0 unit or equivalent, at level NIII. This requirement is exceeded in any engineering HNC/D programme which started after September 1994, as this requires a minimum of one H-level unit of mathematics
 - computing, with assignment work related to engineering applications of at least 1.0 unit value or equivalent, at level NII. This requirement is universally met through the quality requirements applied for the approval of all engineering programmes since September 1987.

Benchmark Routes for Incorporated Engineer:



*The normally expected full-time equivalent course lengths are 3 years for IEng degree and 2 years for the HND

1.2 Summary of Common Skills outcome statements

Common Skills	Outcome
Managing and Developing Self	1 Manage own roles and responsibilities 2 Manage own time in achieving objectives 3 Undertake personal and career development 4 Transfer skills gained to new and changing situations and contexts
Working with and Relating to Others	5 Treat others' values, beliefs and opinions with respect 6 Relate to and interact effectively with individuals and groups 7 Work effectively as a team member
Communicating	8 Receive and respond to a variety of information 9 Present information in a variety of visual forms 10 Communicate in writing 11 Participate in oral and non-verbal communication
Managing Tasks and Solving Problems	12 Use information sources 13 Deal with a combination of routine and non-routine tasks 14 Identify and solve routine and non-routine problems
Applying Numeracy	15 Apply numerical skills and techniques
Applying Technology	16 Use a range of technological equipment and systems
Applying Design and Creativity	17 Apply a range of skills and techniques to develop a variety of ideas in the creation of new/modified products, services or situations 18 Use a range of thought processes

Further guidance is available in the following Edexcel publications:

Common Skills and Core Themes – General Guidance (80-037-2)

Common Skills and Core Themes – Implementation Guidance (80-040-2)

1.3 Engineering applications

All engineering higher education, being submitted for accreditation for IEng registration, must be provided in the context of Engineering Applications (EA). The term ‘Engineering Applications’ originated in the Finniston Report *Engineering Our Future* in 1980. These are intended for integration into higher education courses to give structure and definition to the application of engineering. They aim to achieve some of the benefits integrated sandwich courses where such courses are not available.

There are two components: Engineering Applications 1 (EA1) and Engineering Applications 2 (EA2).

EA1 – an introduction to the fabrication and use of materials, designed to raise students’ awareness of the realities of present-day industrial processes. This focuses on practical engineering in the context of design, manufacture, construction, assembly, commissioning, operation, maintenance, reliability and quality of products and systems.

EA2 – the application of engineering principles to the solution of practical problems through upon engineering systems and processes. This should ideally be a learning theme which runs through all aspects of the course. However, it will be particularly evident in projects relating to real engineering problems, undertaken both individually and in groups, which integrate practical, theoretical, business and personal development skills and knowledge.

The extent to which a cohort of students needs to be formally introduced to EA will vary with their educational, personal and industrial background. Part-time and integrated sandwich course students, and those with other accredited work-based learning, will have opportunities to develop EA at work. Nevertheless, all students should be aware of the broader educational potential of their own experiences and skills.

There is no clear boundary between EA1 and EA2 and, because many aspects of both can be integrated in the content of programmes, there is every reason not to introduce one.

As new technologies and materials are introduced, engineers need multidisciplinary skills, and the way you implement EA1 and EA2 should reflect this. You should, wherever possible, choose engineering applications that relate to each student’s chosen discipline: for example, for ‘electronic’ technician engineers, workshop methods involving hand tools and materials processing should probably be related to the electronics industry’s manufacturing methods.

EA1 can be done at work or in the centre. In full-time and sandwich (ie HND) programmes, activity for EA1 should take about 300 hours. In a well-designed and implemented course, up to 200 hours of this could be identifiable within programme units. In part-time (HNC and HND) programmes, students can provide evidence of objectives that they have met at work and through a log book signed by a responsible supervisor.

GUIDANCE FOR INTERPRETATION OF ENGINEERING APPLICATIONS

EA1

To achieve EA1 the student should:

- 1 Use safe working practices, and understand the reason for them

Safety in line with good industrial practice and current legislation and regulations must be a theme throughout the course.

- 2 Appreciate multidisciplinary practical skills through the use of industrial equipment and processes

As manufacturing systems and products become more complex, technician engineers will need a wide range of technological skills. An increasingly necessary requirement is for the integration of skills from mechanical engineering, electronic engineering and computing. Activities must therefore reflect the general convergence of traditionally separate disciplines.

All the following should be covered, though the depth of cover and the illustrative material required will vary according to the needs of students and industry:

- hand tools
- material removal
- material forming
- measurement
- installation, maintenance and fault-finding
- electrical installation and wiring
- electrical circuitry and printed circuits and components
- pneumatic and hydraulic circuitry and components.

- 3 Select and use appropriate computer software packages

Students should develop the ability to operate a computer keyboard and use a range of software packages. They should have an awareness of:

- obligations under the Data Protection Act
- the need for system security
- use of software documentation
- understanding basic software tools
- interconnection of appropriate microcomputer and peripheral devices.

- 4 Interpret engineering drawings and circuit diagrams

Activities should be designed according to the needs and aims of the student. Some exercises should also make use of the knowledge and skills in objective 2 that relate to interpreting engineering drawings and circuit diagrams.

- 5 Be aware of developing technologies and appropriate techniques in areas such as:
 - microprocessors
 - programmable logic controllers
 - computer-aided design
 - numerical robotics
 - systems approach to manufacture.

EA2

To achieve EA2 the student should:

- 1 Appreciate the uses and limitations of engineering materials and components
- 2 Appreciate the cost factors relating to the design, manufacture and servicing of a product
- 3 Appreciate the importance of a logical approach to engineering activities
- 4 Work in a team.

Some EA2 objectives can be met through assignments and other studies in appropriate design, manufacturing technology, materials and industrial management units or subjects. Others can be met through integrative assignments or projects.

An appropriate approach might be to use case studies involving the design and manufacture of engineering components and systems. This would enable students to consider design, selection of materials and components, manufacturing methods, and cost factors in the manufacturing and servicing of products. The case studies would also develop students' awareness of problems associated with a logical approach to efficient production, and of the importance of effective maintenance schedules. In addition case studies could help develop students' abilities to work as part of a team.

1.4 Overall structure of OSCEng Higher Level Standards: Functional Map

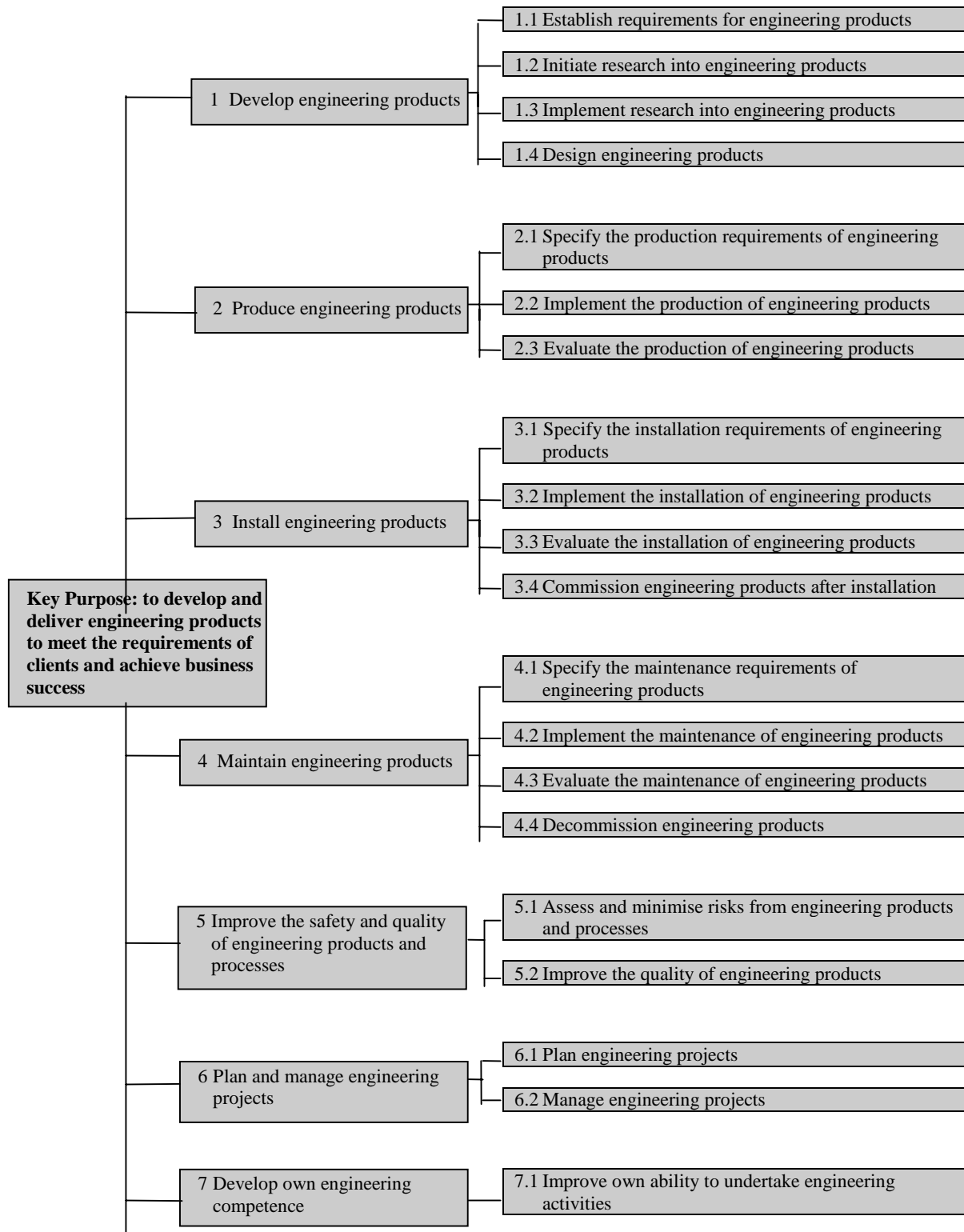


Illustration of possible links between Engineering HN units and Higher Level OSCEng standards

BTEC Unit \ OSCEng Stds	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	6.1	6.2	7.1	
Common Skills																					
Business Management Techniques 21716P																					
Engineering Science 21718P																					
Mechanical Principles 21722P																					
Electrical & Electronic Principles 21759P																					
Electrical, Electronic & Digital Principles 21760P																					
Electronics 21762P																					
Aircraft System Principles 21723P																					
Vehicle Engineering Principles 21726P																					
Plant Process Principles 21725P																					
Analytical Methods 21717P																					
Engineering Design 21719P																					
Project 21720P																					
Project Management 21800P																					
Health & Safety & Risk Assessment 21777P																					
Quality Assurance & Management 21802P																					

OSCEng Stds	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	5.1	5.2	6.1	6.2	7.1
BTEC Unit																				
Design for Manufacture 21758 P				■	■															
Purchasing for Manufacture 21801P					■	■	■	■	■		■	■						■	■	
Materials Engineering 21799P				■	■	■	■	■	■	■										
Planning & Scheduling Principles 21724P					■	■	■													
Manufacturing Process 21788P					■	■	■	■	■		■					■	■	■		
Introduction to Machine Tools 21784P					■	■	■	■	■							■				
Advanced Machine Tools 21739P					■	■	■	■	■							■				■
CAM 217555P					■	■	■	■	■											■
CAD/CAM 21750P				■	■	■	■	■	■											■
Manufacturing Electrical Products 21787P					■	■	■	■	■											■
Stastitical Process Control 21807P				■			■										■			
Plant Operation & Performance. 21797P								■	■	■	■									
Plant Maintenance & Management 21796P												■	■	■	■					
Plant Technology 21798P								■	■											
Condition Monitoring & Fault Diagnosis 21756P						■	■		■	■	■		■	■	■					
Plan & Co-ordinate Vehicle Maintenance 21795P											■	■	■	■	■					
Fault Diagnosis & Repair 21770P								■					■	■						

2.0 OTHER RELEVANT PUBLICATIONS

The following publications can be obtained from:

Edexcel Publications
Adamsway
Mansfield
Notts NG18 4LN

Tel: 01623 467 467

Fax: 01623 450 481

E-mail: publications@mailin.co.uk

- *BTEC Policy Framework (Y000726)*
- *Common Skills & Core Themes - General Guidance (80-037-2)*
- *Common Skills & Core Themes - Implementation Guidance (80-040-2)*
- *Key Skills Units, Level 3 (X001721)*
- *Key Skills Units, Level 4 (X001722)*
- *Key Skills Units, Level 5 (X001723)*
- *Accreditation of Prior Learning (APL) - General Guidance (80-092-0)*
- *Key Skills Guidance - Delivering and Assessing Application of Number in Educational and Work-based Settings (X001729)*
- *Key Skills Guidance - Delivering and Assessing Communication in Educational and Work-based Settings (X001730)*
- *Key Skills Guidance - Delivering and Assessing Applying Technology in Educational and Work-based Settings (X001731)*
- *Key Skills Guidance - Delivering and Assessing Improving Own Learning and Performance in Educational and Work-based Settings (X001286)*
- *Key Skills Guidance - Delivering and Assessing Working With Others in Educational and Work-based Settings (X001288)*