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IAgrE

Institution of Agricultural Engineers

Initial Professional Development

G6 – Professional Development Regulations

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Introduction

The UK Engineering Council (EngC) was established to ensure that engineers are educated and trained to high standards of professionalism, and that this training is recognised formally by entering their names on to a Register. IAgrE, as a Licensed body of the Engineering Council, fully supports this objective, and urges all members who can do so to apply for registration.

Those wishing to be recognised as professional engineers need to be able to demonstrate standards of academic achievement, competence and commitment in order to register.

Professional Development Regulations (ENGINEERING) for:

- Chartered Engineer (CEng)
- Incorporated Engineer (IEng)
- Engineering Technician (EngTech)

1.0 Purpose

This booklet has been prepared to help IAgrE members to understand the requirements and procedures for registration and to relate their own qualifications to the criteria established for all engineers by the EngC, as published in the EngC document UK Standards for Professional Engineering Competence and Commitment (UK-SPEC).

In particular this booklet tries to relate the EngC's criteria to the wide spectrum of interests and activities of members of lAgrE.

The professional membership of IAgrE consists of engineers, scientists and technologists concerned with the application of engineering and technology to the land-based sector including agriculture, horticulture, forestry, amenity, the environment and construction. Members may be involved in:

- research and development,
- the design and manufacture, specification, scheduling, purchasing, management and maintenance of many kinds of installation and equipment.
- the promotion and practice of developing solutions oriented approaches to sustainability

Technical areas include tractors/machinery, precision agriculture, robotics/autonomous vehicles, crop storage and processing, farm buildings and the control of environment, renewable energy, food engineering and technology, livestock engineering, amenity and sports, forestry, waste treatment and disposal, irrigation, drainage, water supplies and erosion control, ergonomics, relevant aspects of health and safety at work and advisory/consulting work.

As a licensed body of the EngC, IAgrE encourages all individuals who are eligible for registration to do so.

As a founder constituent body of the Society for the Environment (SocEnv), IAgrE is also able to offer the professional qualification of Chartered Environmentalist (CEnv) and Registered Environmental Practitioner (REnvP) to suitably experienced and qualified members. This booklet deals only with those with engineering aspirations. For those with environmental aspirations a separate booklet is available from the Secretariat and for download from the IAgrE Website.

There is no reason why suitably experienced and qualified members should not aspire to becoming a Registered Environmental Practitioner or Chartered Environmentalist's as well as a registered engineer.

A separate procedure, designed to maintain comparable standards, applies to applicants for membership who are technically qualified and experienced in relevant scientific disciplines rather than in engineering, or the environment. Such applicants may not necessarily meet the requirements for EngC or SocEnv registration. Both the EngC and SocEnv recognise that there are those who may have experience which could be deemed to have provided the requisite training. Similarly, scientists, mathematicians and others may well be able to qualify for registration. Further details can be found in para. A.1.6 (b) of Appendix 1, attached.

2.0 The Register and Registration Grades

2.1. Introduction

The Register is maintained in three sections: Chartered Engineer, Incorporated Engineer and Engineering Technician.

Successful practice of engineering involves an interdisciplinary and interdependent team effort by a large number of people, many of whom would claim to be 'engineers' but who possess an extremely diverse range of engineering qualifications perhaps entitling them to be registered as Chartered Engineers, Incorporated Engineers or Engineering Technicians. In addition there are those practising engineering with science and other qualifications.

There is an Interim Stage of registration recording only educational attainment. Those with full (Final Stage) registration are authorised to use the style and title appropriate to the section in which they are registered and the designatory letters CEng, IEng or EngTech as appropriate. Registration is normally conditional on continued membership of a Nominated Body such as IAgrE. Thus, a Chartered Engineer with IAgrE would be authorised to use the letters CEng MIAgrE. Similarly, and Engineering Technician with IAgrE would use the letters EngTech MIAgrE.

The problem of definition of the various levels of engineer is complicated by the fact that in practice there is no hard and fast line between the kind of work undertaken by those in the different register grades.

A general statement about definitions, roles and responsibilities of the three grades may nonetheless be helpful in order to guide the setting of standards, the specification of the academic and training content of courses, and to help judge whether courses submitted for approval measure up to the required standards.

2.2. Engineer

An Engineer is one who acquires and uses scientific, technical and other pertinent knowledge and skills to create, operate and maintain efficient systems, structures, machines, plant, processes and devices of practical and economic value.

2.3. Chartered Engineers

Chartered Engineers are concerned with the progress of technology through innovation, creativity and change. They should be able to develop and apply new technologies, promote advanced designs and design methods, introduce new and more efficient production techniques, marketing and construction concepts and pioneer new engineering services and management methods. They may also be involved with the effective direction of advanced existing technology involving high risk and capital-intensive projects.

The work of a Chartered Engineer is therefore predominantly intellectual and varied. It requires the exercise of original thought and judgement concerning the development of new systems and technologies, the ability to supervise the work of others and, in due time, the maturity to assume responsibility for the direction of important tasks, including the profitable management of industrial and commercial enterprises. In their work Chartered Engineers have a responsibility to society with regard to the ethical, economic and environmental impact of technical need and changes.

2.4. Incorporated Engineers

Incorporated Engineers perform technical duties of an established or novel character either independently or under the general direction of more senior engineers. They require the power of logical thought and, when in a management role, the qualities of leadership and effective control.

Fundamentally the nature of the posts occupied by Incorporated Engineers is such as to demand a practical approach and a detailed understanding of a particular technology. They require specific and detailed knowledge of the bases and practices of current technology and are concerned with maintaining and managing existing technology efficiently. They also need communication skills and awareness of the environment beyond the limits of their specific responsibility.

Incorporated Engineers provide, either independently or as leaders, the most satisfactory service possible through existing resources and so exercise a significant influence on the overall effectiveness of the organisation in which they work.

2.5. Engineering Technicians

Engineering Technicians are competent by virtue of their education, training and practical experience to apply knowledge and proven techniques and procedures to the solution of practical problems in a wide variety of contexts. There is always a strong element of personal responsibility, often applied in consultation with Chartered Engineers or Incorporated Engineers.

3.0 Stages of, and Routes to, Registration

The EngC recognises registration at two successive stages. These are:

3.1 Interim Stage:

Completion of academic requirement.

A Chartered Engineer requires one of the following:

- An accredited Bachelors degree with honours in engineering or technology, plus either an appropriate Masters degree or engineering doctorate, or appropriate further learning to Master level.
- An accredited integrated Master degree in engineering or technology.
- An accredited Bachelors degree with honours in engineering or technology (started prior to Sep 1999).
- Equivalent qualifications or apprenticeships accredited or approved by a licensee or at an equivalent level in a relevant national/international qualifications framework.

An Incorporated Engineer requires one of the following:

- An accredited Bachelors or honours degree in engineering or technology.
- An accredited Higher National Certificate (HNC)/Higher National Diploma (HND) started prior to 1999 in engineering or technology.
- An HNC/HND started after 1999 (but prior to Sept 2010 in the case of the HNC) or a Foundation degree in engineering or technology, plus appropriate further learning to degree level.
- A National Vocational Qualification (NVQ) or Scottish Vocational Qualification (SVQ) at level 4 approved by a licensee, plus appropriate further learning to degree level.
- Equivalent qualifications or apprenticeships accredited or approved by a licensee or at an equivalent level in a relevant national/international qualifications framework.

An Engineering Technician requires one of the following:

- Successful completion of an apprenticeship or other work-based learning programme approved by the licensee, such as the Land-based Service Engineering Technician (IfATE ST0243)
- Alongside appropriate working experience, holding a qualification approved by a licensee in engineering set at either:
    - Level 3 (or above) - England, Wales and Northern Ireland
    - Level 5 (or above) - Ireland
    - Level 6 (or above) - Scotland
- Such qualifications include:
    - Pearson National and Extended Diplomas in Land-based Engineering
    - City and Guilds Advanced Extended Technical Diplomas in Land-based Engineering
    - Institute of the Motor Industry Extended Diploma in Land-based technology
- An Institution-approved work-based learning route
- Qualifications in cognate areas, subject to academic appraisal by Institutions

The accreditation and/or approval of qualifications will be undertaken by the professional engineering institutions licensed by EngC eg IAgrE. Other qualifications, which can be shown to be equivalent to these, may be submitted to the EngC for Individual Case approval.

For those that do not possess formal qualifications, but may have achieved the necessary underpinning knowledge through substantial work experience, experiential learning and other qualifications to a level commensurate with the required qualification level can submit applications through the Individual Assessment route.

3.2 Final Stage

- Completion of a period of at least four years of structured Initial Professional Development (IPD), normally after the completion of the academic qualification on which the Interim registration is based. Approved sandwich periods may count up to one year of the IPD. This period of IPD will normally be during the early years of employment and practice.
- This IPD period is completed with a Professional Review carried out by the Institution, which then makes the recommendation for Registration.

This period of professional development is divided into two parts of roughly equal length, the first concentrating on training and the second on progression to responsible employment.

These parts should be structured as outlined in the Appendices to this booklet and should be devised to suit the circumstances of the trainee and his/her employer. Special care may have to be taken to make best use of the limited opportunities for conventional patterns of training presented by some kinds of agricultural engineering employment.

This is a vital part in the progression to eventual registration with the EngC at the Final Stage. Intending registrants should be prepared to exert every effort to ensure that a suitable scheme can be implemented. Ideally, before accepting offers of employment, an intending registrant should ascertain if the employer is willing to facilitate such an IPD scheme, which should be put into effect as soon as is reasonably possible.

IAgrE should approve the registrant's Initial Professional Development scheme. Where there is no formal scheme, alternative requirements should be met. (See Appendices A.1.6. or A.2.6)

A Record of Training must be kept and duly certified in the appropriate form provided by IAgrE. Certification should be by a Mentor who is a Registered Engineer of at least the register grade for which the trainee is registered at the Interim Stage.

3.3. Details of Professional Development Requirements

These are given for Chartered Engineers in Appendix 1, and for Incorporated Engineers and Engineering Technicians in Appendix 2.

3.4. Details of Responsibility Requirements see Appendix 3.

3.5. Submission of Personal Develop Schemes to IAgrE

Proposed schemes of professional development should be based on the guidance given in the relevant Appendix, and should be submitted to IAgrE for approval as mentioned above. As soon as a scheme is approved, a PD Record Book will be sent to the candidate.

Wherever possible, a suitable member of IAgrE will be asked to assist with the supervision of the scheme and to visit the trainee during the period of training.

3.6. Entry on the Register

The following evidence is required for the two stages of registration:

- Interim Stage: a copy of the Certificate of academic achievement
- Final Registration: a portfolio covering the IPD period

NOTE: For candidates whose Initial Professional Development has already been completed, IAgrE provides a Professional Development (PD) Report book, to be used or the certification of the candidate's past industrial training and experience. This can be used as part of the portfolio that will be required when a candidate applies for Final Registration.

APPENDIX 1 - INDUSTRIAL TRAINING REQUIREMENTS FOR CHARTERED ENGINEERS

A.1.1. OBJECTIVES OF TRAINING

Training should emphasise the complementary nature of theory and practice. It should also be challenging and relevant to the future careers of the trainees, and should stretch their intellectual powers.

The training objectives and the standards to be achieved should be stated in clear, simple terms; these may differ from discipline to discipline but should always be aimed at developing the trainee's abilities to undertake engineering duties requiring a high degree of practical expertise. It is important that, during the final period of training, trainees should carry out work of an engineering nature for which they are held responsible, if only to a limited degree.

Some aspects of training will be considered by the appropriate Nominated Body to be essential. These must be completed in full. When the trainee's current employer is unable to provide such training, the facilities of other organisations or establishments should be used.

Training Overseas

Trainees domiciled overseas must remember that they are preparing for a United Kingdom engineering qualification and therefore must meet the normal Engineering Council UK requirements for training. The Institution may arrange for training carried out overseas to be supervised by a suitably qualified and approved person.

A.1.2. ELEMENTS OF TRAINING

Training must enable graduate engineers to extend the scope of their knowledge beyond their degree studies and to apply their understanding of engineering principles and theory to the solving of real problems.

Training may be obtained by following an approved training programme and/or by acquiring experience provided that such experience conforms to guidelines issued by the Institution and gives a sound and broad understanding of agricultural engineering.

Training should include a structured introduction under supervision involving a range of practical assignments with as wide a range of engineering and management activities as possible while at the same time learning how available techniques, both practical and analytical, can best be applied in practical situations. Above all, training must aim to develop judgement and critical abilities so that in later life trainees will be better able to undertake engineering projects with due regard to technical, management, economic, financial, commercial, social and other relevant factors.

Training should enable candidates to develop flexible attitudes so that they can meet the challenge of rapidly changing technology, which may require them to be concerned with materials, techniques and processes not yet fully developed.

After a period of induction and basic instruction, trainees should acquire a broad and sound knowledge of engineering practice relevant to agricultural engineering. This should include familiarity with design, materials, techniques and processes used in that branch and in related branches of engineering.

A.1.3. DETAILS OF INDUSTRIAL TRAINING FOR CHARTERED ENGINEERS

This will consist of three separate elements. The total training time will be a minimum of two years. Training schemes may be approved on in-Company, Group or individual basis. Approved periods of sandwich training may be taken into account.

Induction Training

The precise details here will depend very much on the company or organisation for which the trainee is working. The induction period should be short and cover:

- The objectives and nature of the employing organisation.
- The organisational structure both in general terms and more particularly as it affects the trainee.
- The trainee's future role within the organisation and appropriate channels of communication.
- An understanding of safe working procedures.
- A broad introduction to the programme of training and associated education.

Basic and General Training

This part aims to provide the fundamental skills required by all engineers. Training will be devised to give the trainee the skills and abilities to carry out the following activities safely and accurately:

A record must be maintained throughout the training period.

NOTE: Training activities, which have been completed during an Engineering Applications (EA1 or EA2) component of an academic course, or in an industrial sandwich period, need not be repeated.

Examples of fundamental skills:

- Use of hand and simple powered tools to make brackets, bolted fixtures, simple jigs and special tools. (This includes skill in the use of hacksaws, files, marking-out equipment, hand and bench drills, pedestal grinders, taps and dies).
- Use of a lathe and basic lathe tools to make simple pins and shafts and to drill and bore holes.
- Use of hand tools, guillotines, bending and rolling machines to mark out, fold, solder and rivet simple boxes, ducts, funnels and slide doors, made from mild steel and galvanised sheet and plate.
- Use of oxyacetylene equipment for brazing, bronze welding and fusion welding of mild steel and small sections of cast iron.
- Use of gas cutting torch to cut and gouge mild steel plate.
- Use of electric arc welding equipment to weld mild steel plate and iron castings.
- Identify commonly used metals by their texture, colour and density and the use of a file and a grinding wheel.
- Heat-treat a medium carbon steel chisel; case harden a pin, shaft or wear plate, then test for hardness.
- Carry out a simple repair to electric or electronic equipment, such as renewing the cable for a portable electric tool, and then test for electrical safety.
- Dismantle, repair and re-assemble a power take-off driven agricultural implement such as a rotary cultivator or simple root harvester.
- Explain orally to the supervisor the steps taken in the course of dismantling, repair and overhaul, paying particular attention to all checks for wear and distortion and the repairs to be carried out.
- Observe a skilled technician whilst they carry out a major overhaul on an internal combustion engine, and write a detailed report, complete with sketches on:
    - Valve grinding and fitting, measurement of wear, abrasion, taper and ovality of crankshafts, journals and other bearings.

- Assemble crankshaft bearings to correct torque loadings, fit timing gears, check injection pump timing, adjust valve clearances.

A.1.4. SPECIALISED TRAINING FOR CHARTERED ENGINEERS

Individual specialised industrial training programmes may include elements from any of the following examples, or other comparable activities:

(a.) Soil and water engineering

Analysis of weather records and design for an area drainage scheme; preparation of a scheme for control of erosion in a given area; design of a small-scale dam and water storage project.

(b.) Tractor and machinery engineering:

Analysis of design requirement for a mounting frame for a secondary implement to be attached to and driven from a primary tractor-mounted implement; analysis of drive characteristics of a tractor-driven implement and recommendation of appropriate devices to safeguard against overloads; study of control requirements for a conveyor system to deliver a crop from a harvesting machine into an accompanying bulk vehicle; analyse component failures, carry out operational tests on a typical failed component, redesign, test and cost such a redesigned component.

(c.) Livestock engineering:

Analysis of feed handling requirements for a livestock enterprise and design of appropriate system; design of a marshalling system for a large sheep flock, including facilities for veterinary inspection and pest control; design of a dairy herd marshalling and milking facility.

(d.) Storage, processing and packaging of crops:

Design of grain drying, storage and seed cleaning plant; design of livestock feed milling, mixing and cubing plant with pre- and post-process storage; design of grading and packaging plant for vegetable or fruit crops.

(e.) Structures and environment control:

Design of buildings for crop storage, livestock housing or workshop operations; analysis of system requirements for a controlled-environment house for pigs or poultry and recommendations as to building construction, insulation, heating, cooling and ventilation; design of a controlled environment store for potatoes or fruit.

(f.) Environmental protection:

Analysis of manure disposal requirements of a livestock enterprise and plant nutrients acceptance capacity of available land areas, and design of appropriate handling system; design of disposal system for waste water from a vegetable processing plant; design of system to reduce noise emission from a crop drying plant or other continuous source of noise.

(g.) Forestry engineering:

Design of suitable road network with necessary bridges for harvesting a block of forest; analysis of stresses in a heavy duty long-range cable crane system; investigation of the performance of a high-pressure hydraulic system in a forestry application, including transients, flow control, pressure drops, temperature problems and difficulties in maintenance and repair; comparison of the respective merits of hydrostatic and mechanical transmissions in forestry machines and vehicles; optimisation of suspension and traction systems for machines and vehicles used in steep, rough or boggy terrain and consideration of fatigue problems induced by such working conditions.

(h.) Health and Safety:

Design of dust control system for grain processing plant; design of guards for the moving parts of a tractor-mounted implement; analysis of control requirements of a self-propelled harvesting machine.

As a result of the general and specialised activities of the training programme, trainees should have reached standards that will enable them to:

(a) apply the code of professional conduct of a Chartered Engineer.
(b) make appropriate provision in engineering projects to ensure safety and the required standards of quality and reliability.
(c) fulfil responsibilities to their employers, colleagues, customers, other engineers and the community at large.
(d) apply theoretical knowledge to the design, manufacture, construction, marketing, operation and maintenance of the particular products or services with which their employing organisations are concerned.
(e) have a working knowledge of the general factors affecting an industrial organisation, such as:
(i) the financial, economic, environmental and commercial constraints.
(ii) limitations imposed by the qualities of the manpower and materials available.
(iii) the operational and maintenance requirements that may affect engineering decisions.
(f) the vital importance of good industrial relations, safety, health and welfare not only to employees but in the general public interest.
(g) the need to understand the point of view of others and to promote good personal relationships at all levels within an organisation.
(h) the need to exercise sound judgement and to accept responsibility for decisions.
(i) the need for good engineering practice and for individuals to develop their leadership abilities to the best advantage.

At the conclusion of the period, trainees must be able to accept increasing responsibility in their particular branch of engineering.

For those undertaking formalised programmes it is unlikely that the necessary elements of training stated above could be completed satisfactorily in less than two years. At least six months of this must normally be undertaken after Interim Stage requirements have been fulfilled.

A.1.5. SUPERVISION OF TRAINING

It is the responsibility of the IAgrE to monitor training programmes and schemes through identified Mentors who should preferably be Chartered Engineers holding a responsible position within the organisation providing the training.

Although trainees may be under the control of a training officer in their place of employment and under instruction from people in various departments, it is essential that they should also have direct guidance from their Mentor irrespective of the method whereby they aim to satisfy the training requirements. The progress of trainees should be regularly assessed, and they should produce regular reports of their work including, in particular, the engineering projects on which they have been engaged.

The Mentor should be both guide and adviser to trainees and be readily accessible for discussions on technical and professional matters ensuring that they are benefiting from the training programme and discussing its development with them at frequent intervals.

It is the duty of the Mentor to ensure that during the course of the training period the trainees become aware of the matters outlined in A.1.2.

Trainees should maintain a record of training authenticated by the appropriate supervisors in the form prescribed by their Institution. A satisfactory report by the Supervising Engineer based upon this record will normally be accepted as documentary evidence that the training requirements have been met.

A.1.6. CASES WHERE A PROGRAMME OR SCHEME IS ABSENT

The Engineering Council recognises that some prospective Chartered Engineers are unable either to take part in a formal, supervised, training programme or gain experience as part of a scheme, which fulfils the training requirements of the Institution.

Candidates who have not followed a route outlined in A.1.2 may be considered as follows:

(a) Experience deemed to provide training

The early experience candidates acquire (including that acquired by engineering teachers and research workers) after they have satisfied the academic requirements may be accepted as training provided such experience has given them a broad and sound understanding of their particular branch of engineering and of good working practice in line with the general requirements on training and is vouched for by a training report endorsed by one or more Chartered Engineers, or other suitable persons approved for the purpose. The length of such experience will generally be significantly longer then that necessary in an approved programme or scheme.

(b) Scientists, Mathematicians, and Others

Employers are encouraged to offer appropriate training facilities for engineering teachers, scientists, mathematicians and others who wish to become Chartered Engineers.

The work of a scientist or mathematician in relation to engineering problems will usually be specialised; consequently the period of training, or of experience deemed to be acceptable as training, will in the majority of cases be longer than that required of an engineering graduate. In its assessment special regard must be given to its engineering content. Applicants will need to demonstrate their awareness and appreciation of the whole engineering content of the work with which they have been concerned.

The importance of exposure to industrial activities is emphasised, however, and such candidates will be urged to seek all possible means of contact with industry, which will afford experience of this kind. Examples of such contact include: secondment to industry, participation in industrially sponsored research, or in joint projects and consultancy.

Because the industrial training opportunities and experience gained in these ways will be much less concentrated than in a prescribed programme of training, up to 4 years of such activities will normally be required for each "allowable" year towards training and responsible experience required for CEng registration.

APPENDIX 2 - INDUSTRIAL TRAINING FOR INCORPORATED ENGINEERS AND ENGINEERING TECHNICIANS

A.2.1. INCORPORATED ENGINEERS

Elements of Training

Incorporated Engineers need to be able to understand the reasons for, and purposes of, the operations for which they are responsible and to be competent to perform them.

The purposes of training for aspiring Incorporated Engineers are to develop abilities to use equipment, instruments, apparatus and techniques; to make trainees familiar with as wide a range of good engineering practice as possible, and to help them understand how available techniques, both practical and analytical, can be applied in practice.

Training should include a period of induction, a period of basic training and a period devoted to acquiring a broad and sound knowledge of relevant engineering practice and competence in its application. Trainees should be made familiar with the materials, components, techniques and processes used both in their own branch and in related branches of engineering.

It is important that Incorporated Engineers should develop a flexible attitude so that they will be able to meet the challenge of rapidly changing technology. Training should therefore be as deep and broad as possible, particularly during the earlier period, so that a sound foundation is created on which can be built the specialised knowledge and competence required at a later stage.

Throughout the training period for Incorporated Engineers particular emphasis should be placed on developing, to the agreed standards, the ability to:

(a) fulfil the code of conduct of an Incorporated Engineer including discharge of responsibilities to employers, colleagues and the community at large
(b) use and communicate information
(c) choose materials and components and understand the processing of materials
(d) understand good engineering practice and use a variety of equipment, measuring and controlling instruments, and apparatus
(e) undertake design work
(f) ensure appropriate provision for safety, reliability and maintenance of required standards of quality
(g) understand the organisation of engineering activities and the associated financial and economic practice
(h) exercise diagnostic skills and apply technical and analytical techniques
(i) organise and give direction to the work of others.

It is unlikely that the elements of training outlined above can be satisfactorily completed in less than two years. It is desirable that some of this training should be undertaken after the Interim Stage requirements have been fulfilled.

A.2.2. ENGINEERING TECHNICIANS

Elements of Training

Engineering Technicians need to be able to understand the reasons for, and purposes of, the operations for which they are responsible and to be competent to perform them.

The purposes of training for aspiring Engineering Technicians are to develop abilities to use equipment, instruments and apparatus; to make trainees familiar with as wide a range of good engineering practice as possible; and to help them understand how available techniques, both practical and analytical, can best be applied in practice.

Their training should include a period of induction, a period of basic training and a period devoted to acquiring a broad and sound knowledge of relevant engineering practice and competence in its application. In the course of their training, trainees should be made familiar with the materials, equipment and processes used both in their own branch and in related branches of engineering.

It is important that Engineering Technicians should develop a flexible attitude so that they will be able to meet the challenge of rapidly changing technology. Training should therefore be as deep and broad as possible, particularly during the earlier period, so that a sound foundation is created on which can be built the specialised knowledge and competence required at a later stage.

Throughout the training period for Engineering Technicians particular emphasis should be placed on developing to the appropriate level the ability to:

(a) use and communicate information
(b) understand good engineering practice and use a variety of equipment, measuring and controlling instruments, and apparatus
(c) use materials and components correctly and understand the processing of materials
(d) appreciate and implement the appropriate provision for safety, reliability, and the maintenance of the required standards of quality
(e) understand the organisation of engineering activities and the associated financial and economic practice
(f) exercise diagnostic skills

It is unlikely that the elements of training outlined above can be satisfactorily completed in less than two years.

A.2.3. DETAILS OF INDUSTRIAL TRAINING FOR INCORPORATED ENGINEERS AND ENGINEERING TECHNICIANS

This will consist of three separate elements. The total training time will be a minimum of two years, including approved portions of industrial sandwich elements.

Training schemes may be in-Company, Group or on an individual basis.

Induction Training

The precise details here will depend very much on the company or organisation for whom the trainee is working. The induction period should be short and cover:

- The objectives and nature of the organisation.
- The organisational structure both in general terms and more particularly as it affects the trainee.
- The trainee's future role within the organisation and appropriate channels of communication.
- An understanding of safe working procedures.
- A broad introduction to the programme of training and associated education.

Basic and General Training

This part aims to provide the fundamental skills required by all Engineering Technicians and Incorporated Engineers and will normally take one year to complete. Training will be devised to give the trainee the skills and abilities to carry out the following activities safely and accurately.

A record must be maintained throughout the training period.

Examples of fundamental skills:

- Use of hand and simple powered tools to make brackets, bolted fixtures, simple jigs and special tools. (This includes skill in the use of hacksaws, files, marking-out equipment, hand and bench drills, pedestal grinders, taps and dies).
- Use a lathe and basic lathe tools to make simple pins and shafts and to drill and bore holes.
- Use hand tools, guillotines, bending and rolling machines to mark out, fold, solder and rivet simple boxes, ducts, funnels and slide doors, made from mild steel and galvanised sheet and plate from 0.8-6mm thickness.
- Use of oxyacetylene equipment for brazing, bronze welding and fusion welding of mild steel down to 1.6mm thick, and small sections of cast iron.
- Use of gas cutting torch to cut and gouge mild steel plate.
- Use electric arc welding equipment to weld mild steel plate and iron castings.
- Identify commonly used metals by their texture, colour and density and the use of a file and a grinding wheel.
- Heat treat a medium carbon steel chisel; case harden a pin, shaft or wear plate, then test for hardness.
- Carry out a simple repair to electric or electronic equipment, such as renewing the cable for a portable electric tool, and then test for electrical safety.
- Dismantle, repair and re-assemble a power take-off driven agricultural implement such as a rotary cultivator or simple root harvester.
- Explain orally to his/her supervisor the steps taken in the course of dismantling, repair and overhaul, paying particular attention to all checks for wear and distortion and the repairs to be carried out.
- Observe a skilled technician whilst they carry out a major overhaul on an internal combustion engine, and write a detailed report, complete with sketches on:
    - Valve grinding and fitting, measurement of wear, abrasion, taper and ovality of crankshafts, journals and other bearings.
    - Assemble crankshaft bearings to correct torque loadings, fit timing gears, check injection pump timing, adjust valve clearances.

Special Training

During this phase the trainee will be prepared for a specific job at an appropriate level. In all cases it will take a further year to complete. Wherever possible this training should be done on the job in the working situation. Because of the diversity of roles for Technicians in Agricultural Engineering it is not possible to lay down hard and fast criteria for all trainees. However in order to maintain a standard training programme all trainees should receive training in at least four of the following eight areas (a) to (h). Further training exercises will be selected for each individual trainee to provide a full programme of training appropriate to the activities of the employing organisation.

Incorporated Engineers will need to approach and carry through these tasks in a more analytical manner than **Engineering Technicians**, as well as undergoing the additional training detailed later.

(a.) Carry out and report on:

- Measurement of sowing rate of a grain and a precision drill.
- Measurement of application rates of a ground crop sprayer, both from individual nozzles and overall.
- Measurement of application rates and balance of spread of a fertiliser distributor.
- Timing of a baler ram, packer and knotter assembly.
- Repair and adjustment of a baler knotter.

(b.) Carry out a major overhaul as specified in the workshop manual on a complex power-driven machine such as a baler, potato harvester or mower/conditioner.

- Check the threshing cylinder assembly of a combine harvester for wear and balance.
- Carry out a pre-delivery inspection on a new power-driven machine to ensure that all parts are working freely and correctly adjusted, paying particular attention to the operation of safety devices and the machine's compliance with current safety regulations; then deliver to the customer and explain operation, working adjustments, maintenance and safety features.

(c.) Carry out a major overhaul on a worn internal combustion engine; measure all working parts for wear and replace as needed; rebuild and adjust to manufacturers specification; run-in engine then measure power output on a dynamometer; check relevant exhaust emissions are within specification; carry out any necessary repairs or adjustments to correct any issues.

(d.) Use test gauges and equipment to carry out a systematic fault-finding sequence on a well-used tractor to check its electrical charging system, hydrostatic steering system and hydraulic linkage system.

(e.) Completely strip, check, rebuild and adjust a tractor's hydraulic linkage and braking system.

(f.) Install a mill, mixer, cleaner, grader or similar machine in a farm building; this will include preparation of foundations and fixings, correct siting, positioning and fixing, installation and connection of electric or other motor. Make and fit necessary ducts, chutes and control flaps or doors; run machine and test in work.

(g.) Carry out a comparative field trial of two similar implements or machines and prepare a detailed report covering rate of work, fuel consumption, standard of work, ease of operation and adjustment, breakages and replacements, compliance with current safety regulations.

(h.) Prepare a design and contract documents for a forest road system or for a bridge in a specific situation; investigate non-destructive testing and inspection techniques and make realistic recommendations for use in the maintenance of forestry or other machines; investigate and make recommendations for elimination of unwitting abuse of forestry or other machines arising from factors such as: employment in inappropriate terrain, misunderstanding characteristics of diesel engines, over-riding hydraulic safety systems, incorrect de-bogging procedures, etc; investigate and establish the realistic and economic limits of operator maintenance of forestry machines; compare the economics of alternative techniques of timber extraction in a specific situation.

(i.) Investigate environmental health and safety aspects and legal requirements, and make recommendations for improvement of specific machinery systems or equipment installations, with

particular reference to exposure of workers to dust, noise, vibration, electric shock, risk of bodily injury, etc.

A.2.4. INCORPORATED ENGINEERS

In addition to carrying out the above programmes all INCORPORATED ENGINEERS should also undertake activities such as:

- Carry out a design study on the re-organisation of the layout and job sequences of their workshops or stores to accommodate an increased workload. The study should include details of present and new layouts, and estimated costs of improvement.
- Work with and supervise the work of a young apprentice continuously for a period of at least 3 months in one or more of the skilled areas listed under (a.) to (i.) above, and in which the Incorporated Engineer is already proficient.
- Prepare layout plans for an installation such as those referred to in (f.) above.

A.2.5. SUPERVISION OF TRAINING FOR INCORPORATED ENGINEERS

It is the responsibility of the institution to monitor training programmes through approved Mentors who should preferably be Chartered Engineers or Incorporated Engineers holding responsible positions within the organisation providing the training.

It is the duty of the Mentor to ensure that the training covers adequately the aspects outlined in A.2.1.

Although trainees may be under the direction of a training officer in their place of employment and under instruction from people in various departments, it is essential that they should also have direct guidance from their Mentor irrespective of the method whereby they aim to satisfy the training requirements. The progress of trainees should be assessed regularly, and they should produce reports of their work including, in particular, the engineering projects on which they have been engaged.

Trainees should maintain a record of their training for submission in the form prescribed by the institution. A satisfactory report by the Supervisor based upon this record will normally be accepted as documentary evidence that the training requirements have been met.

A.2.6. CASES WHERE A PROGRAMME OR SCHEME IS ABSENT

The EngC recognises that some prospective Incorporated Engineers may be unable to take part either in a formal training programme supervised as required in A.2.5 or gain experience as part of a scheme, which fulfils the training requirements of the Institution.

(a) Experience deemed to provide training

The early experience candidates acquire (including that acquired by engineering teachers and research workers) after they have satisfied the academic requirements may be accepted as training provided that such experience has given them a sound and broad understanding of their particular branch of engineering and of good working practice in line with the general requirements on training. It is also essential that such periods of experience deemed to provide training can be satisfactorily authenticated. In general, relevant experience supported by suitable documentary evidence may be accepted on a basis of not less than two years' experience for each year of training.

(b) Scientists, Mathematicians, and Others

Employers are encouraged to offer appropriate facilities for scientists, mathematicians and others who wish to become Incorporated Engineers. (NB These may include those with Higher National Certificates, Diplomas or ordinary degrees). In such cases the period of training, or of experience deemed to provide training, will normally be longer than that required of those with the equivalent engineering qualifications and in its assessment special regard must be given to its engineering content.

A.2.7. SUPERVISION OF TRAINING FOR ENGINEERING TECHNICIANS

A programme of training should preferably be monitored by a Nominated Body through an approved Supervisor who should be a registered Engineering Technician (or higher) holding a responsible position within the organisation providing the training.

It is the duty of the Supervisor to ensure that the training covers adequately the aspect outlined in A.2.1.

Although trainees may be under the direction of a training officer in their place of employment and under instruction from people in various departments, it is essential that they should also have direct guidance from their Mentor irrespective of the method whereby they aim to satisfy the training requirements. The progress of trainees should be regularly assessed, and they should produce reports of their work including, in particular, the engineering projects on which they have been engaged.

Trainees should maintain a record of their training for submission in the form prescribed by the institution. A satisfactory report by the Supervisor based upon this record will normally be accepted as documentary evidence that the training requirements of the bye-laws have been met.

Experience deemed to provide training

The EngC recognises that some prospective Engineering Technicians may be unable to take part either in a formal training programme supervised as required in A.2.1; or as part of a scheme which fulfils the training requirements of the Institution.

Special consideration as indicated below may therefore be given to candidates who have not followed a normal route:

The early experience candidates acquire either after they have satisfied the academic requirements or in parallel with them (including that acquired by engineering teachers) may be accepted as training provided that such experience has given them a sound and broad understanding of, and familiarity with, their particular branch of engineering and of good working practice in line with the general requirements on training and that they have shown a satisfactory standard of competence. It is also essential that such periods of experience deemed to provide training can be satisfactorily authenticated. In general, relevant experience supported by suitable documentary evidence may be accepted on a basis of not less than two years' experience for each year of training.

APPENDIX 3 - FINAL STAGE REGISTRATION - RESPONSIBLE EXPERIENCE

A.3.1. GENERAL - ALL SECTIONS OF THE REGISTER

As with training, it is advocated that in measuring responsible experience, emphasis should be placed on performance in the job so that any minimum periods mentioned should be regarded as guidelines only. It is important that those intending to become CEng or IEng should be entrusted with early responsibility.

As candidates must be able, when qualified, to discharge their responsibilities in the United Kingdom, they must be competent in the English Language.

For all of these levels, it is unlikely that sufficient experience of the level required can be obtained in less than two years.

A.3.2. CHARTERED ENGINEER

Those intending to become Chartered Engineers will be considered to be gaining responsible experience when their employment requires them to develop and prove fully their technical competence and to demonstrate a satisfactory range of functions and characteristics, which may include:

(a) the exercise of independent technical judgement requiring both practical experience and the application of engineering principles.
(b). direct responsibility for the management or guidance of technical staff and other resources.
(c). innovation in technical matters through such activities as design, development, research and manufacturing technology.
(d). professional and personal integrity and responsible attitude to engineering and changes in the field of technology.
(e). understanding and consideration of financial, economic, commercial, statutory and national considerations.
(f). creation of systems and procedures and proving their cost effectiveness.
(g). design, development and manufacture of products, equipment and processes to a competitive level of costs, safety, quality, reliability and appearance.
(h). involvement in human and industrial relations.

A.3.3. INCORPORATED ENGINEER

The experience appropriate for Final Registration as an Incorporated Engineer is generally embraced by the list given above but with a different emphasis and a more limited depth and range than that appropriate for Chartered Engineers, bearing in mind the definitions and roles appropriate outlined in 2.2 - 2.5. The functions and characteristics (in addition to those listed for Engineering Technicians in A.3.4.) will normally include:

(a). the exercise of independent technical judgement at an appropriate level.
(b). design, development and manufacture of products, equipment and processes to a competitive level of cost, safety, quality reliability and appearance.
(c). understanding of, and involvement in, financial, statutory and commercial considerations.
(d). communications skills and involvement in human and industrial relations.
(e). maintaining a responsible attitude to engineering and changes in the field of technology.

A.3.4. ENGINEERING TECHNICIANS

Engineering Technicians should be fully responsible in their own right for work undertaken in their particular field where proven techniques and procedures are used. In assessing their experience, they should be competent in those skills and abilities relevant to their own specialisation, for example:

(a). construction of accurate models and special equipment.
(b). sound knowledge of safe working practices and considerations.
(c). leadership at supervisory level.
(d). effective communication, both oral and written in the English language.
(e). the interpretation of technical drawings and specifications.
(f). the capabilities, limitations and possibilities of oils, materials, equipment and operations.
(g). some knowledge of the design and operation of systems and related mathematical skills.
(h). principles of industrial relations.

A.3.5. QUALIFICATIONS IN SUBJECTS RELATED TO ENGINEERING – SPECIAL PROVISION

Entry at the Final Stage of all sections of the Register is open to individuals who possess academic qualifications of the requisite level in subjects related to engineering such as applied mathematics and pure or applied science, provided that the EngC is satisfied that their subsequent training and responsible experience compensate for any deficiency in the vocational orientation of the academic course and that the candidate's achievements, taken as a whole, can provide a satisfactory basis for registration in the appropriate section of the Register.