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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	1. Introduction			**1**
	1.1 Information about the Company			
Location 1	***Description 1***			
	1.1.1 Own Organisation			
	a) Discuss the size, history and internal culture of the trainee's own organisation.	*CCO 1.10*	11	
	b) Discuss an overview of the relationship between the trainee's own organisation, government departments and other organisations.	*CCO 1.10*	11	
	c) Discuss the structure and functions of different units within the trainee's own organisation.	*CCO 1.10*	11	
	d) Demonstrate the awareness to follow operational procedures and practices as required by the trainee's own organisation.	*CCO 1.10*	11	
	e) Discuss the objectives, requirements and processes that support the quality assurance system within the trainee's own organisation.	*CCO 1.10*	11	
	f) Apply the quality assurance system according to the policy of the trainee's own organisation.	*CCO 1.10*	11	
	1.1.2 Training Programme, Prospects and Career Development			
	a) Discuss an overview of the internal communication systems, training system and career development pathway within the trainee's own organisation.	*CCO 1.10*	11	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Demonstrate a commitment to extend and develop up-to-date technical knowledge through reading relevant engineering publications, participating in seminars or conferences, and information searching.	*CCO 1.2*	11	
	c) Demonstrate a commitment to extend and develop up-to-date knowledge of local, regional and international current affairs through reading relevant engineering publications, participating in seminars or conferences, and information searching.	*CCO 1.3*	11	
	d) Demonstrate a commitment to participate in the local organisations or community services for general personal development.	*CCO 1.3*	11	
	1.2 Information about the HKIE			
Location 2	***Description 2***			
	a) Discuss an overview of the HKIE organisation as well as its history and role in society.	*CCO 1.1*	11	
	b) Demonstrate a commitment to participate in relevant activities organised by the HKIE.	*CCO 1.1*	11	
	2. Engineer as a Profession (Professional and General)			**Conti-nuous**
	2.1 Professionalism			
Location 3	***Description 3***			
	a) Discuss the social and ethical responsibilities of engineers in society.	*CCO 1.2*	8	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Explain the rules and standard requirements of conducting engineering activities to the HKIE, employers, clients, general public and colleagues in accordance with the HKIE Rules of Conduct.	*CCO 1.2*	8	
	c) Explain the ethical standards and responsibilities of professional engineers as required by the HKIE.	*CCO 1.2*	8	
	d) Demonstrate the awareness to follow the codes of practice of professional engineers.	*CCO 1.2*	8	
	e) Demonstrate the awareness to uphold the dignity, standing and reputation of the engineering profession.	*CCO 1.2*	8	
	f) Demonstrate the awareness to protect the interests of the community including the environment, welfare, health and safety in conducting engineering activities.	*CCO 1.2*	8	
	2.2 Occupational Safety and Health			
Location 4	***Description 4***			
	a) Demonstrate an understanding of the statutory health and safety requirements.	*CCO 1.5*	9	
	b) Demonstrate an understanding of the responsibilities of professional engineers for the health and safety of the employers, employees and general public when engaging in engineering activities.	*CCO 1.5*	9	
	c) Apply the safety management system in accordance with the industry standards and regulatory requirements.	*CCO 1.5*	7	
	2.3 Environment			
Location 5	***Description 5***			
	a) Demonstrate an understanding of the relevant statutory environmental requirements related to the trainee's discipline.	*CCO 1.6*	9	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Evaluate the inter-relationship of technology with the environment in the work place.	*CCO 1.6*	9	
	c) Demonstrate the awareness of the impact of technology on the environment in society.	*CCO 1.6*	9	
	3. Discipline-Core Outcomes (Mandatory Elements) (Please refer to the Appendix)			**72**
	3.1 Project Management			
Location 6	***Description 6***			
	a) Comprehend project management principles.	*CO 1.1*	1	
	b) Carry out supervisory or managerial duty in a team or project.	*CO 1.1*	6	
	c) Carry out multi-disciplinary team work.	*CO 1.1*	6	
	d) Develop a logical management approach to engineering tasks.	*CO 1.1*	4	
	e) Carry out preparation of a work programme.	*CO 1.1*	6	
	f) Apply appropriate skills to supervise subordinates.	*CO 1.1*	6	
	g) Examine the project progress against the schedule and make necessary amendment.	*CO 1.1*	5	
	3.2 Specimen Preparation and Sampling			
Location 7	***Description 7***			
	a) Justify the selection of specimen sampling strategy.	*CO 1.2*	12	
	b) Plan the implementation or supervision of the sampling process.	*CO 1.2*	4	
	c) Analyse data from specimen sampling.	*CO 1.2*	3	

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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	3.3 Materials Testing and Standards			
Location 8	***Description 8***			
	Trainee will need to gain experience in determining at least three mechanical properties, at least one physical property and at least one test of chemical resistance.			
	a) Evaluate the application and limitations of National and International materials testing and standards.	*CO 1.3*	1	
	b) Comprehend local standards (e.g. Construction Standards CS1, CS2 & CS2), codes of practice and technical memoranda etc. taking into account their application and limitations.	*CO 1.3*	2	
	c) Carry out and supervise physical, mechanical and chemical testing of materials.	*CO 1.3*	1	
	d) Design and propose material testing regimes.	*CO 1.3*	6	
	e) Analyse test results to solve engineering problems.	*CO 1.3*	3	
	3.4 Micro-structural and Chemical Characterisation of Materials			
Location 9	***Description 9***			
	a) Comprehend the methods for characterising the micro-structure and composition of materials.	*CO 1.4*	1	
	3.5 Measurement and Control System			
Location 10	***Description 10***			
	a) Apply methods to measure and control process variables (e.g. industrial process, materials production or manufacturing process).	*CO 1.6*	1	
	b) Acknowledge the advantages and limitations of different measuring systems.	*CO 1.6*	1	

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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	3.6 Quality Standards and Assurance			
Location 11	***Description 11***			
	a) Familiarise with the quality systems of the company.	*CO 1.5*	1	
	b) Appreciate the principles of quality control to meet a specification.	*CO 1.5*	1	
	c) Carry out equipment calibration procedures.	*CO 1.5*	1	
	3.7 Engineering Practice			
Location 12	***Description 12***			
	a) Appraise the engineering practice in terms of employer's activities; e.g. the manufacturing process, engineering control and sampling techniques, software packages.	*CO 1.7*	1	
	3.8 Engineering Drawing			
Location 13	***Description 13***			
	a) Interpret engineering drawings according to local and international standards.	*CO 1.8*	1	
	b) Utilise engineering drawings in project execution.	*CO 1.8*	10	
	3.9 Workshop Practice			
Location 14	***Description 14***			
	a) Ensure safe working practice	*CO 1.9*	9	
	b) Evaluate the benefits and limitations of machine tools and other workshop equipment.	*CO 1.9*	9	
	3.10 Selection and Use of Materials			
Location 15	***Description 15***			
	a) Evaluate engineering materials and materials usage relating to the field of employment.	*CO 1.10*	1	
	b) Comprehend the financial and environmental constraints relating to materials selection and usage.	*CO 1.10*	1	
	c) Select appropriate materials for engineering applications.	*CO 1.10*	5	

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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	3.11 Financial Awareness			
Location 16	***Description 16***			
	a) Comprehend the financial constraints within which companies operate.	*CO 1.11*	1	
	b) Comprehend costing solutions to problems	*CO 1.11*	2	
	c) Estimate project cost.	*CO 1.11*	2	
	d) Control project budget.	*CO 1.11*	2	
	e) Recognise basic contract terms and other related areas such as insurance, procurement procedures, tender document preparation and evaluation, and commercial terms etc.	*CO 1.11*	6	
	3.12 Plan and Execute Projects			
Location 17	***Description 17***			
	a) Comprehend project budget and time constraints by taking into considerations of work planning, programming and control.	*CO 1.12*	1	
	b) Comprehend project planning.	*CO 1.12*	10	
	c) Produce accurate project progress reports.	*CO 1.12*	1	
	4. Industry-Specific Elements (Please refer to the Appendix)			**31**
	Significant experience is required in five of the elements listed in the appendix. In each case, the theoretical understanding and practical involvement should be a significant extension to previous experience and should develop an awareness of cost. This list is not exhaustive and the Employer may submit other topics of consideration to the HKIE. All Training Outcomes, if not yet achieved in earlier parts of training, should be completed here.			
	5. Other Common Core Outcomes for Continuous Development			**Conti-nuous**
	5.1 Development of Personal Qualities			
Location 18	***Description 18***			
	a) Identify appropriate innovative approach and/or tools for professional development.	*CCO 1.4*	11	
	b) Demonstrate interpersonal skills for professional development.	*CCO 1.4*	10	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	c) Demonstrate negotiating skills required for various engineering activities.	*CCO 1.4*	10	
	d) Demonstrate sound time management skills for professional development.	*CCO 1.4*	11	
	e) Demonstrate a commitment to continuous development and enhancement.	*CCO 1.4*	11	
	5.2 Communication			
Location 19	***Description 19***			
	a) Communicate ideas orally in an accurate and clear manner under various situations (including presentations and meetings).	*CCO 1.7*	10	
	b) Formulate an oral presentation of complicated data and information in an effective and persuasive manner.	*CCO 1.7*	10	
	c) Produce grammatically correct, clear and concise documents (including memos, letters, instructions, reports, resumes and technical papers) which meet the business objectives.	*CCO 1.7*	10	
	d) Evaluate the needs of the intended readers to design appropriate technical contents for communication.	*CCO 1.7*	10	
	5.3 Human Resources Management			
Location 20	***Description 20***			
	a) Demonstrate the awareness of the duties and employment criteria for different job positions in an engineering project.	*CCO 1.8*	6	
	b) Demonstrate an understanding of the relevant legal requirements and regulatory issues of labour employment and management.	*CCO 1.8*	6	
	c) Discuss the appropriate staff training and development programmes in the organisation.	*CCO 1.8*	6	
	5.4 Business Operations			
Location 21	***Description 21***			
	a) Recognise the importance of intellectual property to business operations.	*CCO 1.11*	11	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Describe the legal requirements in Hong Kong relevant to intellectual property rights.	*CCO 1.11*	11	
	c) Identify appropriate tools and method to measure and improve the productivity of business operations.	*CCO 1.11*	11	
	d) Identify appropriate information technology applications to manage business information and to facilitate business operations.	*CCO 1.11*	11	
	e) Recognise the importance of research and development towards business operations.	*CCO 1.11*	11	
	f) Demonstrate the awareness of financial considerations in operating business.	*CCO 1.11*	11	
	g) Recognise the importance of business development in business operations.	*CCO 1.11*	11	
	5.5 Leadership and Management			
Location 22	***Description 22***			
	a) Discuss the various leadership qualities required of a leader including accountability, conflict management and resources management etc.	*CCO 1.9*	6	
	b) Explain the importance of accountability and responsibility required by a leader for making decisions on engineering activities.	*CCO 1.9*	6	
	c) Apply various management skills in engineering projects.	*CCO 1.9*	6	
	d) Distinguish the relationship between good leadership and good management skills.	*CCO 1.9*	6	
	e) Demonstrate an understanding of the importance of teamwork and partnering skills in engineering projects.	*CCO 1.9*	6	

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N.B.

1. The training period must not be less than 104 weeks (24 months).
2. The programme set out is for guidance only but substantial departure should not be made. Employers should endeavour to provide training to their trainees in as many areas as possible as is appropriate to the sector of employment.
3. This guide should be read in conjunction with Section 3 of the M3 Routes to Membership.
4. During the training, each trainee is required to maintain a Graduate Training Log Book, Record of Continuing Professional Development and Record of Training Outcomes.

Appendix – Materials Engineering

I. Notes for Section 3 – Discipline Core Outcomes (Mandatory Elements)

3.1 Project Management

The trainee must gain experience and demonstrate experience in project management during the training period. The training should provide a team work environment at a multi-disciplinary level. Coverage should include, but not be limited to considerations in efficiency, safety, quality, control, pollution, environmental protection and energy conservation issues. Training should emphasise the approach to:

(a) Engineering specification
(b) Work coordination
(c) Material handling
(d) Budget planning
(e) Work programme preparation
(f) Critical path analysis
(g) Progress monitoring

The trainee should also understand the importance of supervising and providing clear guidance to subordinates as well as the responsibilities associated with staff development.

3.2 Specimen Preparation and Sampling

Practical experience of sampling and specimen preparation schemes for property testing and structural examination. The understanding of the importance of sample selection and collection in accordance with national / international standards. The ability to design specimen preparation schemes and to interpret microstructural information.

3.3 Materials Testing and Standards

To learn the importance of testing according to internationally recognised local, national and /or international standards. To gain experience in determining at least three mechanical properties, at least one physical property and at least one test of chemical resistance. To develop an awareness of the problems associated with testing different materials. To interpret test results and use the information obtained.

3.4 Mircro-structural and Chemical Characterisation of Materials

To become familiar with routine techniques used to characterise the micro-structure and composition of materials. To gain in subsequent interpretation of the results of these techniques.

3.5 Measurement and Control System

To gain experience in measuring and controlling process variables for at least two items of laboratory equipment or industrial plant. This experience should include the setting up or modification of a

control system. An understanding of the advantages and limitations of different measuring systems must be developed. Familiarise with HOKLAS and similar schemes.

3.6 Quality Standards and Assurance

To understand the application of quality standards and quality techniques used in industry and commerce to meet recognised International Standards, particularly international standards. To be familiar with the company's quality system, understand the principles of quality control to meet a specification and appreciate or have experience of equipment calibration procedures.

3.7 Engineering Practice

Engineering Practice appropriate to the employer activities, e.g. use of tools, manufacturing process, safety requirements, the property and choice of materials, application and calibration of measurement instruments, choice of engineering control and sampling techniques, use of engineering software packages.

3.8 Engineering Drawing

To become familiar with recognised international standards for hand and computer aided drafting procedures. To understand engineering drawings and communicate with other engineers using drawings.

3.9 Workshop Practice

To be aware of safe working practices, able to use hand tools, understand the benefits and limitations of machine tools and other workshop equipment. To obtain experience in the use of machine tools and understand the application of computers in engineering (e.g. CAD, CNC machining and CAE).

3.10 Selection and Use of Materials

To become aware of the factors including financial and environmental constraints which affect the selection and use of materials and to demonstrate personal experience of materials selection.

3.11 Financial Awareness

To become aware of the financial constraints within which the organisation works. Have experience in costing solutions to problems, building up cost-estimates and control of a project budget. Understand the basic forms of contract and show an appreciation of insurance, procurement procedures, tender document preparation and valuation and commercial terms.

NB: It is recognised that the precise experience gained by the candidate in this respect will vary greatly depending on the type of company involved and its organisational structure.

3.12 Selection and Use of Materials

To gain experience of planning, controlling and implementing projects to meet defined objectives within time and cost constraints and be aware of techniques for project planning.

II. Notes for Section 4 - Industry-Specific Elements

(1) Materials Production

To obtain experience in the operation and control of either a primary production process or a secondary process involving chemical recycling. Should also be aware of the sources of raw materials, handling techniques and monitoring of raw materials and gain experience in comparing existing processes with alternative production routes.

(2) Synthesis of Materials

To demonstrate an understanding of the parameters which govern the purity and yield of a product and be able to identify the controlling variables from practical experience. To understand what steps would have to be taken to develop the process to a production scale.

(3) Materials Design

To make an experimental design or theoretical simulation of "engineering" the mirco-structure of a material to suit its intended use. To utilise theoretical concepts of micro-structure vs. property relationships to achieve desired properties which should then be measured and correlated with the appropriate structural information.

(4) Modeling

To obtain experience in the development, testing or use of an analogue or mathematical model of the micro-structure, processing or properties of a material. The result should be tested against actual performance and the trainee should be aware of the relative costs of modeling.

(5) Jointing

To gain practical experience in at least two different methods of jointing and understand those factors which affect the integrity and properties of the joint. This must include preparation of the materials to be jointed, control of the jointing process and subsequent treatments of the joint.

(6) Thermal Treatment

To gain practical experience in the operation and control of ovens, furnaces or stoves to thermally treat materials of prime concern to your professional development (e.g. heat treatment of metals, firing of ceramics). The trainee should take account of temperature variations within the furnace and the thermal stresses induced during heating or cooling (particularly during quenching of metals). Methods of mitigating these problems should be considered for at least two processes.

(7) Surface Engineering

To gain experience in methods of producing controlled surfaces using chemical, physical or mechanical methods should be evaluated as appropriate to the material and surface condition required. The trainee should undertake detailed study of two or more processes.

(8) Component Manufacture

To obtain experience in one or more of the manufacturing processes used in the production route for a component.

(9) Chemical Characterisation

To familiarise with both conventional chemical methods of analysing bulk samples and electron optical and X-ray techniques for characterising small volumes of materials. The trainee should become competent in two or more techniques.

(10) Micro-Structural Characterisation

To be competent in the operation of two or more methods of micro-structural characterisation. The trainee's understanding should include the capabilities and limitations of a range of techniques and methods of interpreting the results.

(11) Advanced Physical Testing of Materials

To gain experience in an extension of the routine testing contained within the mandatory elements. The trainee's knowledge of micro-structure vs. property relationships must be applied to make most effective use of existing testing procedures or lead to the development of new test techniques. The trainee must have experience of at least three different techniques which cover determination of different mechanical, electrical, magnetic or optical properties.

(12) Electronic Materials

To obtain experience of two techniques of characterising electronic materials or fabricating and testing of the resultant devices.

(13) Non-Destructive Evaluation

To be aware of the limitations of various testing methods. To gain experience in at least two techniques should be considered in detail and a high level of practical and theoretical competence demonstrated.

(14) Fracture Mechanics and Effects Analysis

To obtain experience in at least two significant investigations of the causes of, or methods of preventing failure. The trainee should understand the methodology used in fractography and be able to apply this to appropriate materials.

(15) Degradation

To obtain experience in both long term and accelerated tests of performance in an aggressive environment and become familiar with a range of testing techniques appropriate to the material the trainee is concerned with.

(16) Stress Analysis

To obtain experience in at least two methods of stress analysis. The trainee should understand the contribution made by both experimental and mathematical approaches and know the advantages and limitations of the techniques.

(17) Design-Oriented Activities

To gain experience in material specification, codes of practice, standards, design utilisation, critical analysis and objective evaluations of design; maintainability, safety, health and environmental considerations, standards and regulations.

(18) Process or Production-Oriented Activities

To gain experience in in the production process using various engineering materials. Typical aspects may include raw materials sourcing and requirements. Effects of material variability on final quality. Processing variable and their effect on quality. Quality control technique and sampling storage and delivery.

(19) Other topics

To gain experience in other topics as approved by the HKIE. If the company wishes to offer a topic not listed above, they should contact the HKIE for approval at an early stage.