THE HONG KONG INSTITUTION OF ENGINEERS
SCHEME "A" GRADUATE TRAINING
CONSOLIDATED MODEL TRAINING GUIDE
CHEMICAL ENGINEERING

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	

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	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	
	e) Discuss the business operation of the company, training program, prospectus and career development.	*CO 1.1*	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. Process Safety, Health and Environment			**32**
	2.1 Safety Aspects of Process Plant Design and Operation			
Location 3	***Description 3***			
	a) Appraise the relevant industrial safety / safety at work standards of process plant design and operation.	*CO 1.2*	2	

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	b) Comply with the relevant legislation requirements on health and safety.	*CO 1.2*	2	
	c) Communicate with relevant personnel to ensure proper health and safety practices in plant.	*CO 1.2*	6	
	d) Appraise Hazard and HAZOP studies in the design of a process plant.	*CO 1.2*	1	
	e) Appraise the proper procedures for pollutions controls and safe handling of pollutants.	*CO 1.2*	1	
	f) Appraise the proper procedures for safe handling of chemicals.	*CO 1.2*	1	
	g) Categorise hazardous areas.	*CO 1.2*	12	
	h) Appraise the proper procedures for the automatic start-up / shut down of process plant.	*CO 1.2*	1	
	i) Apply appropriate diagnostic techniques to analyse faults (e.g. studying alarm patterns).	*CO 1.2*	5	
	j) Appraise the proper emergency procedures (e.g. evacuation, shut down and any major accidents).	*CO 1.2*	1	
	2.2 Aspects of the Safety Management System			
Location 4	***Description 4***			
	a) Appraise the company's safety policies.	*CO 1.3*	1	
	b) Appraise the environmental regulations and standards.	*CO 1.3*	9	
	c) Appraise the requirements of safety audit (e.g. whole plant or individual processing units).	*CO 1.3*	2	
	d) Use personal protective equipment.	*CO 1.3*	1	
	e) Analyse accidents and incident reports.	*CO 1.3*	3	
	f) Appraise COSHH assessment.	*CO 1.3*	1	
	g) Appraise the proper storage and handling procedures of flammable materials.	*CO 1.3*	1	
	h) Carry out safety training programme.	*CO 1.3*	1	
	i) Demonstrate an understanding of the statutory health and safety requirements.	*CCO 1.5*	9	

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	j) 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	
	k) Apply the safety management system in accordance with the industry standards and regulatory requirements.	*CCO 1.5*	7	
	2.3 Aspects of environmental management / protection			
Location 5	***Description 5***			
	a) Appraise various environmental management / protection ordinance such as CAP 311 Air Pollution Control Ordinance, CAP 354 Waste Disposal Ordinance, CAP 358 Water Pollution Ordinance 1993, CAP 400 Noise Control Ordinance, CAP 499 Environmental Impact Assessment Ordinance, CAP 295 Dangerous Goods Ordinance, CAP 145 Control of Chemicals Ordinance etc.	*CO 1.4*	2	
	b) Plan the environmental monitoring and investigation on plant and equipment.	*CO 1.4*	3	
	c) Appraise Environmental Management System.	*CO 1.4*	1	
	d) Carry out loss prevention study.	*CO 1.4*	7	
	e) Carry out environmental training programme.	*CO 1.4*	1	
	f) Integrate results from environmental impact assessment in environmental management / protection.	*CO 1.4*	12	
	g) Demonstrate an understanding of the relevant statutory environmental requirements related to the trainee's discipline.	*CCO 1.6*	9	
	h) Evaluate the inter-relationship of technology with the environment in the work place.	*CCO 1.6*	9	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	i) Demonstrate the awareness of the impact of technology on the environment in society.	*CCO 1.6*	9	
	3. Chemical Engineering Practice, Design and Projects			**26**
	3.1 Aspects of Design Practice for Process Plant			
Location 6	***Description 6***			
	a) Select suitable size of pipelines and materials for process plant design.	*CO 2.1*	12	
	b) Design new plant and equipment.	*CO 2.1*	4	
	c) Assess process plant design from economic perspective.	*CO 2.1*	5	
	d) Design process flowsheets.	*CO 2.1*	4	
	e) Develop equipment specification.	*CO 2.1*	4	
	f) Assess the equipment specification for approval.	*CO 2.1*	5	
	g) Select site for process plant and factory for equipment manufacture.	*CO 2.1*	12	
	h) Integrate Heat and Mass Balance on continuous / batch process calculation.	*CO 2.1*	4	
	i) Apply computer simulation to process plant design.	*CO 2.1*	1	
	j) Evaluate different operation conditions on plant performance.	*CO 2.1*	3	
	k) Appraise design codes.	*CO 2.1*	1	
	3.2 Drawing Office Practices for Process Plant Design			
Location 7	***Description 7***			
	a) Develop various design diagrams such as P&I diagrams and isometric diagrams etc.	*CO 2.2*	4	
	b) Apply Computer Aided Design (CAD) to process plant design.	*CO 2.2*	1	
	c) Assess the accuracy of drawings prior to issue.	*CO 2.2*	5	
	3.3 Aspects of Project Management			
Location 8	***Description 8***			
	a) Develop cost estimates.	*CO 2.3*	6	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Evaluate the installation of new equipment / plant from economic perspective.	*CO 2.3*	3	
	c) Apply the results from economic feasibility studies to project management.	*CO 2.3*	6	
	d) Assess the critical path of project management.	*CO 2.3*	3	
	e) Develop the project implementation plan.	*CO 2.3*	6	
	f) Carry out contract negotiations with tenders.	*CO 2.3*	6	
	g) Develop project planning and budgeting.	*CO 2.3*	6	
	h) Produce project reports.	*CO 2.3*	10	
	3.4 Aspects of Instrumentation, Control and Computer Applications			4
Location 9	***Description 9***			
	a) Appraise the operations of PLC controller and DDC controller.	*CO 2.4*	1	
	b) Appraise wiring diagram.	*CO 2.4*	1	
	c) Integrate feed forward and feedback control loop in pH adjustment.	*CO 2.4*	4	
	d) Select instrumentation for plant control.	*CO 2.4*	5	
	e) Apply computer applications for process plant management.	*CO 2.4*	1	
	f) Apply information system for process plant management.	*CO 2.4*	1	
	4. Operation Practice, Projects and Other Aspects of Engineering Practice			**19**
	4.1 Aspects of Process Operation Activities			
Location 10	***Description 10***			
	a) Carry out installation, validation and inspection of equipment.	*CO 3.1*	1	
	b) Carry out process trouble shooting.	*CO 3.1*	12	
	c) Evaluate plant operation.	*CO 3.1*	3	
	d) Carry out process / plant maintenance, modification, economics and accountancy assessment and commissioning.	*CO 3.1*	6	
	e) Plan Quality Control (QC) and Quality Assessment (QA) processes by employing appropriate approach and methodology.	*CO 3.1*	6	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	f) Appraise quality management system.	*CO 3.1*	1	
	g) Develop sampling procedures.	*CO 3.1*	4	
	h) Develop analytical procedures.	*CO 3.1*	4	
	i) Appraise test methods.	*CO 3.1*	1	
	j) Comply the process operation activities with the relevant code of practices.	*CO 3.1*	2	
	k) Communicate with relevant personnel to ensure proper code of practice.	*CO 3.1*	10	
	4.2 Project Development / Technical Sales, Marketing and Contract Negotiation (choose either 4.2.1 or 4.2.2)			
Location 11	***Description 11***			
	4.2.1 Project Development			
	a) Carry out project or process development works.	*CO 3.2*	6	
	b) Carry out R&D project planning, team management and product / process design.	*CO 3.2*	6	
	4.2.2 Technical Sales, Marketing and Contract Negotiation			
	a) Carry out technical sales activities.	*CO 3.2*	6	
	b) Communicate effectively with clients / customers for negotiations and liaison.	*CO 3.2*	10	
	c) Carry out marketing activities and/or market research.	*CO 3.2*	6	
	4.3 Aspects of Engineering Ethics			
Location 12	***Description 12***			
	a) Discuss the social and ethical responsibilities of engineers in society.	*CCO 1.2*	8	
	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	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Competence Ref.	Length of Time (weeks)
	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	
	g) Appraise the role of ICAC.	*CO 3.3*	8	
	5. Objective Training			**26**
	This section covers any activities related to Chemical Engineering. It should aim to develop skills and knowledge needed to make an effective start as an engineer. Specialist courses dealing with the particular technologies having a bearing on future work may be necessary during training. All Training Outcomes, if not yet achieved in earlier parts of training, should be completed here.			
	6. Other Common Core Outcomes for Continuous Development			**Continuous**
	6.1 Leadership and Management			
Location 13	***Description 13***			
	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	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Competence Ref.	Length of Time (weeks)
	e) Demonstrate an understanding of the importance of teamwork and partnering skills in engineering projects.	*CCO 1.9*	6	
	6.2 Development of Personal Qualities			
Location 14	***Description 14***			
	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	
	c) Demonstrate negotiating skills required for various engineering activities.	*CCO 1.4*	10	
	d) Demonstrate sound time management skill for professional development.	*CCO 1.4*	11	
	e) Demonstrate a commitment to continuous development and enhancement.	*CCO 1.4*	11	
	6.3 Communication			
Location 15	***Description 15***			
	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	
	6.4 Human Resources Management			
Location 16	***Description 16***			
	a) Demonstrate the awareness of the duties and employment criteria for different job positions in an engineering project.	*CCO 1.8*	6	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Competence Ref.	Length of Time (weeks)
	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	
	6.5 Business Operations			
Location 17	***Description 17***			
	a) Recognise the importance of intellectual property to business operations.	*CCO 1.11*	11	
	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 operation business.	*CCO 1.11*	11	
	g) Recognise the importance of business development in business operations.	*CCO 1.11*	11	

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.

Additional Notes:

1. Section 3: Chemical Engineering Practice, Design and Projects

   At least <u>two</u> of the following topics (the trainee needs to reference the work done to the below topics):
   (1) Materials selection and analysis (e.g. hazardous substances in material, nano-tech material).
   (2) Process and product evaluation (technical, economic, safety and environment).
   (3) Process, plant, product and equipment design (chemical / environmental engineering related design which may include mass transfer, energy transfer, momentum transfer, material science, unit operations and other chemical / environmental engineering topics.)
   (4) Process / manufacturing plant operation or management (inclusive of the operation or management of plant or process such as wastewater treatment plant, waste incinerator, air pollution control system).
   (5) Instrumentation or control

2. Section 4: Operation Practice, Projects and Other Aspects of Engineering Practice

   At least <u>three</u> or more of the following topics (the trainee needs to reference the work done to the below topics):
   (1) Testing, inspection, quality (QC and QA) and TQM
   (2) Research / development projects (process and products)
   (3) Quality assessment of process materials (quality control: sampling, analytical and testing methods)
   (4) Computer applications
   (5) Technical sales, marketing and contract negotiations
   (6) Economics, accountancy and other management services
   (7) Project management
   (8) Environmental Technology
   (9) Other relevant training