

THE HONG KONG INSTITUTION OF ENGINEERS
SCHEME “A” GRADUATE TRAINING
CONSOLIDATED MODEL TRAINING GUIDE
MECHANICAL ENGINEERING

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Competence Ref.	Length of Time (weeks)
	1. Introduction			1
	1.1 Information about the Company			
<i>Location 1</i>	<i>Description 1</i>			
	1.1.1 Own Organisation			
	a) Discuss the size, history and internal culture of the trainee’s own organisation.	<i>CCO</i> <i>1.10</i>	11	
	b) Discuss an overview of the relationship between the trainee’s own organisation, government departments and other organisations.	<i>CCO</i> <i>1.10</i>	11	
	c) Discuss the structure and functions of different units within the trainee’s own organisation.	<i>CCO</i> <i>1.10</i>	11	
	d) Demonstrate the awareness to follow operational procedures and practices as required by the trainee’s own organisation.	<i>CCO</i> <i>1.10</i>	11	
	e) Discuss the objectives, requirements and processes that support the quality assurance system within the trainee’s own organisation.	<i>CCO</i> <i>1.10</i>	11	
	f) Apply the quality assurance system according to the policy of the trainee’s own organisation.	<i>CCO</i> <i>1.10</i>	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.	<i>CCO</i> <i>1.10</i>	11	

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	<p>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.</p> <p>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.</p> <p>d) Demonstrate a commitment to participate in the local organisations or community services for general personal development.</p>	<p><i>CCO 1.2</i></p> <p><i>CCO 1.3</i></p> <p><i>CCO 1.3</i></p>	<p>11</p> <p>11</p> <p>11</p>	
	1.2 Information about the HKIE			
Location 2	Description 2			
	<p>a) Discuss an overview of the HKIE organisation as well as its history and role in society.</p> <p>b) Demonstrate a commitment to participate in relevant activities organised by the HKIE.</p>	<p><i>CCO 1.1</i></p> <p><i>CCO 1.1</i></p>	<p>11</p> <p>11</p>	
	2. Engineer as a Profession			Continuous
	2.1 Professionalism			
Location 3	Description 3			
	<p>a) Discuss the social and ethical responsibilities of engineers in society.</p>	<p><i>CCO 1.2</i></p>	<p>8</p>	

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	<ul style="list-style-type: none"> 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. c) Explain the ethical standards and responsibilities of professional engineers as required by the HKIE. d) Demonstrate the awareness to follow the codes of practice of professional engineers. e) Demonstrate the awareness to uphold the dignity, standing and reputation of the engineering profession. f) Demonstrate the awareness to protect the interests of the community including the environment, welfare, health and safety in conducting engineering activities. 	<p><i>CCO 1.2</i></p> <p><i>CCO 1.2</i></p> <p><i>CCO 1.2</i></p> <p><i>CCO 1.2</i></p> <p><i>CCO 1.2</i></p>	<p>8</p> <p>8</p> <p>8</p> <p>8</p> <p>8</p>	
	2.2 Occupational Safety and Health			
Location 4	Description 4			
	<ul style="list-style-type: none"> a) Demonstrate an understanding of the statutory health and safety requirements. 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. c) Apply the safety management system in accordance with the industry standards and regulatory requirements. 	<p><i>CCO 1.5</i></p> <p><i>CCO 1.5</i></p> <p><i>CCO 1.5</i></p>	<p>9</p> <p>9</p> <p>7</p>	
	2.3 Environment			
Location 5	Description 5			
	<ul style="list-style-type: none"> a) Demonstrate an understanding of the relevant statutory environmental requirements related to the trainee’s discipline. 	<p><i>CCO 1.6</i></p>	<p>9</p>	

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	b) Evaluate the inter-relationship of technology with the environment in the work place.	<i>CCO 1.6</i>	9	
	c) Demonstrate the awareness of the impact of technology on the environment in society.	<i>CCO 1.6</i>	9	
	3. Mechanical Engineering Practice, Design and Projects			42
	3.1 Workshop Training - Mechanical Engineering Fundamentals			8
Location 6	Description 6			
	3.1.1 Common Engineering Metallic and Non-metallic Materials			
	a) Propose the types of common engineering metallic and non-metallic materials.	<i>CO 1.1</i>	1	
	b) Assess the properties of common engineering metallic and non-metallic materials.	<i>CO 1.1</i>	1	
	c) Critique the specifications of common engineering metallic and non-metallic materials.	<i>CO 1.1</i>	1	
	d) Appraise appropriate areas of usage of common engineering metallic and non-metallic materials.	<i>CO 1.1</i>	1	
	e) Appraise appropriate special treatment process (e.g. heat) of common engineering metallic and non-metallic materials.	<i>CO 1.1</i>	1	
	f) Appraise appropriate surface coatings or finishing process of common engineering metallic and non-metallic materials.	<i>CO 1.1</i>	1	

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	<p>3.1.2 Materials Shaping</p> <p>3.1.2.1 Traditional Methods</p> <p>a) Select the appropriate operational parameters for the traditional shaping operations including turning, milling, grinding, fitting and drilling.</p> <p>b) Evaluate the reliability factors of traditional materials shaping methods.</p> <p>c) Plan the quality assurance or accuracy checking procedure for products manufactured by the traditional material shaping methods.</p> <p>d) Develop machinery accuracy checking procedures.</p> <p>3.1.2.2 Computer Aided Methods (CNC)</p> <p>a) Select the appropriate operational parameters for the computer aided methods including turning centres, machining centres, jig borers, jib grinders and milling machines.</p> <p>b) Evaluate the reliability factors of computer aided materials shaping methods.</p>	<p><i>CO 1.2</i></p> <p><i>CO 1.2</i></p> <p><i>CO 1.2</i></p> <p><i>CO 1.2</i></p> <p><i>CO 1.2</i></p> <p><i>CO 1.2</i></p> <p><i>CO 1.2</i></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	

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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Competence Ref.	Length of Time (weeks)
	<ul style="list-style-type: none"> c) Plan the quality assurance or accuracy checking procedure for products manufactured by the computer aided materials shaping methods. d) Develop machinery accuracy checking procedures. 	<p><i>CO 1.2</i></p> <p><i>CO 1.2</i></p>	<p>1</p> <p>1</p>	
	<p>3.1.3 Materials Forming Processing (Manual and Computer Aided)</p> <ul style="list-style-type: none"> a) Evaluate the applications and limitations of materials forming related processing equipment (e.g. EDM). b) Appraise the sheet metal forming processes. c) Appraise the mould and die forming processes. d) Appraise the extrusion forming processes. 	<p><i>CO 1.3</i></p> <p><i>CO 1.3</i></p> <p><i>CO 1.3</i></p> <p><i>CO 1.3</i></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	
	<p>3.1.4 Materials Joining</p> <ul style="list-style-type: none"> a) Appraise the various types of material joining methods including welding (hand and auto), brazing, soldering and mechanical fastening (rivets, nuts and bolts). b) Evaluate the applications and limitations of different materials joining process. 	<p><i>CO 1.4</i></p> <p><i>CO 1.4</i></p>	<p>1</p> <p>1</p>	
	<p>3.1.5 Operational Reliability</p> <ul style="list-style-type: none"> a) Appraise the principles and procedures of planned maintenance. b) Evaluate the applications and limitations of different lubricants. 	<p><i>CO 1.5</i></p> <p><i>CO 1.5</i></p>	<p>1</p> <p>1</p>	

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	c) Appraise the benefits of condition based monitoring and the application of various monitoring methods.	<i>CO 1.5</i>	1	
	3.2 Engineering Design			12
Location 7	Description 7			
	3.2.1 Design Office Practice			
	a) Design solutions that comply with relevant codes of practice or meet recognised engineering standard of practice in Hong Kong.	<i>CO 2.1</i>	2	
	b) Assess the requirements of different stages of design.	<i>CO 2.1</i>	4	
	c) Propose appropriate software packages in the engineering design process.	<i>CO 2.1</i>	3	
	d) Produce clear design specifications that may be understood and interpreted without significant elaboration.	<i>CO 2.1</i>	4	
	e) Plan the information retrieval process.	<i>CO 2.1</i>	3	
	f) Evaluate the design with different perspectives.	<i>CO 2.1</i>	3	
	3.2.2 Design Aspects			
	a) Select the appropriate types of (1) bearings, (2) sealing devices and (3) gearings for engineering design work.	<i>CO 2.2</i>	5	
	b) Assess the areas of applications and limitations of (1) bearings, (2) sealing devices and (3) gearings.	<i>CO 2.2</i>	5	
	c) Evaluate different types of engineering tolerances and measurement, their associated measurement methods and their applications to the mechanical part dimensioning.	<i>CO 2.2</i>	5	

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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Competence Ref.	Length of Time (weeks)
	<ul style="list-style-type: none"> d) Derive the cost estimates for various designs. e) Compare cost effectiveness of each design. f) Assess the customer requirements of an engineering design. g) Develop appropriate design specifications accordingly. h) Comply the engineering design with statutory requirements. i) Produce specific design for safety and ease of work in installation, operation and maintenance phases. 	<ul style="list-style-type: none"> <i>CO 2.2</i> <i>CO 2.2</i> <i>CO 2.2</i> <i>CO 2.2</i> <i>CO 2.2</i> <i>CO 2.2</i> 	<ul style="list-style-type: none"> 5 5 5 5 4 4 	
	<p>3.2.3 Synthesis</p> <ul style="list-style-type: none"> a) Justify the selection of appropriate units or components in formulating the design synthesis process. b) Justify the most efficient and effective design by applying the concept of total design considerations. c) Assess alternative design solutions by considering the technological and non-technological perspectives of the design process. 	<ul style="list-style-type: none"> <i>CO 2.3</i> <i>CO 2.3</i> <i>CO 2.3</i> 	<ul style="list-style-type: none"> 12 12 12 	
	3.3 Manufacture or construction or installation of plant			10
Location 8	Description 8			
	<ul style="list-style-type: none"> a) Develop the procedures of manufacture, or construction or installation of plants, including all associated mechanical and electrical equipment. b) Plan the preparation works of manufacture, or construction installation, testing and commissioning of an engineering project. 	<ul style="list-style-type: none"> <i>CO 3.2</i> <i>CO 3.2</i> 	<ul style="list-style-type: none"> 5 5 	

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	3.4 Operational Reliability: Processing Plant Machinery and equipment, Operation procedures, Maintenance			12
Location 9	Description 9			
	3.4.1 Industrial Automation			
	a) Select the appropriate units in designing the automatic control systems.	<i>CO 3.1</i>	5	
	b) Apply Computer Integrated Manufacturing / Control to achieve operational reliability.	<i>CO 3.1</i>	5	
	3.4.2 Installation, Testing and Commissioning			
	a) Develop the procedures of installation, testing and commissioning of an engineering project.	<i>CO 3.2</i>	5	
	b) Plan the preparation works of installation, testing and commissioning of an engineering project.	<i>CO 3.2</i>	5	
	c) Appraise the testing process on the operational reliability.	<i>CO 3.2</i>	5	
	d) Formulate the principle of determining equipment guarantees, and the procedures for handling defects.	<i>CO 3.2</i>	5	
	3.4.3 Instrumentation			
	a) Select appropriate instruments with considerations such as range, accuracy and cost benefit.	<i>CO 3.3</i>	5	
	b) Plan the use of instruments for performance monitoring.	<i>CO 3.3</i>	5	
	c) Compile the calibration procedures of instruments.	<i>CO 3.3</i>	5	

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	<p>3.4.4 Quality Procedures</p> <p>a) Plan the quality assurance procedures by employing the concept and methodology of Total Quality Management.</p> <p>b) Comply the quality assurance procedures with widely adopted international engineering standards.</p> <p>c) Participate in the quality control and quality assurance activities.</p> <p>3.4.5 Maintenance</p> <p>a) Evaluate the applications and limitations of different types of maintenance system to select the appropriate maintenance strategy.</p> <p>b) Apply computer aided maintenance management system to fulfil the requirements of the maintenance strategy.</p> <p>c) Apply appropriate diagnostic techniques to analyse maintenance problems.</p> <p>3.4.6 Operation</p> <p>a) Formulate operational procedures of an engineering process for safety in operation and maintenance.</p> <p>b) Appraise the organisational structure of the operation team such as the roles and responsibilities of team members.</p> <p>c) Assess the adequacy of safety measures during the operation and maintenance of an engineering process.</p> <p>d) Assess and manage risk in the engineering process.</p>	<p><i>CO 3.4</i></p> <p><i>CO 3.4</i></p> <p><i>CO 3.4</i></p> <p><i>CO 3.5</i></p> <p><i>CO 3.5</i></p> <p><i>CO 3.5</i></p> <p><i>CO 3.6</i></p> <p><i>CO 3.6</i></p> <p><i>CO 3.6</i></p> <p><i>CO 3.6</i></p>	<p>6</p> <p>6</p> <p>6</p> <p>5</p> <p>5</p> <p>5</p> <p>5</p> <p>5</p> <p>9</p> <p>7</p>	

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	4. Engineering Administration and Management Techniques			35
	4.1 Leadership and Management			3
Location 10	Description 10			
	a) Discuss the various leadership qualities required of a leader including accountability, conflict management and resources management etc.	<i>CCO 1.9</i>	6	
	b) Explain the importance of accountability and responsibility required by a leader for making decisions on engineering activities.	<i>CCO 1.9</i>	6	
	c) Apply various management skills in engineering projects.	<i>CCO 1.9</i>	6	
	d) Distinguish the relationship between good leadership and good management skills.	<i>CCO 1.9</i>	6	
	e) Demonstrate an understanding of the importance of teamwork and partnering skills in engineering projects.	<i>CCO 1.9</i>	6	
	4.2 Technical and Commercial Leadership			32
Location 11	Description 11			
	4.2.1 Interpretation, preparation and communication of requirements. Specifications and drawings.			8
	a) Analyze the client requirements.	<i>CO 4.1</i>	6	
	b) Compile specifications according to the client requirements.	<i>CO 4.1</i>	6	
	c) Develop engineering drawings.	<i>CO 4.1</i>	6	
	4.2.2 Materials / equipment procurement procedures; tendering procedures, tender appraisal and contract administration.			8
	a) Support the procurement process such as tender, evaluation, contract award and administration.	<i>CO 4.2</i>	6	

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	4.2.3 Estimating labour, materials, installation and transportation costs. a) Derive the cost estimates of the engineering project including labour resources, materials, installation process and transport costs.	<i>CO 4.4</i>	6	4
	4.2.4 Project work, scheduling, management or management information services. a) Develop the project plan and identify the critical path(s). b) Formulate the project budget. c) Formulate project work scheduling and management plan by adopting appropriate management information system.	<i>CO 4.3</i>	12	8
	4.2.5 Preparation of reports. a) Produce well-structured, clear and concise reports.	<i>CO 4.5</i>	12	6
		<i>CO 4.6</i>	10	4
	5 Objective Training			26
	<i>This section covers training in any activities related to mechanical engineering. It should aim to develop skills and knowledge relating to personal qualities, communication, human resources management and business operational sense in addition to the technical, commercial and engineering knowledge acquired by the trainees during earlier parts of their training. Latest developments in the discipline should be included. All Training Outcomes, if not yet achieved in earlier parts of training, should be completed here.</i>			
	6 Other Common Core Outcomes for Continuous Development			Continuous
	6.1 Development of Personal Qualities			
Location 12	Description 12			
	a) Identify appropriate innovative approach and/or tools for professional development.	<i>CCO 1.4</i>	11	

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	<ul style="list-style-type: none"> b) Demonstrate interpersonal skills for professional development. c) Demonstrate negotiating skills required for various engineering activities. d) Demonstrate sound time management skills for professional development. e) Demonstrate a commitment to continuous development and enhancement. 	<p><i>CCO 1.4</i></p> <p><i>CCO 1.4</i></p> <p><i>CCO 1.4</i></p> <p><i>CCO 1.4</i></p>	<p>10</p> <p>10</p> <p>11</p> <p>11</p>	
	6.2 Communication			
Location 13	Description 13			
	<ul style="list-style-type: none"> a) Communicate ideas orally in an accurate and clear manner under various situations (including presentations and meetings). b) Formulate an oral presentation of complicated data and information in an effective and persuasive manner. c) Produce grammatically correct, clear and concise documents (including memos, letters, instructions, reports, resumes and technical papers) which meet the business objectives. d) Evaluate the needs of the intended readers to design appropriate technical contents for communication. 	<p><i>CCO 1.7</i></p> <p><i>CCO 1.7</i></p> <p><i>CCO 1.7</i></p> <p><i>CCO 1.7</i></p>	<p>10</p> <p>10</p> <p>10</p> <p>10</p>	
	6.3 Human Resources Management			
Location 14	Description 14			
	<ul style="list-style-type: none"> a) Demonstrate the awareness of the duties and employment criteria for different job positions in an engineering project. b) Demonstrate an understanding of the relevant legal requirements and regulatory issues of labour employment and management. c) Discuss the appropriate staff training and development programmes in the organisation. 	<p><i>CCO 1.8</i></p> <p><i>CCO 1.8</i></p> <p><i>CCO 1.8</i></p>	<p>6</p> <p>6</p> <p>6</p>	

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	6.4 Business Operations			
Location 15	Description 15			
	a) Recognise the importance of intellectual property to business operations.	<i>CCO 1.11</i>	11	
	b) Describe the legal requirements in Hong Kong relevant to intellectual property rights.	<i>CCO 1.11</i>	11	
	c) Identify appropriate tools and method to measure and improve the productivity of business operations.	<i>CCO 1.11</i>	11	
	d) Identify appropriate information technology applications to manage business information and to facilitate business operations.	<i>CCO 1.11</i>	11	
	e) Recognise the importance of research and development towards business operations.	<i>CCO 1.11</i>	11	
	f) Demonstrate the awareness of financial considerations in operating business.	<i>CCO 1.11</i>	11	
	g) Recognise the importance of business development in business operations.	<i>CCO 1.11</i>	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.