



Specification of Competency Standards for the Testing, Inspection and Certification Industry

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Chapter 1

Testing, Inspection and Certification Industry in Hong Kong

Section 1 Introduction

In his 2009-10 Policy Address¹, the Chief Executive cited the testing and certification industry as one of the six industry sectors that have economic potentials to excel in Hong Kong's future knowledge-based economy. A number of government initiatives were thus developed, which include (1) the establishment of the Hong Kong Council for Testing and Certification (HKCTC) in September 2009 to steer the industry development; and (2) the formation of the Testing, Inspection and Certification Industry Training Advisory Committee (TIC ITAC) in August 2010 to assist in facilitating the manpower development of the TIC industry under QF.

Background of Testing, Inspection and Certification Industry

Hong Kong as a gateway of China is usually referred as the interchange centre to certify the quality standards of products, such as food and toys from overseas and China for internal consumption and/or re-export. The Directives 2002/95/EC of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directives), for example, are to reduce the waste management problems and to protect the human health from certain hazardous substances. Product items exporting to European Union would need to have certification on chemical testing performed on these items which shall be renewed annually. Meeting regulatory requirements from various countries became day-to-day activities of testing, inspection and certification businesses in Hong Kong.

Many reports and statistics suggested that there shall be a growing demand of manpower in the product testing industry in Hong Kong for the years ahead. These suggestions were based on the rapid increase of manufacturing plants in China and in the region, and on China's entry to the World Trade Organisation (WTO), which created an obligation and need for China to fulfil the product standard requirements of its trading partners.

In this situation, Hong Kong has a very important role to play. Overseas companies, as well as companies in China, look at Hong Kong test certificates as a guarantee of the quality of the products. In the Closer Economic Partnership Agreement (CEPA), it was highlighted that China and Hong Kong will urge their respective organisations to strengthen cooperation with a view to promoting conformity assessment (including testing, inspection and certification), accreditation and standardisation management.

With this background, the TIC industry was identified by the Task Force on Economic Challenges (TFEC), in June 2009, as one of six economic areas with high growth potential. Further data from the Hong Kong Special Administrative Region (HKSAR) Government indicated that from 2008 to 2009, the TIC industry's economic growth rate was about 13.1%². The statistics report also revealed that among the six economic areas (cultural and creative industries, medical services, education services, innovation and technology, testing and certification services, and environmental industries), testing and certification services exhibited the highest annual growth rate in terms of contribution to GDP from the year 2008 to 2009. It was considered a significant growth in a

¹ The 2009-10 Policy Address "Breaking New Ground Together"
(<http://www.policyaddress.gov.hk/09-10/eng/index.html>).

² Hong Kong Monthly Digest of Statistics, Feature Article "The Situation of the Six Industries in Hong Kong in 2008 and 2009", Census and Statistics Department of HKSAR, February 2011.
(http://www.censtatd.gov.hk/hong_kong_statistics/four_key_industries/six_industries/index.jsp)

mature economy such as Hong Kong. The total number of persons engaged by private independent TIC establishments was 13,110 in 2011³, representing an increase of about 3.4% compared to 12,680 in 2009.

In order to steer the development of the TIC industry, the HKSAR Government established the Hong Kong Council for Testing and Certification (HKCTC) in September 2009. The vision of HKCTC is to develop Hong Kong into a testing and certification hub in the region by reinforcing the branding of “Tested in Hong Kong, Certified in Hong Kong.”

According to the report published by HKCTC in March 2010⁴, the TIC industry not only has direct economic contribution to Hong Kong, but it also supports the manufacturing, export and other service industries. The TIC industry plays an important role in daily life of the Hong Kong community, e.g. medical testing results for the diagnosis of illness in medical sector. Private laboratories have been playing an increasing role in supporting the food industry for safety and quality assurance and also the Government in food testing. The construction laboratories contribute to ensuring the safety of buildings and infrastructure facilities.

Owing to the immense scale and the diverse nature of the TIC industry, the work nature of the industry was grouped into three core business areas:

- Testing: the determination of one or more characteristics of an object according to a procedure.
- Inspection: the examination of a product design, product, process or installation and determination of its conformity to specific or general requirements on the basis of professional judgement.
- Certification: a third-party attestation related to products, processes, systems or persons.

The existing inspection services in Hong Kong tend to be focused on those areas that have regulatory requirements for inspection such as lift, fire services installation, vehicle, and building inspections. The area of inspection is more related to regulatory activities than commercial activities that contribute significantly to the economic growth. In addition to statutory inspection requirements, there are also voluntary inspection schemes, e.g. inspection of indoor air quality arising from the voluntary “Indoor Air Quality Certification Scheme for Offices and Public Places”.

In a way, the need for goods inspection also arises from the international trade. These activities however tended to be shifted to outside Hong Kong – with the relocation of the manufacturing industry from Hong Kong to the Pearl River Delta (PRD) Region, many goods inspection activities for export to overseas markets have been shifting to the Mainland and are increasingly conducted by Mainland employees.

Certification service could be broadly grouped into two areas: certification of a product or a management system. The TIC industry in Hong Kong provides certification service for different management systems that are recognised internationally and there is an increasing demand for new types of system certification. Product certification can also help enhance the quality of the products concerned and create new business opportunities for the TIC industry. There are new potential areas identified in the certification industry including environmental management system (ISO 14001 certificates), food safety management system (ISO 22000), social accountability system (SA 8000 or other similar code of conduct) and certification services relating to IT, carbon audit and greenhouse gas emissions. Food safety management system, climate change related audits and IT related audits are all in the upward trend.

³ Review Report of the Hong Kong Council for Testing and Certification 2013, March 2013.
([http://www.hkctc.gov.hk/en/doc/HKCTC_Report_Eng\(2013\)LR.pdf](http://www.hkctc.gov.hk/en/doc/HKCTC_Report_Eng(2013)LR.pdf))

⁴ Report of the Hong Kong Council for Testing and Certification, “Tested in Hong Kong, Certified in Hong Kong”, March 2010.

Testing service in general represents the biggest business volume of the TIC industry. The Review Report of HKCTC 2013 stated that a significant portion (representing 80% of the business receipts from testing and 50% of the total business receipts of private establishments in the industry in 2011) of the business receipts of private independent establishments was attributed to testing of textiles, clothing and footwear; toys and games; electrical products; and medical testing. Development of testing in these four trades is more mature and any new developments of testing in these areas may be required by some new initiatives, e.g. introduction of new regulations in local and/or international trade. In addition, the HKSAR Government will focus promotion efforts on the following six selected industries with potential demand for testing and certification services:

- Chinese medicine;
- construction materials;
- food;
- jewellery;
- environmental protection; and
- information and communications technologies.

In the following section, an analysis is carried out to examine the external environment in which the testing, inspection and certification industry is embedded in, while, implications drawn will be focused on the development of the competency standards required by the testing, inspection and certification industry.

Section 2

PEST Scan

A critical review of the macro environment is conducted so as to figure out the future challenges faced by the TIC industry sector. The present project will adopt a systematic approach advanced by **PEST**, in which **Political, Economic, Social and Technological** factors are evaluated in the process of environmental scanning. PEST analysis is particularly effective in analysing the macro-environment which the organisation is in. These macro-environmental factors usually are beyond an organisation's control while changes in the external environment also create new opportunities.

Political Factors: These include those factors on how and to what degree a government intervenes in the economy. Political factors may also include goods and services which the government wants to provide or be provided and those that the government does not want to be provided. Regulatory requirements in China and overseas countries and political stability fall into this category.

Economic Factors: Factors such as GDP, growth rates of various aspects in TIC industry, funding support from the government are examples of economic factors. These factors have major impacts on how businesses operate and make decisions.

Social Factors: This category refers to demographic variables, attitudes or lifestyle of the workforce and clients using the TIC services and the infrastructure supports to the industry. Trends in social factors affect the demand for TIC services and how the TIC establishments operate.

Technological Factors: Factors such as pace of technological changes, level of Research & Development activities etc. affect the cost, production levels, and competitive positioning of a TIC establishment.

As each of the above four factors covers a massive range of issues, the present analysis does not intend to carry out a comprehensive and inclusive evaluation; instead, only factors that have substantial impact on the TIC industry are selected and reviewed in the following paragraphs.

(A) Political Factors

As mentioned in Section 1, the testing and certification industry was identified as one of the six economic areas where Hong Kong enjoys clear advantages and has good potential for further development. The HKSAR Government is currently providing support to the TIC industry through various channels. One of these supports is to provide accreditation to offer official recognition to competent testing and calibration laboratories, inspection bodies and certification bodies which meet international standards by the Hong Kong Accreditation Service (HKAS) of the Innovation and Technology Commission, HKSAR Government. At present, there are three accreditation schemes currently operated by HKAS⁵:

- (i) Hong Kong Laboratory Accreditation Scheme (HOKLAS)
- (ii) Hong Kong Inspection Body Accreditation Scheme (HKIAS)
- (iii) Hong Kong Certification Body Accreditation Scheme (HKCAS)

Users of conformity assessment services will easily identify and select those accredited bodies (laboratories, inspection bodies, or certification bodies) in order to support their business.

As at end of 2012, there were 235 organisations accredited by HKAS, representing an increase of 16% when compared with 202 organisations as at end of 2009. The following table sets out the breakdown and changes in the number of accredited organisations (retrieved from the Review Report of the Hong Kong Council for Testing and Certification 2013³):

Category	Number of Accredited Organisations				
	2009	Terminations	New	2012	Change
Testing Laboratory	167	15	44	196	+17%
Inspection Body	20	3	3	20	-
Certification Body	15	0	4	19	+27%
Total	202	18	51	235	+16%

During the consultation with stakeholders of the TIC industry, some testing laboratories commented that their employees had already acquired more than three years relevant testing experience but they did not have the necessary academic qualifications to be authorised as approved signatories to endorse HOKLAS reports. An alternative route of recognised qualifications will be attractive to the practitioners working in the TIC industry.

HKAS is a member of the International Laboratory Accreditation Cooperation (ILAC) and the International Accreditation Forum (IAF) at international level; and the Asia Pacific Laboratory Accreditation Cooperation (APLAC) and the Pacific Accreditation Cooperation (PAC) at regional level. HKAS has been active in contributing to the international accreditation community. Through joining multilateral mutual recognition arrangements (MRAs) administered by ILAC, IAF, APLAC and PAC, the accreditation granted by HKAS to testing and certification organisations is recognised by about 84 MRA partners in 67 economies, including Hong Kong's major trading partners. This could enhance the recognition of conformity assessment results from local accredited organisations by these trading partners.

HKAS has introduced many new accreditation services to meet the changing needs of the industry and the community at large. These new accreditation services have addressed the needs of the industry, e.g. accreditation for laboratories to carry out testing for the CCC System to support Hong Kong's industry to explore the mainland market. On the certification side, in the past HKAS

⁵ Hong Kong Accreditation Service website (<http://www.itc.gov.hk/en/quality/hkas/about.htm>).

focused its accreditation service on a number of certification activities with high market demand, e.g. certification of quality management system to the ISO 9001 standard. To support local companies in providing a more diversified scope of certification services (in particular to support small and medium enterprises that cannot afford the high cost of seeking accreditation from overseas accreditation bodies), the types of certification services that can be accredited by HKAS have expanded from four to nine (+125%) since April 2010.

New regulatory requirements and initiatives from HKSAR Government bureaux and departments can generate new service demands and hence business opportunities for the TIC industry. In fact, the introduction of regulatory requirements is to achieve policy objectives, e.g. to ensure public safety; however, the TIC industry is ready to render services to concerned trades to facilitate their compliance with regulatory requirements. The following list illustrates some examples of these regulatory requirements and initiatives:

- Registration of proprietary Chinese medicines creates demand for testing of heavy metals and toxic elements, pesticide residues, microbial contaminants, etc.
- Product certification of building / construction materials in Housing Authority's capital works projects.
- Testing of food in compliance with local regulations (e.g. nutrition labelling scheme, new Food Safety Bill to strengthen legislative control on food safety).
- Government Laboratory has outsourced some of the regular food surveillance testing work to the private sector.

Apart from the above initiatives, the Report of HKCTC 2010-2011⁶ has stated that there will have good opportunities to promote the use of the testing and certification services in the selected trades as follows:

- Certification services for food safety management system to ISO 22000;
- Authentication of high-valued food by objective and scientifically-based tests, e.g. DNA sequences analysis, chemical finger-printing, etc.;
- Product certification services for new types of construction materials, e.g. fire rated doors and panel wall partitions, cement products, ceramic tiles, tile adhesive, repair mortar and aluminium window by phases to upgrade quality of buildings;
- Authentication of Chinese medicines by microscopic examination and physicochemical methods in accordance with the Hong Kong Chinese Materia Medica Standards (HKCMMS);
- Product certification scheme for Chinese medicines.

With the economic growth and development of populated urbanised centres, Mainland consumers have shown more and more interest in food quality and safety. Likewise food safety system in Mainland China has enormous impact to Hong Kong consumers that approximately 90% of fresh agricultural products are imported from Mainland China and this figure would be expected to further increase as the food trade activity between Hong Kong and Mainland China has been tightly integrated. Food safety testing and food safety management system are very important to safeguard the public health of Hong Kong against those poisoned food or defective food products. Consequently, the demand for TIC services in food testing and certification of food safety management system will increase.

At present, in support of Hong Kong's external trade, the TIC industry has been providing high volume of testing and inspection services for consumer products manufactured in Hong Kong and the Pearl River Delta (PRD) Region. Under the Supplement VII to the Mainland and Hong Kong

⁶ Report of the Hong Kong Council for Testing and Certification 2010-2011, August 2011.
(http://www.hkctc.gov.hk/en/related_document.html)

Closer Economic Partnership Arrangement (CEPA) signed in May 2010 and details announced in January 2011, testing laboratories in Hong Kong are allowed to co-operate with designated Mainland organisations in testing products for the China Compulsory Certification (CCC) System for four selected products processed in Hong Kong. These testing laboratories have to be accredited by the HKAS in order to undertake tests for the relevant products under the CCC System. Through the Supplement VIII to CEPA signed in December 2011, the pilot was extended to cover all 22 types of products under CCC System. The Supplement IX to CEPA, signed in 2012, has further expanded on a pilot basis in Guangdong Province the scope of certification services that can be undertaken by Hong Kong testing laboratories to cover food. These new measures under CEPA will provide testing laboratories in Hong Kong with more opportunities to provide testing services in Mainland China and hence promote the trade between the two places.

Another important political factor affecting the TIC industry is the attitude and policy of Mainland China government, as well as the economic situations of Mainland China. Over the years, the TIC industry in Hong Kong succeeded to earn high integrity and ethical reputation in the business world. With ever tightening testing, inspection and certification requirements in transnational trading and Mainland China to continue its world factory role in the next decade, opportunities exist for the TIC industry in Hong Kong to contribute and benefit.

In spite of the above factors and opportunities, the local TIC industry still faces many challenges, especially the competition from Mainland China for further development. The Mainland testing laboratories have lower labour and land costs and are geographically close to their clients. Consequently, the Mainland testing and certification service providers enjoy the competitive edge with lower labour and capital costs and shorter travelling time.

From the global perspective, new or more stringent rules and regulations are imposed by the major importing countries on consumer product quality, safety and efficiency. Besides, some incidents occurred worldwide would have impact on the demand of local TIC services. Some examples are listed as follows:

- New EU Directive 2009/48/EC on toy safety (EN71-1:2011, EN71-2:2011, EN71-3:2013, EN71-4:2013, EN71-5:2013, EN71-8:2011, EN71-12:2013, EN62115-A2:2011);
- EU Regulation No. 248/2011 on food container materials;
- Testing and certification under US Energy Star Program;
- Photobiological safety testing for LED lighting products (EN62471);
- RoHS Recast Directive 2011/65/EU on restricting the use of several hazardous heavy metals, brominated flame retardant, phthalates in electrical and electronic equipment, including medical devices and monitoring and control instruments;
- The candidate list of potential Substances of Very High Concern (SVHC) under REACH Regulation has been updated to include a total of 144 substances in June 2013;
- Phthalate testing service after the outbreak of phthalate contamination in sports drinks and beverages in Taiwan;
- Certification of occupational health and safety management system to OHSAS 18001 standard;

- Certification of information security management system to ISO/IEC 27001 standard.

These new or more stringent international regulations and incidents would definitely drive for substantial demand for TIC services from clients who need to comply with these regulatory requirements or to ensure the safety of the consumer products.

(B) Economic Factors

The TIC industry supports the manufacturing, export and other service industries, and is therefore an integral part of the overall supply chain. For instance, consumer product testing and inspection services are mainly for exported goods while construction materials testing and certification, food testing, environmental testing, testing and authentication of Chinese medicines mainly focus on local industries. Demand of system and product certification businesses are generated both locally and externally (e.g. in the Mainland). With the industry's extensive involvement in supporting Hong Kong's external trade, the TIC industry could be affected by the macro economic climate of major economies outside Hong Kong. Indeed, the industry has overcome a lot of challenges in the past few years to maintain a steady growth in business against the background of continuous uncertainties in the US and European markets.

The TIC industrial has revealed a substantial growth trend in recent years according to the following tabulated figures⁷.

(i) TIC industry profile:

	2009	2010	2011
Independent testing laboratories, inspection and certification bodies	570	610	600
Employment	12,610	12,390	13,100
Business receipts (HK\$)	8.6 billion	8.9 billion	10.8 billion
Value-added / contribution to GDP (HK\$)	5.1 billion	5.2 billion	5.4 billion

(ii) Breakdown of business receipts by types of services:

	2009 (HK\$ Million)	2010 (HK\$ Million)	2011 (HK\$ Million)
Testing	5,972 (69%)	6,052 (68%)	6,729 (62%)
Inspection	1,316 (15%)	1,691 (19%)	1,656 (15%)
Certification	517 (6%)	356 (4%)	395 (4%)
Others	818 (9%)	801 (9%)	2,000 (19%)
Total:	8,622 (100%)	8,900 (100%)	10,780 (100%)

(iii) Proportions of business receipts from provision of testing services:

	2009	2010	2011
Textiles, clothing and footwear	24%	26%	21%
Toys and games	24%	26%	24%
Medical testing	20%	22%	21%
Electrical products and telecommunications equipment	14%	9%	13%
Others (construction materials, food, Chinese medicines, indoor air quality)	18%	17%	20%

In 2011, the majority (62%) of business receipts were from testing activities. It is anticipated that

⁷ The figures are extracted from the following sources:

- Report of the Hong Kong Council for Testing and Certification 2011-2012, August 2011
 - Review Report of the Hong Kong Council for Testing and Certification 2013, March 2013
 - PowerPoint file "Industry Profile of Testing and Certification Services in Hong Kong", Census and Statistics Department, June 2013
- (http://www.hkctc.gov.hk/en/doc/Testing_Certification_IndustryProfile2011_CSD_Statistics_LR_e.pdf)

the testing sector will still have the substantial economic growth in coming years due to new regulatory requirements and initiatives from the local government and overseas countries. Such an economic growth in the testing sector will in turn increase the manpower demand to support the business growth in the TIC industry. From the breakdown of business receipts of testing services, the testing of textiles and toys still contribute to about half of the business receipts from testing services, i.e. the major revenue of TIC industry. It was foreseeable that there would be an increasing trend for companies to set up their own laboratory testing divisions in response to such needs, in order to curtail the corresponding operation expenses, as well as boost the efficiency on product testing.

On the other hand, there is a substantial increase in the business receipts from the “Others” item which includes food testing, construction materials testing, and testing of Chinese medicines, etc. This is evidenced by the regulatory requirements on food safety and nutrition labelling, outsourcing of food testing by Government Laboratory, product certification of construction materials, and registration of proprietary Chinese medicines. There will have great potentials for further development in the food testing, construction materials testing and testing of Chinese medicines in the TIC industry.

The set-up cost for certification and inspection bodies is similar to other commercial companies. Testing laboratories have, however, a relatively high set-up cost due to equipment cost and accommodation, etc. As for financing from banks, there is no particular difficulty as compared to other business. SMEs are coping with the set-up costs through various means such as specialisation and outsourcing. Owing to the small size of Hong Kong’s economy, commercial services providers in the TIC industry may be hesitant to invest on certain services that do not have sufficiently large demand and hence revenue. As a result, the variety of services provided by the TIC industry may not be comprehensive enough, i.e. some potential business opportunities cannot be captured.

In view of the capital investment, the HKSAR Government will promote the Small Entrepreneur Research Assistance Programme (SERAP⁸) to those SMEs and encourage them to make use of the funding scheme. From April 2010 till December 2012, five R&D projects relating to testing and certification were supported by SERAP with approved funding of \$9.4 million. An example is the development of transgenic fish for biological testing to monitor heavy metals, toxins and persistent organic pollutants. Moreover, the Hong Kong Productivity Council (HKPC) and the Hong Kong Science and Technology Parks Corporation (Science Park) have laboratory facilities and equipment that are available for shared use by private testing laboratories. In 2011, HKPC set up a new electromagnetic compatibility anechoic chamber with Government funding of \$9.9 million. The new chamber enables local laboratories to test products according to the latest electromagnetic compatibility requirements in the European market. There are also other forms of Government funding support that may help developing the TIC industry. Some examples include the SME Development Fund for a local trade association to develop a professional certification scheme for testing personnel which has been launched in September 2011, the Commercial Information Circulars, and the Innovation and Technology Fund (ITF) to enhance technical capability of the industry.

Testing laboratories are generally located in industrial buildings, except for medical testing laboratories which are usually located in commercial buildings. Inspection and certification bodies are generally accommodated in rented premises of commercial buildings. As at end of 2011, the average vacancy rate of industrial and commercial buildings was 6.7%, equivalent to a total vacant area of about 2.64 million m². In view of the size of vacant building stock as

⁸ SERAP is a technology entrepreneurship programme under Innovation and Technology Fund (ITF) which provides pre-venture capital stage financing to support technology entrepreneurs and small enterprises to carry out research and development work for starting new business and conducting market validation.

compared to only some 600 private establishments in the industry, the supply of premises should generally cope with the demand. The Government is conducting the planning and engineering studies of several new developments, including the Lok Ma Chau Loop and the Northeast New Territories New Development Areas. The TIC industry is interested in additional supply of land in the new development areas with testing and certification as one of the permitted land uses. However, good infrastructure, including convenient transportation network, should be provided.

(C) Social Factors

Hong Kong has been a business and commercial community for a long time in the region. The major strengths enjoyed by Hong Kong are summarised as follows:

- (i) The high level of professional integrity and credibility of the Hong Kong society as a whole give confidence to the users of the local TIC industry. The Independent Commission Against Corruption has developed a “Corruption Prevention Guide for Testing and Certification Industry” which provides a host of good practices to enhance integrity management and internal control. Moreover, good intellectual property protection helps attract business because companies prefer to conduct tests of prototypes of new products in Hong Kong to avoid replicas of new products in the market. Training on ethical management may be useful for practitioners in the TIC industry to upkeep their working standard.
- (ii) Good telecommunications infrastructure would enhance fast communication of testing / inspection results to overseas buyers of products. The language capability of Hong Kong people in English, Chinese and Putonghua would enable the local TIC industry to communicate easily with manufacturers in Mainland China and overseas buyers. The above infrastructure can promote the TIC services providers to the users and hence support the business development of the industry.
- (iii) The sound legal system, low tax rate and simple tax system, good law and order, and good language skills would enable the attraction of foreign conformity assessment bodies to set up branches in Hong Kong. This would bring international experience in TIC services to Hong Kong and strengthen the business opportunities of local TIC industry.
- (iv) Good corporate governance and efficient operation in TIC establishments accredited by HKAS would allow fast turnover and provision of flexible services. Consequently, the quality services of TIC industry can build up good relationship with clients and hence to achieve the sustainability of the business operations.
- (v) Hong Kong has a well established education and training system to provide the necessary manpower in professionals and associate professionals required to support the development of the TIC industry. At present, the local universities offer various undergraduate and postgraduate programmes in science, applied science, engineering, and fashion and textiles disciplines⁹. The Vocational Training Council (VTC) also offers Higher Diploma programmes and part-time in-service training programmes in applied science and engineering disciplines¹⁰ that are relevant to the TIC industry.

In spite of the above strengths, the major challenge faced by the TIC industry is to compete with other industries for talent. The mobility of staff who has worked for less than three years in the TIC industry is much higher than those who have worked longer. The total number of vacancies was about 320 for the TIC industry in 2009. The TIC industry is not attractive to graduates due to the heavy workload, less pleasant working environment, and unfamiliar business nature and prospects. The TIC industry also has difficulties to retain top talent in view of the comparatively small size of the industry. In addition, there is a need to tackle short-term demand surges in response to changes in overseas regulatory requirements for products manufactured in the PRD Region and tested in Hong Kong for export markets. The TIC industry commented that the training could be enhanced to better suit the needs of the industry and also to increase students’ awareness and understanding of the industry to attract talents. Moreover, more enhancement

⁹ For details of the undergraduate and postgraduate programmes offered by local universities, please refer to the website of Hong Kong Council for Testing and Certification (<http://www.hkctc.gov.hk/en/work.html>).

¹⁰ For details of the Higher Diploma and in-service training programmes offered by VTC, please refer to VTC Testing and Certification Portal website (<http://t-cert.vtc.edu.hk/>).

training should be developed for practitioners in order to enhance their skills and professionalism.

(D) Technological Factors

In local TIC industry, there is a high technology requirement, especially for laboratory settings of the testing sector. At present, high proportion of professionals and associate professionals are engaged in TIC industry and most of them are from science and engineering disciplines. Hong Kong has the technological competence to perform most commonly demanded tests by clients. Moreover, international testing laboratories in Hong Kong have the advantage of being relied on their global network for technology transfer support.

However, for further development and growth of the TIC industry, the following research and development (R&D) activities in technology aspects should be necessary:

- Adaptation of new testing technologies developed overseas to the local industry;
- Interpretation of international standards;
- Development of new testing methods locally;
- Continuous improvement to existing testing methods to enhance efficiency and accuracy;
- Automation of routine testing processes.

As most of TIC establishments are operated on commercial basis and some testing laboratories requiring technological input in conducting day-to-day operation are relatively small in size, they may not afford to spend much in R&D activities for new testing methodology if there is no sufficiently large market demand. The following measures may be required to help elevate standards and enhance the overall development of the industry:

- Funding support on various R&D activities such as ITF, SERAP, and R&D Cash Rebate Scheme;
- Assistance to the ITC industry to link to technological institutions in Hong Kong for collaboration opportunities, e.g. development of new testing methodologies, setting up of testing sites, sharing of advanced equipment;
- Keep the industry abreast of the latest development in international standards;
- Technical support from Government Laboratory to share new testing methodologies and skills with the industry, organise proficiency testing, and produce reference materials that are in demand by the local testing industry.

It is anticipated that the establishments of the TIC industry would make use of the above measures to further develop their business opportunities, especially in new service areas.

Section 3

Consultation with Stakeholders of the TIC Industry

As mentioned earlier the work nature of the testing and certification industry can be largely grouped into testing, inspection and certification. In order to further analyse the activities of the TIC industry so as to identify its core functional areas, consultation with different stakeholders of the industry was carried out to collect their views on identification of key functional areas and the skills set or competency required of the practitioners working in the TIC industry. The findings of the consultation / interviews are summarised as follows.

- (i) Most of the practitioners in consumer products testing and environmental testing have acquired the necessary academic qualifications (e.g. Bachelor degrees, higher diplomas, diplomas, etc.) before employment. However, some interviewees commented that there were skills gaps between the academic qualifications and the job competency requirements. Below are some examples of skills gaps identified and the job competency required:
- Interpretation of technical standards / regulatory requirements on product testing;
 - Test method development for new / revised standards and/or regulatory requirements in overseas countries;
 - Field sampling techniques;
 - Laboratory testing techniques;
 - Technical skills in instrumental analysis;
 - Microbiological techniques;
 - Testing of construction materials;
 - Work flow of a testing laboratory;
 - Specific techniques of product testing (e.g. safety tests, electromagnetic compatibility tests) and extension of these techniques from one kind of product to another kind of product;
 - Use, calibration and maintenance of testing equipment;
 - Result verification and reporting;
 - Quality system and requirement;
 - Research and development for new initiatives / new testing methodologies;
 - Code of conduct: professional ethics, integrity, etc.
- (ii) Most of the practitioners in construction materials testing are mainly trained from the apprenticeship system and may not have the minimum academic qualifications required for meeting the tender specifications of construction material testing and certification from the Public Works Central Laboratory of the Civil Engineering and Development Department, HKSAR Government (at least a pass in HKCEE English Language plus two years of relevant working experience) and the Housing Authority (five passes in HKCEE subjects plus one year relevant experience). There is a need of a mechanism or platform for recognising the vocational qualifications and experiences of the practitioners working in construction materials testing in order to supplement the inadequacy of their academic qualifications.
- (iii) The Hong Kong Association for Testing, Inspection and Certification Limited (HKTIC) has launched the Professional Certification Scheme (the Scheme) for Testing Personnel to provide certification of individuals who can demonstrate their knowledge and competencies in their field of testing¹¹. The Scheme has therefore defined the major skills set and competencies required by testing practitioners for certification purpose.
- (iv) Inspection of consumer products is still the dominant business in the inspection sector. However, the demand for inspection of welds, construction products and building materials is increasing in recent years. The competency standards required by the personnel for

¹¹ Professional Certification Scheme for Testing Personnel launched by HKTIC: <http://www.hktic.org/>

conducting inspection of consumer products and building materials can be identified and developed.

- (v) Most of the practitioners working in the certification sector have already acquired the necessary academic qualifications and working experience in related business fields. Moreover, there have already well established competency specifications for auditors in the certification of most management systems. The certification sector would require the competences in the business sense for capturing new niche areas of further business development and in the technical sense for developing new certification schemes for products in local industries.
- (vi) At present, continuing professional development (CPD) training is not mandatory in the TIC industry. However, the users of services providers of the TIC industry may require the accredited testing laboratories, inspection bodies or certification bodies to have their staff's CPD training records in order to ensure the reliability of the test / inspection reports or certification services. This would lead to a demand for the development of quality and recognised training programmes in order to enhance the professional development of practitioners in the TIC industry.

Based on the PEST analysis of the TIC industry in Section 2 and the comments from the industrial stakeholders, the following areas in the TIC industry are identified to have substantial demand for the development of competency standards:

- (i) Testing of consumer products such as textiles and garments, toys, food, electrical products;
- (ii) Testing of construction materials;
- (iii) Environmental testing;
- (iv) Product inspection, especially for building materials;
- (v) Management system and product certification.

Section 4 The Way Forward for TIC Industry

Hong Kong has its own uniqueness such as being a free trade port and a trading hub where there are a lot of buying offices, its proximity to the Mainland and use of both Chinese and English.

It is now timely for the TIC industry to develop its work-based competency standards to guide effective manpower preparation in anticipation of the business demand; and to nurture the trade into a specialised profession.

While the setting of work-based competency standards and the provision of skills upgrading opportunities will prove helpful to future TIC manpower development, the immediate problem identified is the lack of attraction of the industry for youngsters to join. This may partly be due to the unfamiliar business nature of the industry and partly to the lack of professional and social identity. The industry also finds a very high wastage of new recruits in their first two years of engagement, which may be accorded to the repetitive work nature and the short ranged career opportunities perceived from the initial encounter. A pragmatic solution must therefore be required to address these issues as priority.

Chapter 2

Qualifications Framework

Section 1 The Need for Qualifications Framework

In Hong Kong, there is a lack of formal professional status for people working in the TIC industry. During the interview with various stakeholders, there is a skill gap between the academic qualifications (e.g. Bachelor degree, higher diploma) and job competencies required by the TIC industry. There is a need to have a common platform – Qualifications Framework (QF) – to recognise the vocational qualifications for professional development of practitioners in the industry. The QF aims to clearly define the standards of different qualifications acquired from academic, vocational and continuing education, ensure their quality and indicate the articulation ladders between different levels of qualifications. By encouraging and promoting lifelong learning to the workforce, QF will enable individuals to pursue their career goals with the ultimate mission of cultivating a pool of high standard and competitive employees.

Establishments of the TIC industry indicated that they are currently facing difficulties in attracting quality manpower to support the growth of the industry – further business growth would be hampered with this problem. The obstacle of lack of attractiveness is largely related to the structural problems on: (i) the lack of a career ladder, and (ii) the lack of an academic ladder for the TIC industry. Without these two ladders, the TIC industry cannot compete with other industries for quality talent from the workforce.

For the academic ladder, the Open University of Hong Kong (OUHK) launched a distance-learning Bachelor of Science in Product Design, Testing and Certification programme in April 2010 and a part-time Master of Science in Testing and Certification programme in April 2012. The OUHK is planning to launch a full-time Bachelor of Science (Hons) in Testing and Certification programme in 2013. The Hong Kong Baptist University also launched a Bachelor of Science (Hons) in Analytical and Testing Services programme in September 2012. Other educational institutions have also been offering various full-time and part-time testing and certification related training courses. For example, many of the higher diploma programmes from the Vocational Training Council, which are pegged at QF level 4, are related to the TIC industry. In April 2010, VTC offered 11 higher diploma programmes with testing and certification elements in applied science and engineering disciplines. Following the 3+3+4 Education Reform, these programmes were revamped into ten new ones in September 2012. The QF can be used to facilitate the articulation between qualifications of different levels.

For the career ladder, the TIC industry would need an objective framework to quantify the competence levels of the workforce and this framework would then be used as a reference point for career promotion and advancement. A major development in this area is the formation of the TIC ITAC to assist in facilitating the manpower development within the QF in such a way that the QF can be used to develop the career pathways for practitioners in the industry.

The TIC ITAC comprises key industry stakeholders in a steering role to work on job competency standards for core functions. A set of specification of competency standards (SCS) will be developed for the TIC industry. SCS comprises a whole set of core competencies which describe skills, knowledge and attributes that are required by the industry at various levels under different functional areas. SCS can be further customised to serve as an objective basis for education, training, qualification recognition, human resources management, etc. in individual organisations. Nevertheless, the QF is a platform where different stakeholders can find useful information related to the qualifications or competency requirements of the sector. To cater for different purposes, readers can tailor the information according to their own needs.

Chapter 3

Specification of Competency Standards

Section 1 Applications of the Specification of Competency Standards

In general, the specification of competency standards (SCS) can be applied in the following ways:

- Education and training: SCS provides the learning outcomes (required competencies at various QF levels) and assessment criteria for training institutions to design the curriculum of suitable training programmes and also provides a basis for credit accumulation and transfer among different training institutions.
- Human resources management and development: for employers to design their in-house or internal training to individual employees or to use the SCS as yardsticks for identifying personnel with suitable skills and knowledge for recruitment or promotional purposes.
- Qualifications and assessment: SCS provides assessment base for the recognition of prior learning (RPL) of employees.
- SCS can facilitate lifelong learning of students and working adults.
- The development of QF system for the TIC industry can sustain competitiveness and enhance employability of Hong Kong people.

Once the TIC industry functional map is established, it shall form the basic framework for developing the specification of competency standard (SCS). This SCS, when ready, could serve as outcome benchmark for: (i) vocational education and training, (ii) competency assessment and professional recognition, and (iii) various human resources functions.

The establishment of the SCS under QF system can meet specific needs in the TIC industry which includes:

- Professional certification purpose (e.g. HKTIC Professional Certification Scheme for Testing Personnel)
- Education and training purpose (e.g. benchmarking with OUHK/VTC programme objectives and intended learning outcomes)
- Occupational purpose (e.g. in-service training for enterprise)

The SCS may also make explicit key employment attributes and outcome standards on:

- Occupational qualities (e.g. practice and competency)
- Vocational qualities (e.g. knowledge and skill cognition, work aptitude and attitude)
- Professional qualities (e.g. integrity, conduct and ethics)

TIC SCS may be regarded as a set of core competencies for the identified work functions with specifications on integrated outcome performance for the industry. These competency standards are the industry requirements for the skills, knowledge and attributes required to satisfactorily perform a job at a certain level. The consensual standard on competencies applicable to various skill functions can be presented as Unit of Competencies (UoCs) in the SCS. The UoCs are competency-based, contextual and outcome criteria referencing. Each UoC represents an inseparable, self-contained set of competencies required to perform a specific task. The UoCs can be grouped into building blocks for serving different purposes.

The drafting of TIC SCS would make reference to similar international competency standards. For instance, in Mainland China, the national occupational skill standards have been established for chemical examiner, food examiner, construction material chemical analyst, and Chinese medicine examiner for the occupational skill testing under the National Vocational Qualification (NVQ). The TIC SCS may be benchmarked with the competency requirements of the national occupational skill standards to further promote the TIC industry in the Mainland. Besides, the Australian Qualifications Framework (AQF) has established a set of competency standards for laboratory operations training package including chemical tests and instrumental techniques, physical tests, construction materials tests, microbiological tests, food tests, etc. The New Zealand Qualifications Authority (NZQA) has also established competency standards in Laboratory Practice & Technology and Engineering & Technology under the New Zealand Qualifications Framework (NZQF). In United Kingdom, the National Qualifications Framework (NQF) has relevant units of competency in laboratory science as well as building and construction. The benchmarking of HKQF with NVQ, AQF, NZQF and NQF will be explored in the future.

Section 2

Major Functional Areas of TIC Industry

The Testing, Inspection and Certification Industry Training Advisory Committee recommend the major functional areas of the TIC SCS as follows:

(I) Laboratory / On-site Testing

(i) Testing Operations

Testing Operations functional area incorporates a complete workflow of a testing laboratory to provide quality-assured test results and reports on samples according to the request of customers. The major functions in this functional area include Testing Method Development and Operation Planning; Sampling and Sample Handling; Testing (including Chemical, Biological/Microbiological, Environmental, Electrical and Electronic, Physical and Mechanical); Data Collection, Analysis and Interpretation; Quality Assurance of Test Results; Measurement Traceability; Equipment Maintenance; and Test Result Reporting.

(ii) Testing Quality Management

Quality management is an important aspect in a testing laboratory to ensure the quality of outputs of its testing work by maintaining its quality system in compliance with the requirements of relevant international standards and/or accreditation criteria. The major functions in this functional area include Laboratory Quality System Development, Implementation, Monitoring and Maintenance.

(II) Inspection

(i) Inspection Operations

Inspection Operations functional area describes a complete workflow of an inspection body to provide quality-assured inspection results and reports according to the request of customers. The major functions in this functional area include Inspection Method Development and Preparation; Conducting Inspection; Quality Assurance of Inspection Results; and Inspection Result Reporting.

(ii) Inspection Quality Management

Quality management is an important aspect in an inspection body to ensure the quality of outputs of its inspection work by maintaining its quality system in compliance with the requirements of relevant international standards and/or accreditation criteria. The major functions in this functional area include Inspection Quality System Development, Implementation, Monitoring and Maintenance.

(III) Certification

(i) Certification Operations

Certification Operations functional area describes a complete workflow of a certification body to provide quality-assured audit reports and certificates according to the request of customers. The major functions in this functional area include Certification Audit Planning; Conducting Audit; Quality Assurance of Auditing; and Audit Reporting.

(ii) Certification Quality Management

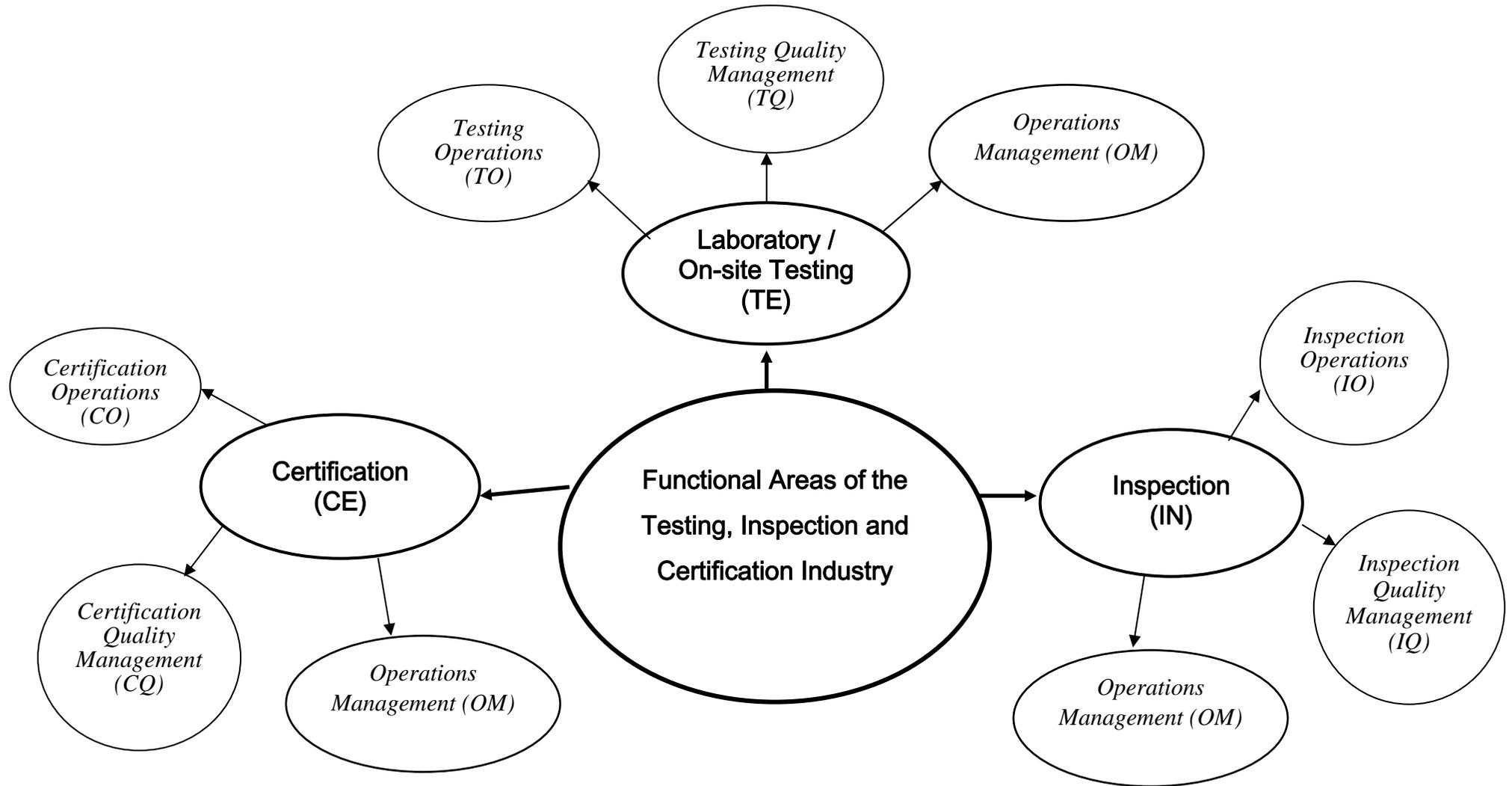
Quality management is an important aspect in a certification body to ensure the quality of outputs of its auditing work for certifying a management system or a product by maintaining its quality system in compliance with the requirements of relevant international standards and/or accreditation criteria. The major functions in this functional area include Certification Quality System Development, Implementation, Monitoring and Maintenance.

(IV) Operations Management

Operations Management covers the provision of operational and management support for TIC activities. The major functions in this functional area include Ethical Management; Environmental Protection; Occupational Safety and Health; Risk Management; Human Resources Management; and Customer Service.

Chapter 4 Units of Competency

Functional Map Showing the Functional Areas of the Testing, Inspection and Certification Industry



Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Test Method Development and Operation Planning				Validate test methods (2 Credits) 105761L4 (P4.3 - 2)	Adopt test methods and procedures from standard methods (2 Credits) 105755L5 (P4.3 - 5)	Establish and evaluate laboratory operations in functional area (2 Credits) 105753L6 (P4.3 - 17)	
				Verify test methods (2 Credits) 105762L4 (P4.3 - 3)	Develop non-standard test methods (2 Credits) 105756L5 (P4.3 - 6)	Formulate work schedule for laboratory / on-site testing (2 Credits) 105754L6 (P4.3 - 18)	
				Estimate and report measurement uncertainty (2 Credits) 105768L4 (P4.3 - 4)	Develop procedures for estimation of measurement uncertainty in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (4 Credits) 105757L5 (P4.3 - 7)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Test Method Development and Operation Planning					Develop procedures for estimation of measurement uncertainty in chemical testing using EURACHEM approach (4 Credits) 105758L5 (P4.3 - 8)		
					Develop procedures for estimation of measurement uncertainty in microbiological testing using EURACHEM/MIKE approach (4 Credits) 105759L5 (P4.3 - 9)		
					Formulate method validation protocol (2 Credits) 105760L5 (P4.3 - 11)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Test Method Development and Operation Planning					Prepare method validation reports (2 Credits) 105763L5 (P4.3 - 12)		
					Interpret international standards and regulatory requirements (1 Credit) 105764L5 (P4.3 - 13)		
					Evaluate customer's requests on testing services (2 Credits) 105765L5 (P4.3 - 14)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Test Method Development and Operation Planning					Devise test plans (2 Credits) 105766L5 (P4.3 - 15)		
					Supervise laboratory / on-site testing (2 Credits) 105767L5 (P4.3 - 16)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Sampling		Collect routine site samples (2 Credits) 105774L2 (P4.3 - 19)		Obtain representative samples in accordance with sampling plan (2 Credits) 105772L4 (P4.3 - 20)	Formulate sampling plan (2 Credits) 105769L5 (P4.3 - 22)		
				Apply statistical techniques in sampling (2 Credits) 105773L4 (P4.3 - 21)	Supervise field sampling activities (2 Credits) 105770L5 (P4.3 - 23)		
					Select sampling methods (2 Credits) 105771L5 (P4.3 - 24)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Sample Handling		Receive samples (1 Credit) 105776L2 (P4.3 - 25)	Pre-condition test samples (1 Credit) 105777L3 (P4.3 - 26)	Establish procedures for handling of test / inspection items and samples (2 Credits) 105775L4 (P4.3 - 29)			
			Handle and transport samples (1 Credit) 105778L3 (P4.3 - 27)				
			Prepare samples for testing (1 Credit) 105986L3 (P4.3 - 28)				

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Chemical Testing		Apply cleansing methods for labware (2 Credits) 105799L2 (P4.3 - 30)	Perform basic chemical tests and procedures (2 Credits) 105791L3 (P4.3 - 33)	Apply chromatographic techniques to chemical testing (6 Credits) 105784L4 (P4.3 - 41)	Apply mass spectrometric and hyphenated techniques to chemical testing (6 Credits) 105780L5 (P4.3 - 54)	Select test methods and measuring instruments (chemical testing) (2 Credits) 105779L6 (P4.3 - 62)	
		Conduct laboratory / field work (2 Credits) 105987L2 (P4.3 - 31)	Apply separation and cleanup techniques to organic analysis (2 Credits) 105792L3 (P4.3 - 34)	Apply atomic spectrometric techniques to chemical testing (6 Credits) 105785L4 (P4.3 - 43)	Perform chemical analysis on food (4 Credits) 105781L5 (P4.3 - 56)		
		Maintain laboratory/workplace fit for purpose (1 Credit) 105988L2 (P4.3 - 32)	Apply extraction techniques to organic analysis (2 Credits) 105793L3 (P4.3 - 35)	Apply inductively coupled plasma spectroscopic techniques to chemical testing (6 Credits) 105786L4 (P4.3 - 45)	Perform chemical analysis on pharmaceutical products (4 Credits) 105782L5 (P4.3 - 58)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Chemical Testing			Apply sample treatment techniques to chemical testing (2 Credits) 105794L3 (P4.3 - 36)	Apply molecular spectrometric techniques to chemical testing (6 Credits) 105787L4 (P4.3 - 47)	Perform chemical analysis on Chinese medicine (4 Credits) 105783L5 (P4.3 - 60)		
			Prepare standard solutions (2 Credits) 105795L3 (P4.3 - 37)	Perform chemical tests on construction materials (4 Credits) 105788L4 (P4.3 - 49)			
			Prepare working solutions and reagents (1 Credit) 105796L3 (P4.3 - 38)	Perform on-site indoor air quality measurement and analysis (6 Credits) 105789L4 (P4.3 - 51)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Chemical Testing			Prepare laboratory materials, equipment and facilities for chemical testing (2 Credits) 105797L3 (P4.3 - 39)	Perform complex tests to measure chemical properties of materials (4 Credits) 105790L4 (P4.3 - 53)			
			Handle chemicals, solutions and reagents (2 Credits) 105798L3 (P4.3 - 40)				

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Biological / Microbiological Testing		Apply cleansing methods for microbiological testing labware (2 Credits) 105992L2 (P4.3 - 63)	Prepare biological samples (2 Credits) 105806L3 (P4.3 - 64)	Perform microbiological tests (4 Credits) 105802L4 (P4.3 - 70)	Evaluate microbiological quality (2 Credits) 105801L5 (P4.3 - 74)	Select test methods and measuring instruments (biological / microbiological testing) (2 Credits) 105800L6 (P4.3 - 75)	
			Prepare microbiological samples (2 Credits) 105807L3 (P4.3 - 65)	Perform biological and biochemical tests (4 Credits) 105803L4 (P4.3 - 71)			
			Perform sterilisation and aseptic techniques (2 Credits) 105808L3 (P4.3 - 66)	Perform microscopic examination (2 Credits) 105804L4 (P4.3 - 72)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Biological / Microbiological Testing			Prepare culture media and solutions (2 Credits) 105809L3 (P4.3 - 67)	Perform staining techniques (2 Credits) 105805L4 (P4.3 - 73)			
			Follow bio-safety rules and precautions (2 Credits) 105810L3 (P4.3 - 68)				
			Prepare equipment and facilities for biological / microbiological testing (2 Credits) 105811L3 (P4.3 - 69)				

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Environmental Testing			Perform on-site testing (2 Credits) 105816L3 (P4.3 - 76)	Perform environmental testing (microbiological) (4 Credits) 105814L4 (P4.3 - 77)	Design and supervise complex environmental field surveys (2 Credits) 105812L5 (P4.3 - 80)		
				Perform environmental testing (physical) (6 Credits) 105815L4 (P4.3 - 78)	Perform environmental testing (chemical) (4 Credits) 105813L5 (P4.3 - 81)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Electrical and Electronic Testing			Follow laboratory electrical safety rules (2 Credits) 105830L3 (P4.3 - 83)	Perform electric shock and energy hazard tests (6 Credits) 105820L4 (P4.3 - 84)	Perform electromagnetic compatibility (emission) tests (8 Credits) 105818L5 (P4.3 - 102)	Select test methods and measuring instruments (electrical and electronic testing) (2 Credits) 105817L6 (P4.3 - 106)	
				Evaluate electrical insulation properties by electrical measurements (6 Credits) 105821L4 (P4.3 - 86)	Perform electromagnetic compatibility (immunity) tests (8 Credits) 105819L5 (P4.3 - 104)		
				Evaluate electrical insulation properties by physical measurements (6 Credits) 105822L4 (P4.3 - 88)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Electrical and Electronic Testing				Evaluate energy efficiency of electrical and electronic products (6 Credits) 105823L4 (P4.3 - 90)			
				Perform radiation tests (6 Credits) 105824L4 (P4.3 - 91)			
				Perform thermal hazard related tests (6 Credits) 105825L4 (P4.3 - 93)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Electrical and Electronic Testing				Perform flammability tests (electrical and electronic products) (6 Credits) 105826L4 (P4.3 - 95)			
				Perform electromagnetic field measurements (6 Credits) 105827L4 (P4.3 - 97)			
				Perform photometric measurements (6 Credits) 105828L4 (P4.3 - 98)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Electrical and Electronic Testing				Perform radio-frequency measurements (6 Credits) 105829L4 (P4.3 - 100)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Construction Materials)			Perform physical and mechanical tests on concrete and its constituent materials (6 Credits) 105837L3 (P4.3 - 107)	Perform basic non-destructive tests on welds (4 Credits) 105832L4 (P4.3 - 115)	Perform foundation tests (6 Credits) 105831L5 (P4.3 - 121)		
			Perform physical and mechanical tests on mortar and grout (6 Credits) 105839L3 (P4.3 - 108)	Perform basic physical and mechanical tests on soil and rock (6 Credits) 105835L4 (P4.3 - 116)	Perform advanced structural diagnostic tests on concrete structures (8 Credits) 105833L5 (P4.3 - 122)		
			Perform physical and mechanical tests on building components (6 Credits) 105840L3 (P4.3 - 109)	Perform physical and mechanical tests on steel (6 Credits) 105836L4 (P4.3 - 117)	Perform advanced physical and mechanical tests on soil and rock (8 Credits) 105834L5 (P4.3 - 123)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Construction Materials)			Perform physical and mechanical tests on glass and glazing materials (2 Credits) 105841L3 (P4.3 - 110)	Perform physical and mechanical tests on bituminous materials (6 Credits) 105838L4 (P4.3 - 118)			
			Perform visual examination on welds (2 Credits) 105843L3 (P4.3 - 111)	Perform basic structural diagnostic tests on concrete structures (8 Credits) 105842L4 (P4.3 - 119)			
			Perform construction site measurements (2 Credits) 105844L3 (P4.3 - 112)	Perform advanced non-destructive tests on welds (8 Credits) 105993L4 (P4.3 - 120)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Construction Materials)			Perform basic physical and mechanical tests (4 Credits) 105845L3 (P4.3 - 113)				
			Perform sampling and basic field tests on fresh concrete and on-site curing on concrete cubes (2 Credits) 105846L3 (P4.3 - 114)				

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Electrical Products)				Perform stability and mechanical tests (4 Credits) 105847L4 (P4.3 - 124)			
				Evaluate the construction of products by visual inspection (electrical products) (4 Credits) 105848L4 (P4.3 - 125)			
				Perform acoustic measurements (electrical products) (4 Credits) 105849L4 (P4.3 - 126)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Toys and Hardlines)				Design testing fixtures and tools to perform tests (4 Credits) 105850L4 (P4.3 - 128)			
				Perform flammability tests (toys and hardlines) (4 Credits) 105851L4 (P4.3 - 129)			
				Perform stability, physical and mechanical tests (4 Credits) 105852L4 (P4.3 - 131)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Toys and Hardlines)				Evaluate the construction of products by visual inspection (consumer products) (2 Credits) 105853L4 (P4.3 - 133)			
				Perform acoustic measurements (consumer products) (2 Credits) 105854L4 (P4.3 - 134)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Textiles and Garments)				Perform fabric construction tests (2 Credits) 105856L4 (P4.3 - 136)	Perform evaluation tests (4 Credits) 105855L5 (P4.3 - 151)		
				Perform fabric strength and performance tests (4 Credits) 105857L4 (P4.3 - 137)			
				Perform fibre analysis (4 Credits) 105858L4 (P4.3 - 139)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Textiles and Garments)				Perform care performance tests (4 Credits) 105859L4 (P4.3 - 141)			
				Perform colour fastness tests (4 Credits) 105860L4 (P4.3 - 142)			
				Perform flammability tests (textiles and garments) (4 Credits) 105861L4 (P4.3 - 144)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (Textiles and Garments)				Perform feather and down analysis (2 Credits) 105862L4 (P4.3 - 146)			
				Perform garment trim tests (2 Credits) 105863L4 (P4.3 - 147)			
				Perform footwear tests (2 Credits) 105864L4 (P4.3 - 149)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Physical and Mechanical Testing (General Consumer Products)				Perform physical tests on pharmaceutical products (2 Credits) 105866L4 (P4.3 - 153)		Select test methods and measuring instruments (physical and mechanical testing) (2 Credits) 105865L6 (P4.3 - 155)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Data Collection, Analysis and Interpretation			Record and present data (2 Credits) 105873L3 (P4.3 - 156)	Apply statistical calculations to measurement data (2 Credits) 105871L4 (P4.3 - 157)	Review test results (2 Credits) 105867L5 (P4.3 - 159)	Validate laboratory information management system (4 Credits) 105869L6 (P4.3 - 161)	
				Process data (2 Credits) 105872L4 (P4.3 - 158)	Interpret test results (2 Credits) 105868L5 (P4.3 - 160)	Validate laboratory self-developed software (2 Credits) 105870L6 (P4.3 - 162)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Quality Assurance of Test Results				Implement laboratory quality control procedures (2 Credits) 105878L4 (P4.3 - 163)	Formulate quality control protocol for monitoring the validity of tests (4 Credits) 105874L5 (P4.3 - 166)		
				Control reference materials and working standards (2 Credits) 105879L4 (P4.3 - 164)	Evaluate subcontractor laboratory (2 Credits) 105875L5 (P4.3 - 167)		
				Verify critical consumables (2 Credits) 105880L4 (P4.3 - 165)	Control purchasing of services and supplies (2 Credits) 105876L5 (P4.3 - 168)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Quality Assurance of Test Results					Organise and implement proficiency testing activities (2 Credits) 105877L5 (P4.3 - 169)		
					Control laboratory documents and records (2 Credits) 105994L5 (P4.3 - 171)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Measurement Traceability				Calibrate and maintain reference standards (2 Credits) 105889L4 (P4.3 - 172)	Formulate calibration programme for reference standards (2 Credits) 105881L5 (P4.3 - 177)		
				Verify and maintain reference materials (2 Credits) 105890L4 (P4.3 - 173)	Formulate verification programme for reference materials (2 Credits) 105882L5 (P4.3 - 178)		
				Verify and maintain reference and working cultures (2 Credits) 105891L4 (P4.3 - 175)	Formulate verification programme for reference and working cultures and sub-cultures (2 Credits) 105883L5 (P4.3 - 179)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Measurement Traceability				Handle and perform equipment calibration (2 Credits) 105892L4 (P4.3 - 176)	Formulate equipment calibration plan (2 Credits) 105884L5 (P4.3 - 180)		
					Develop equipment calibration methods (4 Credits) 105885L5 (P4.3 - 181)		
					Select competent laboratories for calibration of equipment and reference standards (2 Credits) 105886L5 (P4.3 - 182)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Measurement Traceability					Evaluate calibration results of equipment and reference standards (2 Credits) 105887L5 (P4.3 - 183)		
					Select and handle certified reference materials (2 Credits) 105888L5 (P4.3 - 184)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Equipment Maintenance			Handle and transport equipment (1 Credit) 105895L3 (P4.3 - 185)	Perform equipment maintenance and performance checks (2 Credits) 105894L4 (P4.3 - 186)	Formulate equipment maintenance plan (2 Credits) 105893L5 (P4.3 - 187)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Test Result Reporting					Authorise test results and reports (2 Credits) 105896L5 (P4.3 - 188)		
					Investigate complaints and appeals on testing services (2 Credits) 105897L5 (P4.3 - 189)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Laboratory Quality System Development						Formulate laboratory quality management system (6 Credits) 105898L6 (P4.3 - 191)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Laboratory Quality System Implementation					Implement laboratory quality management system (2 Credits) 105899L5 (P4.3 - 193)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Laboratory Quality System Monitoring					Conduct management review of laboratory (2 Credits) 105902L5 (P4.3 - 194)	Monitor and review implementation of laboratory quality management system (2 Credits) 105900L6 (P4.3 - 196)	
					Conduct internal audit of laboratory quality system (2 Credits) 105903L5 (P4.3 - 195)	Manage and handle nonconforming testing work (2 Credits) 105901L6 (P4.3 - 197)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Testing Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Laboratory Quality System Maintenance				Implement corrective actions for testing services (2 Credits) 105904L4 (P4.3 - 198)			
				Implement preventive actions for testing services (2 Credits) 105905L4 (P4.3 - 199)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Ethical Management				Implement ethical practices (2 Credits) 105961L4 (P4.3 - 259)	Monitor the implementation of ethical practices (2 Credits) 105960L5 (P4.3 - 260)	Formulate ethical management policy (2 Credits) 105956L6 (P4.3 - 261)	
						Establish code of conduct for testing services (2 Credits) 105957L6 (P4.3 - 262)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Environmental Protection				Monitor environmentally sustainable work practices (2 Credits) 105964L4 (P4.3 - 265)	Implement environmental management system (2 Credits) 105963L5 (P4.3 - 266)	Formulate environmental management system and workplace environmental policy (4 Credits) 105962L6 (P4.3 - 267)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Occupational Safety and Health		Master terminology related to testing / inspection / certification (1 Credit) 105975L2 (P4.3 - 269)	Maintain laboratory / field workplace safety (2 Credits) 105973L3 (P4.3 - 271)	Implement occupational safety and health supervision (2 Credits) 105969L4 (P4.3 - 273)	Establish occupational safety and health system and guidelines (2 Credits) 105966L5 (P4.3 - 277)	Formulate occupational safety and health policy and improvement plans (2 Credits) 105965L6 (P4.3 - 280)	
		Follow hygiene procedures (1 Credit) 105976L2 (P4.3 - 270)	Handle and investigate general industrial accidents (1 Credit) 105974L3 (P4.3 - 272)	Monitor occupational safety and health system (2 Credits) 105970L4 (P4.3 - 274)	Establish chemical waste handling procedures (1 Credit) 105967L5 (P4.3 - 278)		
				Handle and dispose of chemical wastes (2 Credits) 105971L4 (P4.3 - 275)	Perform risk assessment for laboratory / site work (2 Credits) 105968L5 (P4.3 - 279)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Occupational Safety and Health				Identify hazards associated with testing / inspection / certification activities (1 Credit) 105972L4 (P4.3 - 276)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Risk Management					Develop risk management strategies (2 Credits) 105978L5 (P4.3 - 281)	Formulate risk management plans (2 Credits) 105977L6 (P4.3 - 283)	
					Implement crisis management plans (2 Credits) 105979L5 (P4.3 - 282)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Human Resources Management				Develop and implement staff training and development programmes (2 Credits) 105982L4 (P4.3 - 284)	Recruit and retain competent personnel (2 Credits) 105981L5 (P4.3 - 285)	Formulate staff training and people development plan (2 Credits) 105980L6 (P4.3 - 286)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Laboratory / On-site Testing

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Customer Service			Interact and exchange information with customers (2 Credits) 105985L3 (P4.3 - 287)	Follow up feedback from customers (2 Credits) 105984L4 (P4.3 - 288)	Handle and resolve customer service problems (2 Credits) 105983L5 (P4.3 - 289)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Inspection Method Development and Preparation			Prepare work documents for conducting inspection (1 Credit) 105914L3 (P4.3 - 201)	Identify equipment and resources requirement for conducting inspection (2 Credits) 105911L4 (P4.3 - 202)	Develop inspection methods from international standards (2 Credits) 105906L5 (P4.3 - 205)		
				Identify items and samples for inspection (2 Credits) 105912L4 (P4.3 - 203)	Develop non-standard inspection methods (2 Credits) 105907L5 (P4.3 - 206)		
					Define defect classification and acceptance criteria (2 Credits) 105913L4 (P4.3 - 204)	Manage inspection methods (2 Credits) 105908L5 (P4.3 - 207)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Inspection Method Development and Preparation					Evaluate customer's requests on inspection services (2 Credits) 105909L5 (P4.3 - 208)		
					Formulate inspection plans (2 Credits) 105910L5 (P4.3 - 209)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Conducting Inspection			Record inspection observations and findings (2 Credits) 105919L3 (P4.3 - 210)	Perform on-site inspection of production processes / delivery of services (4 Credits) 105916L4 (P4.3 - 211)	Supervise on-site inspection (2 Credits) 105915L5 (P4.3 - 214)		
				Inspect items and samples (2 Credits) 105917L4 (P4.3 - 212)			
				Perform compliance inspection on materials (2 Credits) 105918L4 (P4.3 - 213)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Quality Assurance of Inspection Results				Implement inspection quality control procedures (2 Credits) 105921L4 (P4.3 - 215)	Formulate quality control protocol for monitoring inspection results (2 Credits) 105920L5 (P4.3 - 216)		
					Control inspection documents and records (2 Credits) 105991L5 (P4.3 - 217)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Operations

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Inspection Result Reporting					Authorise inspection results and reports (2 Credits) 105922L5 (P4.3 - 218)		
					Investigate complaints and appeals on inspection services (2 Credits) 105923L5 (P4.3 - 219)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Inspection Quality System Development						Formulate quality management system for inspection services (6 Credits) 105924L6 (P4.3 - 221)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Inspection Quality System Implementation					Implement inspection quality management system (2 Credits) 105925L5 (P4.3 - 222)		
					Evaluate subcontractor of inspection activities (2 Credits) 105926L5 (P4.3 - 223)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Inspection Quality System Monitoring					Conduct management review on inspection services (2 Credits) 105927L5 (P4.3 - 224)		
					Conduct internal audit of inspection services (2 Credits) 105928L5 (P4.3 - 225)		
					Manage and handle nonconforming inspection work (2 Credits) 105929L5 (P4.3 - 226)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Inspection Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Inspection Quality System Maintenance				Implement corrective actions and preventive actions for inspection services (2 Credits) 105930L4 (P4.3 - 227)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Ethical Management				Implement ethical practices (2 Credits) 105961L4 (P4.3 - 259)	Monitor the implementation of ethical practices (2 Credits) 105960L5 (P4.3 - 260)	Formulate ethical management policy (2 Credits) 105956L6 (P4.3 - 261)	
						Establish code of conduct for inspection services (2 Credits) 105958L6 (P4.3 - 263)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Environmental Protection				Monitor environmentally sustainable work practices (2 Credits) 105964L4 (P4.3 - 265)	Implement environmental management system (2 Credits) 105963L5 (P4.3 - 266)	Formulate environmental management system and workplace environmental policy (4 Credits) 105962L6 (P4.3 - 267)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Occupational Safety and Health		Master terminology related to testing / inspection / certification (1 Credit) 105975L2 (P4.3 - 269)	Maintain laboratory / field workplace safety (2 Credits) 105973L3 (P4.3 - 271)	Implement occupational safety and health supervision (2 Credits) 105969L4 (P4.3 - 273)	Establish occupational safety and health system and guidelines (2 Credits) 105966L5 (P4.3 - 277)	Formulate occupational safety and health policy and improvement plans (2 Credits) 105965L6 (P4.3 - 280)	
		Follow hygiene procedures (1 Credit) 105976L2 (P4.3 - 270)	Handle and investigate general industrial accidents (1 Credit) 105974L3 (P4.3 - 272)	Monitor occupational safety and health system (2 Credits) 105970L4 (P4.3 - 274)	Establish chemical waste handling procedures (1 Credit) 105967L5 (P4.3 - 278)		
				Handle and dispose of chemical wastes (2 Credits) 105971L4 (P4.3 - 275)	Perform risk assessment for laboratory / site work (2 Credits) 105968L5 (P4.3 - 279)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Occupational Safety and Health				Identify hazards associated with testing / inspection / certification activities (1 Credit) 105972L4 (P4.3 - 276)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Risk Management					Develop risk management strategies (2 Credits) 105978L5 (P4.3 - 281)	Formulate risk management plans (2 Credits) 105977L6 (P4.3 - 283)	
					Implement crisis management plans (2 Credits) 105979L5 (P4.3 - 282)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Human Resources Management				Develop and implement staff training and development programmes (2 Credits) 105982L4 (P4.3 - 284)	Recruit and retain competent personnel (2 Credits) 105981L5 (P4.3 - 285)	Formulate staff training and people development plan (2 Credits) 105980L6 (P4.3 - 286)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Inspection

Functional Area: Operation Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Customer Service			Interact and exchange information with customers (2 Credits) 105985L3 (P4.3 - 287)	Follow up feedback from customers (2 Credits) 105984L4 (P4.3 - 288)	Handle and resolve customer service problems (2 Credits) 105983L5 (P4.3 - 289)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Operation

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Certification Audit Planning				Identify and select competent audit team (2 Credits) 105936L4 (P4.3 - 229)	Review client's application for certification (4 Credits) 105932L5 (P4.3 - 231)	Manage certification services (2 Credits) 105931L6 (P4.3 - 236)	
				Prepare work documents for conducting audit (2 Credits) 105938L4 (P4.3 - 230)	Develop audit programme (4 Credits) 105933L5 (P4.3 - 233)	Qualify competent personnel for conducting certification activities (2 Credits) 105990L6 (P4.3 - 237)	
					Formulate certification / surveillance audit plan (2 Credits) 105934L5 (P4.3 - 234)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Operation

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Certification Audit Planning					Identify requirements of management system in international standards (2 Credits) 105935L5 (P4.3 - 235)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Operation

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Conducting Audit				Select samples of record / evidence for characteristics determination (2 Credits) 105941L4 (P4.3 - 238)	Perform documentation review for initial certification of management system (2 Credits) 105937L5 (P4.3 - 239)		
					Lead and supervise on-site certification audit activities (2 Credits) 105939L5 (P4.3 - 240)		
					Perform on-site audit for initial certification of management system (2 Credits) 105940L5 (P4.3 - 241)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Operation

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Quality Assurance of Auditing					Verify the effectiveness of corrections and corrective actions for nonconformities (2 Credits) 105943L5 (P4.3 - 242)	Review attestation of audit reports and conclusions (2 Credits) 105942L6 (P4.3 - 244)	
					Control certification documents and records (2 Credits) 105989L5 (P4.3 - 243)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Operation

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Audit Reporting					Generate audit reports (2 Credits) 105945L5 (P4.3 - 245)	Make certification decision (2 Credits) 105944L6 (P4.3 - 247)	
					Investigate complaints and appeals on certification services (2 Credits) 105946L5 (P4.3 - 246)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Certification Quality System Development						Formulate quality management system for certification services (6 Credits) 105947L6 (P4.3 - 249)	
						Evaluate performance of personnel involved in audits and certification activities (2 Credits) 105948L6 (P4.3 - 250)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Certification Quality System Implementation				Implement actions taken against misuse of marks and hazardous certified products (2 Credits) 105951L4 (P4.3 - 251)	Implement certification quality management system (2 Credits) 105949L5 (P4.3 - 253)		
				Implement procedures for evaluation of authenticity of certified products (2 Credits) 105952L4 (P4.3 - 252)	Evaluate subcontractor of certification activities (2 Credits) 105950L5 (P4.3 - 254)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Certification Quality System Monitoring					Conduct management review on certification services (2 Credits) 105953L5 (P4.3 - 255)		
					Conduct internal audit of certification services (2 Credits) 105954L5 (P4.3 - 256)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Certification Quality Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Certification Quality System Maintenance				Implement corrective actions and preventive actions for certification services (2 Credits) 105955L4 (P4.3 - 257)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Operations Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Ethical Management				Implement ethical practices (2 Credits) 105961L4 (P4.3 - 259)	Monitor the implementation of ethical practices (2 Credits) 105960L5 (P4.3 - 260)	Formulate ethical management policy (2 Credits) 105956L6 (P4.3 - 261)	
						Establish code of conduct for certification services (2 Credits) 105959L6 (P4.3 - 264)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Operations Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Environmental Protection				Monitor environmentally sustainable work practices (2 Credits) 105964L4 (P4.3 - 265)	Implement environmental management system (2 Credits) 105963L5 (P4.3 - 266)	Formulate environmental management system and workplace environmental policy (4 Credits) 105962L6 (P4.3 - 267)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Operations Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Occupational Safety and Health		Master terminology related to testing / inspection / certification (1 Credit) 105975L2 (P4.3 - 269)	Maintain laboratory / field workplace safety (2 Credits) 105973L3 (P4.3 - 271)	Implement occupational safety and health supervision (2 Credits) 105969L4 (P4.3 - 273)	Establish occupational safety and health system and guidelines (2 Credits) 105966L5 (P4.3 - 277)	Formulate occupational safety and health policy and improvement plans (2 Credits) 105965L6 (P4.3 - 280)	
		Follow hygiene procedures (1 Credit) 105976L2 (P4.3 - 270)	Handle and investigate general industrial accidents (1 Credit) 105974L3 (P4.3 - 272)	Monitor occupational safety and health system (2 Credits) 105970L4 (P4.3 - 274)	Establish chemical waste handling procedures (1 Credit) 105967L5 (P4.3 - 278)		
				Handle and dispose of chemical wastes (2 Credits) 105971L4 (P4.3 - 275)	Perform risk assessment for laboratory / site work (2 Credits) 105968L5 (P4.3 - 279)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Operations Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Occupational Safety and Health				Identify hazards associated with testing / inspection / certification activities (1 Credit) 105972L4 (P4.3 - 276)			

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Operations Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Risk Management					Develop risk management strategies (2 Credits) 105978L5 (P4.3 - 281)	Formulate risk management plans (2 Credits) 105977L6 (P4.3 - 283)	
					Implement crisis management plans (2 Credits) 105979L5 (P4.3 - 282)		

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Operations Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Human Resources Management				Develop and implement staff training and development programmes (2 Credits) 105982L4 (P4.3 - 284)	Recruit and retain competent personnel (2 Credits) 105981L5 (P4.3 - 285)	Formulate staff training and people development plan (2 Credits) 105980L6 (P4.3 - 286)	

Functional Matrix for the Testing, Inspection and Certification Industry

Branch: Certification

Functional Area: Operations Management

QF Level Sub-Functional Area	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Customer Service			Interact and exchange information with customers (2 Credits) 105985L3 (P4.3 - 287)	Follow up feedback from customers (2 Credits) 105984L4 (P4.3 - 288)	Handle and resolve customer service problems (2 Credits) 105983L5 (P4.3 - 289)		

Units of Competency for Laboratory / On-site Testing - Testing Operations

Unit of Competency**Functional Area: Testing Operations**

Title	Validate test methods
Code	105761L4
Range	This unit of competency (UoC) covers the ability to validate laboratory-developed / non-standard test method according to authorised method validation protocol to ensure that the test method is based on sound scientific principles and is fit for the purpose for which it is to be used in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Determine types and quantities of data / information required for method validation <ul style="list-style-type: none"> • Employ the principles, concepts, accreditation requirements, traceability and statistical evaluation of results related to method validation. • Determine types and quantities of data / information required. • Ensure that equipment calibration complies with appropriate standards. • Confirm that the test method has an acceptable level of uncertainty. 2. Validate test method according to authorised validation protocol <ul style="list-style-type: none"> • Ensure validation protocol is authorised by appropriate personnel. • Validate test method according to validation protocol including: <ul style="list-style-type: none"> • conduct literature searches on background of testing materials, • start up, set up/optimize, calibrate and operate equipment to manufacturer's specifications, • prepare test samples and standards for validation, • carry out validation tests according to the validation protocol. 3. Exhibit professionalism <ul style="list-style-type: none"> • Recommend staff training need appropriately. • Recommend update of relevant documentation as a result of the validation.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • validate the laboratory-developed / non-standard test method as fit for purpose according to the authorised validation protocol.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Verify test methods
Code	105762L4
Range	This unit of competency (UoC) covers the ability to verify the standard test method for confirmation, through the provision of objective evidence, that specified requirements have been fulfilled in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Describe procedures for verification of test method adopted from international/national standard <ul style="list-style-type: none"> • Determine parameters of standard test method to be verified, e.g. equipment, reference materials / standards and/or reagents required, environmental conditions, method performance, staff competence to perform the test. • Identify performance characteristics for system suitability specifications established for test method, e.g.: <ul style="list-style-type: none"> • method blanks or un-inoculated media to assess contamination, • laboratory control samples to assess accuracy, • precision based on the analysis of duplicates, • calibration check standards analysed periodically in the analytical batch for quantitative analysis, • monitoring quality control samples through the use of control charts. • Employ the principles, concepts, accreditation requirements, traceability and statistical evaluation of results related to method verification. • Apply the concepts of uncertainty to the verification procedures. 2. Verify test method adopted from international/national standard <ul style="list-style-type: none"> • Select appropriate technique for method performance determination, e.g.: <ul style="list-style-type: none"> • calibration using reference standards and reference materials, • comparison of results achieved with other methods, • inter-laboratory comparisons, • systematic assessment of the factors influencing the result, • assessment of uncertainty of results based on scientific understanding of the theoretical principles of the method and practical experience. • Verify test method by using selected technique and analysing appropriate performance characteristics. • Evaluate method verification results and, if any, the associated uncertainties by using appropriate statistical techniques to confirm that the specified requirements of test method have been fulfilled. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain records of verification of test method that meet the requirements of intended application.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • verify the standard test method by using appropriate technique and analysing its performance characteristics to confirm that specified requirements of the test method have been fulfilled.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Estimate and report measurement uncertainty
Code	105768L4
Range	This unit of competency (UoC) covers the abilities to estimate and report measurement uncertainty for laboratory / on-site testing activities or calibration activities relative to specified limits/tolerance of the test / calibration and specifications of customer's request according to the predetermined procedures.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of procedures for estimating measurement uncertainty and determine the need for reporting measurement uncertainty <ul style="list-style-type: none"> • Differentiate the applications of various statistical tests • Identify steps in the measurement, test or calibration involved. • Determine customer's request for need of reporting measurement uncertainty. • Relate validity of test results in association with measurement uncertainty. • Determine the uncertainty interval and results that are considered as inconclusive. 2. Estimate and report measurement uncertainty <ul style="list-style-type: none"> • Specify an equation for the measurement and list uncertainty components that are associated with each input in the equation. • Use calibration reports, manufacturer's specifications, quality control and validation data, and experimental data to collect other available information on the uncertainty components. • Calculate the standard uncertainty of each input factor and the combined uncertainty. • Calculate the expanded uncertainty of the reported results. • Obtain the uncertainty interval as stated in the test standard. • Report results and measurement uncertainty (expanded uncertainty) according to the test standard/specifications. • State all necessary information for the interpretation of the reported uncertainty including coverage factor and confidence interval. • Report compliance against specifications/limits taking into consideration of measurement uncertainty and state compliance only for conclusive results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Report measurement uncertainty and necessary information as required by the test / calibration.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • determine whether the uncertainty in results should be reported by analysing the customer's request and considering the validity of test results and inconclusive interval, • estimate the uncertainty of measurement, test or calibration and necessary information relative to the tolerance or required accuracy of the test or calibration, • report the compliance of the sample under test against specifications for results outside the inconclusive interval.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Adopt test methods and procedures from standard methods
Code	105755L5
Range	This unit of competency (UoC) covers the abilities to develop test methods and procedures from international/national standards in testing laboratories to meet enterprise and/or regulatory requirements and to fulfil customer's needs.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Research and determine appropriate international/national standards for laboratory / on-site testing <ul style="list-style-type: none"> • Research and review relevant international/national standards. • Evaluate resource, enterprise and regulatory requirements for proposed test methods and procedures to be developed. • Investigate possible alternative standards and choose the most appropriate standard. 2. Adopt test methods and procedures from international/national standards <ul style="list-style-type: none"> • Adopt and develop test methods and procedures according to relevant requirements. • Trial run the adopted test method. • Evaluate records to substantiate and justify the chosen test method. • Compile documents for test methods and associated standard operating procedures. • Obtain final approval for newly adopted test methods. • Issue approved test methods in conformance with international/national standards. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure adopted test methods and procedures meet enterprise and regulatory requirements and fulfil customer's need.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • adopt and develop test methods and procedures from relevant international/national standards to meet regulatory requirements and satisfy customer's needs, • compile documents of test methods and procedures for seeking approval and issue approved test methods in conformance with international/national standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Develop non-standard test methods
Code	105756L5
Range	This unit of competency (UoC) covers the abilities to develop new test methods and procedures that can meet enterprise requirements, regulatory testing requirements and/or customer's test requests in testing laboratories.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of theoretical and practical basis of test/analysis <ul style="list-style-type: none"> • Describe principles and practices of operation of a range of testing equipment. • Describe characteristics, capabilities and limitations of equipment. • Discuss relative advantages/disadvantages of different analytical methods. • Outline theoretical procedures for method development. • Describe method validation requirements. 2. Develop non-standard test methods to meet requirements <ul style="list-style-type: none"> • Interpret enterprise and regulatory testing requirements. • Analyse requirements for new analysis and procedures to meet testing briefs or request. • Evaluate resource requirements for proposed methods/procedures. • Investigate possible alternative methods and procedures and choose appropriate method/procedure by evaluating criteria, e.g.: <ul style="list-style-type: none"> • economic factors, • safety considerations, • resource factors, including equipment and personnel, • regulatory, accreditation and registration considerations. • Develop analytical test method to meet requirements. • Trial run method/procedure against test method/procedure requirements. • Validate test method/procedure. • Document analytical method/procedure and associated standard operating procedures (SOPs) and seek approval for issuance. • Issue new method/procedure according to enterprise procedures in consultation with appropriate expert if required. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain records to substantiate and justify chosen method/procedure.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • interpret test requests to determine testing requirements, • develop new test methods and procedures to meet requirements by applying theoretical concepts and practical principles and critically eliminating other possible alternatives, • document and issue new method/procedure according to enterprise procedures.
Remark	This UoC should be used together with another UoC "Validate test methods (105761L4)".

Unit of Competency**Functional Area: Testing Operations**

Title	Develop procedures for estimation of measurement uncertainty in accordance with the ISO Guide to the Expression of Uncertainty in Measurement
Code	105757L5
Range	This unit of competency (UoC) covers the abilities to develop procedures for estimating the measurement uncertainty in testing or calibration activities by interpreting the requirements in the ISO Guide to the Expression of Uncertainty in Measurement (ISO GUM) in testing laboratories.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and principles of estimating the measurement uncertainty in accordance with ISO GUM <ul style="list-style-type: none"> • Command the knowledge of statistics, e.g. mean, standard deviation, variance, standard deviation of the mean, degrees of freedom. • Explain the applications of various significance tests, e.g. t-test, F-test, analysis of variance (ANOVA), standard deviation of prediction, linear regression. • Identify steps in the measurement, test or calibration involved. • Employ the principles and procedures of relevant measurements. • Determine the degree of rigour in estimation of measurement uncertainty to meet the requirements of intended use, test standards and/or regulatory specifications. • Examine and verify information on calibration certificates, specifications, repeated measurements and variations due to operation such as operators, environment conditions and setup. 2. Develop and document procedures for estimation of measurement uncertainty according to ISO GUM <ul style="list-style-type: none"> • Construct a mathematical model for the measurement. • Identify factors affecting the components of the model. • Determine the required confidence level. • Describe the method for estimating the standard uncertainty and sensitivity coefficient of each input factor. • Explain the approaches to determine the following parameters for the estimation: <ul style="list-style-type: none"> • combined uncertainties according to the law of propagation, • degree of freedom for each input factor and effective degree of freedom of final output, • expanded measurement uncertainty by multiplying the combined uncertainties with the coverage factor as devised from the effective degree of freedom. • Verify and document the procedures for estimation of measurement uncertainty in accordance with ISO Guide to the Expression of Uncertainty in Measurement. 3. Exhibit professionalism <ul style="list-style-type: none"> • Recommend improvement and control of test operation and use of equipment meeting the uncertainty requirement.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • analyse steps of measurement with the use of appropriate equipment, test or calibration involved in the testing or calibration activities, • construct a mathematical model and categorise input factors affecting the measurement uncertainty, • develop and document the procedures for estimation of measurement uncertainty by applying the knowledge of statistical tests and approaches in accordance with ISO Guide to the Expression of Uncertainty in Measurement (ISO GUM).
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Develop procedures for estimation of measurement uncertainty in chemical testing using EURACHEM approach
Code	105758L5
Range	This unit of competency (UoC) covers the abilities to develop procedures for estimating the measurement uncertainty in chemical testing using EURACHEM approach by evaluating all critical factors and the associated uncertainties in measurement steps in testing laboratories.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge and principles of estimating measurement uncertainty in chemical testing</p> <ul style="list-style-type: none"> • Command the knowledge of statistics, e.g. mean, standard deviation, variance, standard deviation of the mean, degrees of freedom. • Explain the applications of various significance tests, e.g. t-test, F-test, analysis of variance (ANOVA), standard deviation of prediction, linear regression. • Employ the principles and procedures of relevant measurements. • Interpret the approaches such as bottom up, top down and using data from collaborative study, based on the nature of the test methods and measurements. • Determine the degree of rigour in estimation of measurement uncertainty to meet the requirements of intended use, test standards and/or regulatory specifications. • Examine and verify information from calibration certificates, equipment/apparatus/reagent specifications, validation data from trueness, recovery and precision studies, and quality control data. <p>2. Develop and document procedures for estimation of measurement uncertainty in chemical testing</p> <ul style="list-style-type: none"> • Select an appropriate approach for estimation of measurement uncertainty in chemical testing. • Identify all critical factors affecting the overall measurement uncertainty. • Estimate the standard uncertainty of each factor and eliminate duplication. • Convert the standard uncertainty into relative standard uncertainty before combination. • Expand and calculate the method uncertainty range at the regulatory limits or other limits for making critical decision. • Critically control factors that contribute significantly to the measurement uncertainty to ensure the uncertainty satisfies regulatory tolerance/limits and/or specifications of test standards. • Review and re-evaluate the uncertainty regularly taking into account of the quality control data and variations of operation. • Document the procedures for estimation of measurement uncertainty in chemical testing <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Consider all factors and estimate the measurement uncertainty appropriately and ensure its compliance with requirements of test standards and/or regulatory limits. • Ensure the control of experimental parameters critical to the results.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • determine and justify the approaches for estimation of measurement uncertainty in chemical testing, • identify all factors affecting the measurement uncertainty and critically control factors that contribute significantly to the overall measurement uncertainty, • develop and document the procedures for estimation of measurement uncertainty by applying the knowledge of statistics and approaches in compliance with requirements of test standards and/or regulatory limits.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Develop procedures for estimation of measurement uncertainty in microbiological testing using EURACHEM/MIKE approach
Code	105759L5
Range	This unit of competency (UoC) covers the abilities to develop procedures for estimating the measurement uncertainty in microbiological testing using EURACHEM or “Uncertainty of Quantitative Determinations Derived by Cultivation of Microorganisms (MIKE)” approach by evaluating all critical factors and the associated uncertainties in measurement steps in testing laboratories.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge and principles of estimating measurement uncertainty in microbiological testing</p> <ul style="list-style-type: none"> • Command the knowledge of statistics, e.g. mean, standard deviation, variance, standard deviation of the mean, degrees of freedom. • Explain the applications of various significance tests, e.g. t-test, F-test, analysis of variance (ANOVA), standard deviation of prediction, linear regression. • Interpret the approaches of estimation of measurement uncertainty in microbiological testing, e.g.: <ul style="list-style-type: none"> • EURACHEM, • “Uncertainty of Quantitative Determinations Derived by Cultivation of Microorganisms (MIKE)”, • approaches as stipulated in test standards. • Differentiate types of distribution of microorganisms, e.g. Poisson and negative binominal distribution and statistical manipulation of such distribution • Identify major factors affecting uncertainty of quantitative determination. • Examine and verify information on quantitative evaluation of media, intermediate precision and between operators precision. <p>2. Develop and document procedures for estimation of measurement uncertainty in microbiological testing</p> <ul style="list-style-type: none"> • Select an appropriate approach for estimation of measurement uncertainty in microbiological testing. • Identify factors other than precision affecting the uncertainty. • Determine the required confidence interval. • Outline the steps for estimation of measurement uncertainty including: <ul style="list-style-type: none"> • convert the data to logarithm form and calculate the intermediate, • precision based on duplicate determinations, • compute the uncertainty due to factors such as media and operators using statistical approach (pair comparison), • combine uncertainty of all factors, • calculate the uncertainty interval and convert back to CFU by anti-logging the uncertainty value. • Critically control other experimental factors, e.g. temperature of incubator, incubation time, storage temperature, maximum holding time of samples. • Review and re-evaluate the uncertainty regularly taking into account of quality control data and variations in operation. • Document the procedures for estimation of measurement uncertainty in microbiological testing. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Consider all factors and estimate the measurement uncertainty appropriately. • Ensure the control of experimental parameters critical to the results.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• select the appropriate approach for estimation of measurement uncertainty in microbiological testing,• evaluate all factors affecting the measurement uncertainty and control factors that contribute significantly to the overall measurement uncertainty,• develop and document the procedures for estimation of measurement uncertainty by applying the knowledge of microbiological testing and statistical methods in compliance with requirements of test standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Formulate method validation protocol
Code	105760L5
Range	This unit of competency (UoC) covers the ability to formulate validation protocol that can be adopted for test methods used in accredited testing laboratories. Validation protocol is a documented programme which provides a high degree of assurance that a specific test method will consistently produce a reliable result.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of test method validation parameters and acceptance criteria <ul style="list-style-type: none"> • Determine parameters of test method which should be validated and acceptance criteria for validating test method. • Justify those checks which should be considered to ensure performance characteristics of test method are scientifically sound, such as selectivity, linearity, range, sensitivity, limit of detection, limit of quantitation / practical quantitation limit, accuracy, precision, recovery, ruggedness, traceability, 2. Formulate method validation protocol <ul style="list-style-type: none"> • Develop test method validation protocol in consultation with appropriate personnel. • Recommend appropriate mathematical/statistical treatment of data for presenting data and results in appropriate formats in compliance with the performance characteristics. • Verify formulated validation protocol. • Authorise and issue method validation protocol according to enterprise procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the formulated protocol can validate test methods that can consistently produce reliable results.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • formulate method validation protocol to validate test methods that are fit for purpose.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare method validation reports
Code	105763L5
Range	This unit of competency (UoC) covers the abilities to prepare method validation reports to ascertain a test method's technical soundness, performance and suitability for its intended use in testing laboratories.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess the knowledge of statistics for analysing validation results for reporting <ul style="list-style-type: none"> • Identify mathematical/statistical techniques available for evaluation of validation results. • Explain enterprise/regulatory requirements regarding validation and reporting. 2. Prepare method validation reports <ul style="list-style-type: none"> • Apply theoretical knowledge and appropriate statistical techniques to interpret validation data and reach correct conclusions. • Evaluate validation results to confirm suitability of test method. • Interpret validation data and present the results in appropriate reporting formats according to standard operating procedures. • Make conclusions and recommendations in validation reports and file validation records based on the results. • Issue validated method according to standard operating procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the technical soundness, performance and suitability of the validated test method fit for its intended use.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • interpret validation data and reach correct conclusions by applying theoretical knowledge and appropriate statistical techniques, • prepare method validation reports to record validation results and communicate recommendations according to standard operating procedures.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Interpret international standards and regulatory requirements
Code	105764L5
Range	This unit of competency (UoC) covers the ability to critically interpret international standards and regulatory requirements for laboratory / on-site testing.
Level	5
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of contexts of international standards and regulatory requirements <ul style="list-style-type: none"> • Describe contexts of international standards (e.g. EN71, ASTM) and regulatory requirements posed by overseas countries. • Specify requirements for the competence of testing and calibration laboratories (e.g. ISO/IEC 17025). 2. Interpret and apply international standards and regulatory requirements <ul style="list-style-type: none"> • Interpret and apply international standards to laboratory operations to ensure their conformance to those standards. • Interpret and apply contexts of regulatory requirements to laboratory operations to fulfil the client's need and requirements. 3. Exhibit professionalism <ul style="list-style-type: none"> • Keep abreast of the latest version of international standards and regulatory requirements. • Ensure that laboratory operations conform to the latest standards and regulatory requirements.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • critically interpret and apply contexts of international standards and regulatory requirements to ensure that laboratory / on-site testing and operations conform to standards and/or regulatory requirements.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Evaluate customer's requests on testing services
Code	105765L5
Range	The unit of competency (UoC) covers the abilities to critically evaluate the requests on testing services from customers, review the contract on testing services and respond to customers with accurate and relevant information in compliance with the laboratory / accreditation requirements.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of evaluating customer's requests on testing services <ul style="list-style-type: none"> • Describe procedures relating to customer service and communication methods. • Explain technical details of test methods, data and sample collection and the key features of testing results. • Analyse customer information about laboratory products and services.. • Employ the procedures for reviewing the contract terms and conditions. 2. Evaluate customer's requests on testing services and provide appropriate response to customer <ul style="list-style-type: none"> • Clarify and confirm the source, nature and priority of the request. • Critically evaluate the request to generate the required information given the priority and costs involved. • Ensure that the information is accurate, relevant and complies with laboratory / accreditation requirements. • Compile a range of information to customer using appropriate technical terminology through the most appropriate communication method. • Check that the response has met the customer's needs and take appropriate actions if required. • Review and liaise the contract terms and conditions with the customer. • Record and document all information and responses accurately in accordance with laboratory procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Deal with the customer politely, efficiently and appropriately in accordance with laboratory procedures. • Maintain security and confidentiality of information according to code of conduct of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate and assess customer's requests on testing services to generate and synthesise the required information, • compile a range of response information that is accurate and relevant and communicate the response with the customer in an efficient and polite manner, taking into account of the customer's needs.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Devise test plans
Code	105766L5
Range	This unit of competency (UoC) covers the abilities to devise test plans by interpreting test requirements and determining test methods and resources for carrying out testing activities in laboratories or during on-site testing.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of developing test plans <ul style="list-style-type: none"> • Interpret and confirm the objectives, scope of competency, deliverables, constraints and principal work activities of test request. • Determine resource requirements for developing test plans, including personnel, equipment and materials. • Analyse quality requirements to ensure compliance with quality standards of the organisation. • Develop risk management strategies and risk management plans to ensure successful and timely outcomes. 2. Devise and manage test plan <ul style="list-style-type: none"> • Develop a detailed implementation plan for the testing activities outlining methodology, data collection and treatment, resources and turnaround time. • Prioritise different testing activities in the test plan. • Allocate roles and responsibilities, balancing job roles and skills development opportunities. • Implement agreed time management strategies and workflow to ensure the turnaround time is met. • Apply agreed quality requirements to measure performance and outcomes. • Monitor and report progress of activities in relation to the test plan. • Work with the team to analyse and diagnose problems and determine corrective actions. • Implement agreed variations to the test plan to accommodate changing situations. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain accurate records and effective communication with customers and testing team members. • Ensure test objectives are met and deliverables are provided on time.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • analyse test requirements and devise a feasible test implementation plan by considering resources and constraints, • plan testing activities and resources, consult and communicate with team members effectively to ensure test results and conclusions are achieved within the timeframe, • monitor and evaluate the progress of testing activities.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Supervise laboratory / on-site testing
Code	105767L5
Range	The unit of competency (UoC) covers the abilities to supervise testing operators performing testing activities in the laboratory / testing and investigations on site, monitor and optimise operational performance to ensure that products and services meet customer expectations.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of laboratory / on-site testing and key performance indicators of testing services</p> <ul style="list-style-type: none"> • Explain the standard operating procedures and technical details of sampling, testing, equipment and instrumentation within the work area. • Specify the legislation, standards and accreditation requirements relevant to laboratory / on-site testing. • Employ the principles of operational planning, efficient resource use and key performance indicators. • Command problem solving techniques, mentoring and coaching techniques and contingency planning skills. <p>2. Supervise and monitor laboratory / on-site testing</p> <ul style="list-style-type: none"> • Ensure that testing personnel follow all relevant procedures, regulations and standards. • Confirm that all technical work is performed in accordance with relevant standards, standard operating procedures and schedules. • Ensure that analytical results/data are checked, collated and distributed in accordance with enterprise requirements. • Monitor testing and sampling procedures for quality control in accordance with enterprise requirements. • Identify and resolve complex problems by using agreed problem solving strategies and act to prevent their recurrence. • Provide coaching and mentoring to support personnel who have difficulties in meeting targets for performance and/or resource usage. • Establish and maintain effective communication with all personnel and clients to ensure smooth and efficient operations. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure that testing personnel are competent to perform required tasks accurately and safely and organise training if required. • Identify health and safety risks associated with testing operations and promote the use of safe work procedures and protective equipment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • supervise laboratory / on-site testing operations and personnel so that planned outcomes are achieved within agreed resource and performance parameters without compromising safety, quality and ethics, • monitor outputs, analyse processes, introduce ways to improve operations and motivate personnel to improve performance.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Establish and evaluate laboratory operations in functional area
Code	105753L6
Range	This unit of competency (UoC) covers the abilities to plan, allocate and coordinate the tasks among laboratory personnel, to ensure quality assurance within the laboratories, to monitor the resource usage, to critically evaluate and report operations, and to develop new operations in testing laboratories.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of laboratory operations <ul style="list-style-type: none"> • Analyse the characteristics enterprise business, strategic and operational plans, laboratory services, customers, and quality assurance. • Employ the principles of budgeting, operational planning and efficient resource use. • Describe legislation, codes of practice, and standards relevant to the work area or function. • Command problem solving techniques and contingency planning, team leadership and development techniques, mentoring and coaching techniques. • Exercise judgement in allocation of tasks and work sequences. • Interpret the new/changed standards relating to laboratory services. 2. Establish and evaluate laboratory operations within functional area <ul style="list-style-type: none"> • Plan and organise daily work activities within functional area to ensure the smooth operation in the laboratory. • Allocate job tasks to laboratory personnel and assign the work sequences. • Establish resource requirements and performance management criteria. • Manage laboratory personnel within functional area and provide training opportunities for staff development. • Procure resources to achieve operational plans. • Critically evaluate laboratory operations and report findings to the management of enterprise. • Critically analyse and predict the market trend in the business of laboratory services to develop new operations in accordance with the new/changed standards. 3. Exhibit professionalism <ul style="list-style-type: none"> • Identify and resolve work problems. • Monitor and optimise operational performance of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • establish laboratory operational plans and performance management criteria, • manage laboratory operations and personnel so that planned outcomes are achieved within agreed resources, • monitor outputs, analyse processes to identify work problems, and formulate ways to improve operations, • develop new operations for laboratory services by analysing the market trend and interpreting the new/changed standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Formulate work schedule for laboratory / on-site testing
Code	105754L6
Range	This unit of competency (UoC) covers the abilities to formulate work schedule for laboratory / on-site testing activities to meet operational requirements by critically justifying the resource requirements.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Determine testing work requirements and resources availability <ul style="list-style-type: none"> • Determine and prioritise demand for laboratory services in work area for the planning period. • Access and verify information on orders/service requests, stocks and delivery. • Critically justify the resource requirements, e.g. the personnel, material and equipment required to deliver services. 2. Formulate work schedules <ul style="list-style-type: none"> • Plan work schedules which meet the demand for services and balance the best use of available resources with skill development opportunities. • Distribute work schedules to team or appropriate personnel and confirm contents with them. • Monitor workflow and outputs against schedules and assess any variations or potential disruptions. • Critically evaluate possible causes for the variations and revise schedules in response to operational variations. 3. Exhibit professionalism <ul style="list-style-type: none"> • Evaluate work schedule critically in accordance with work requirements.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate work schedules that are efficient and satisfy operational requirements without compromising safety, quality, accuracy and ethics, • assess potential disruptions to planned timetable and revise schedules and resource requirements efficiently in response to variations.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Collect routine site samples
Code	105774L2
Range	This unit of competency (UoC) covers the abilities to collect samples at field or production sites using specified equipment and standard or routine procedures.
Level	2
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of sample collection methods and procedures <ul style="list-style-type: none"> • Confirm the purpose, priority and scope of the sampling request. • Describe sampling methods and procedures. • Identify the sampling points, sampling time, sampling method, sampling tools, sampling containers and techniques for sampling. • Determine the quantity of samples and sample size required. • Apply the principles of representative samples. • Maintain identification of samples relative to their source. • Describe safety precautions during site sampling. 2. Collect routine site samples <ul style="list-style-type: none"> • Confirm the sampling location, number, size and type of samples, and notify sampling timing and frequency from the sampling plan. • Use the required sampling equipment and clean containers in accordance with given procedures. • Collect and identify representative samples according to sampling procedure and plan. • Closely follow sampling procedures when collecting a variety of samples at a range of sites to maintain their integrity. • Record all labelling information in accordance with traceability requirements. • Record sample appearance, environmental conditions and any other factors that may impact on sample integrity. • Specify sampling under standard conditions or sampling after processes are adjusted in response to variation or non-conformance. • Deliver samples to the required collection point and complete all documentation to ensure traceability. • Seek advice if the required samples cannot be collected or if procedures require modification. 3. Exhibit professionalism <ul style="list-style-type: none"> • Use established work practices and personal protective equipment to ensure personal and public safety at the site. • Minimise environmental impacts of sampling and generation wastes.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • collect and deliver routine site samples efficiently, safely and with minimal environmental impact by following the established sampling procedures and plans correctly, • maintain the validity, integrity and security of samples following the traceability requirements.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Obtain representative samples in accordance with sampling plan
Code	105772L4
Range	This unit of competency (UoC) covers the abilities to obtain a range of samples that are representative of the source material (e.g. raw materials, product in process, final product) in accordance with a defined sampling plan.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of sampling preparation <ul style="list-style-type: none"> • Confirm the sampling location, number and type of samples, and timing and frequency of sampling from enterprise or client's sampling plan. • Select sampling equipment and conditions to achieve representative samples. • Check that all standard operating procedures (SOPs) are in accordance with client or enterprise requirements, relevant standards and codes. • Assemble and check all sampling equipment, materials, containers and safety equipment. 2. Obtain representative samples in accordance with sampling plan <ul style="list-style-type: none"> • Locate sampling sites. • Conduct representative sampling in accordance with sampling plan and defined procedures. • Take photos of sampling sites and samples if necessary. • Record all information and label samples in accordance with traceability requirements. • Prepare sub-samples and back-up sub-samples that are representative of the source. • Label all sub-samples to ensure traceability and store in accordance with the SOPs. • Follow defined preparation and safety procedures to limit hazard or contamination to samples, self, work area and environment. • Distribute sub-samples to defined work stations maintaining sample integrity and traceability requirements. • Deliver samples required for testing to the laboratory according to SOP. • Report all relevant aspects of the sampling and preparation phases accurately. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain security and confidentiality of all client/enterprise data and information. • Use defined safe work practices and personal protective equipment to ensure personal safety and that of other laboratory personnel
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • obtain a sample that is representative of the bulk material in accordance with the sampling plan, • label samples and sub-samples to satisfy traceability requirements of the enterprise / accreditation, • record all aspects of the sampling activities accurately.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Apply statistical techniques in sampling
Code	105773L4
Range	This unit of competency (UoC) covers the abilities to apply statistical techniques in sampling in order to collect representative samples for estimating the performance of the batch of products by sample testing and data analysis.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of statistical techniques and sampling requirements <ul style="list-style-type: none"> • Identify and describe statistical terms and measures such as mean, range, frequency, mode, median, standard deviation, relevant graphs and charts. • Describe different statistical methods for sampling. • Specify the regulatory, workplace and standard requirements for sampling. • Study the established sampling plan. 2. Apply statistical techniques in sampling <ul style="list-style-type: none"> • Apply mathematical skills to a level required to undertake accurate sampling. • Analyse the sampling plan to determine the scope and detailed requirements of sampling and the quantity of samples required. • Collect and perform basic statistical calculations on samples drawn from the sampling site. • Use statistical analysis to verify the sampling process. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the sampling is conducted using the statistical techniques according to the requirements.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply appropriate statistical techniques in sampling to collect representative samples, • monitor and verify the sampling process in accordance with the sampling plan.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Formulate sampling plan
Code	105769L5
Range	This unit of competency (UoC) covers the abilities to formulate a sampling plan to collect representative samples for testing and analysis by critically analysing the purpose, requirements and scope of the sampling request.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of sampling plan formulation <ul style="list-style-type: none"> • Analyse the regulatory, workplace and standard requirements for sampling. • Evaluate the nature, characteristics and deterioration of different sample types. • Identify potential hazards of sampling and review safety procedures for sampling. 2. Formulate sampling plan <ul style="list-style-type: none"> • Analyse critically the purpose, scope and detailed requirements of the sampling request. • Establish a sampling plan according to relevant standards. • Develop procedures and checklist for sampling, e.g. sampling points, sampling time, sampling method, sampling tools, sample containers, quantity of samples required, sampling techniques. • Develop sampling tables with consideration of the sampling purpose and requirements. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the sampling plan can fulfil the requirements of sampling request and assess the risks and hazards of sampling.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically analyse the purpose, scope and regulatory and standard requirements of the sampling, • formulate the sampling plan for collecting representative samples for testing and analysis by developing sampling procedures and checklist.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Supervise field sampling activities
Code	105770L5
Range	This unit of competency (UoC) covers the abilities to supervise sampling activities at the selected site by confirming the requirements of the sampling plans, liaising with site personnel and organising sampling activities.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1.Possess knowledge of field sampling preparation and requirements</p> <ul style="list-style-type: none"> • Identify the sampling job, consult with the client and obtain relevant information, including the level of supervision required, drawings and specifications. • Select appropriate equipment and materials required for the job. • Interpret the regulatory requirements on safety and health concerns in sampling work. • Identify site hazards and the personal protective equipment and safety procedures required for the job. • Organise site induction for self and support personnel as required. • Record description of the job to be undertaken, compare with specification and resolve any variations. <p>2.Supervise sampling activities at the selected site</p> <ul style="list-style-type: none"> • Set up facilities for supervision of sampling activities and sample storage. • Inspect the site to determine the characteristics of the project, including survey control points. • Select sampling equipment and conditions to achieve representative samples and preserve sample integrity during collection, storage and transit. • Design sampling programme in accordance with specifications. • Supervise personnel to conduct sampling in accordance with project requirements. • Remit samples to the base laboratory for testing as required. • Ensure cleaning of equipment does not cause environmental damage • Supervise the removal of equipment and materials from site. <p>3.Exhibit professionalism</p> <ul style="list-style-type: none"> • Minimise environmental impacts of sampling and generation of waste. • Promote the use of safe work procedures and protective equipment.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • supervise sampling activities at the selected site in accordance with the requirements sampling plans.
Remark	<p>The relevant legislation involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • Occupational Safety and Health Ordinance

Unit of Competency**Functional Area: Testing Operations**

Title	Select sampling methods
Code	105771L5
Range	This unit of competency (UoC) covers the ability to select suitable sampling methods for testing / inspection of samples by critically evaluating the types of samples and applying the concepts of sampling.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of sample types and sampling process <ul style="list-style-type: none"> • Critically evaluate different types and nature of samples to be tested / inspected. • Employ the concepts of sampling and determine the process of sampling. • Differentiate various sampling methods and explain their uses. • Determine types of sampling information to be recorded. 2. Select sampling methods <ul style="list-style-type: none"> • Apply the concept of population. • Determine the sampling frame. • Comprehend the difference between probability sampling and non-probability sampling. • Select and apply relevant probability or non-probability sampling methods according to the nature of samples. • Design worksheet for recording necessary sampling information. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the selected sampling method can fulfil the requirements of sampling as requested by the client or relevant standards.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:></p> <ul style="list-style-type: none"> • select a suitable sampling method for a sample to be tested / inspected by critically evaluating the sample type and applying the concepts of sampling.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Receive samples
Code	105776L2
Range	This unit of competency (UoC) covers the abilities to check documentation upon receiving samples and log and distribute samples in the laboratory according to the established procedures.
Level	2
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of sample receipt and documentation <ul style="list-style-type: none"> • Describe the procedures for the receipt, documentation, distribution and storage of samples. • Identify potential hazard and unstable nature of samples. • Describe requirement of specified sample types for specific tests. • Describe sample storage and transport requirements. 2. Receive samples <ul style="list-style-type: none"> • Log samples according to the standard operating procedures including: <ul style="list-style-type: none"> • record date and time of arrival of samples at the reception, • record any abnormalities of sample package/container, • check and match samples with client's request forms before they are accepted, • enter sample information into appropriate laboratory information system. • Label samples accurately and completely. • Apply required document tracking mechanisms. • Distribute samples to work stations maintaining sample integrity. • Check that samples and relevant request forms have been received by laboratory personnel. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure security and traceability of all information, data and records of client/laboratory. • Use appropriate protective equipment to ensure personal safety when transferring or disposing of samples.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • receive and log samples into the laboratory information system in accordance with standard operating procedures, • distribute samples to work stations and maintain sample integrity and traceability.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Pre-condition test samples
Code	105777L3
Range	This unit of competency (UoC) covers the abilities to pre-condition test samples after sampling prior to testing in the laboratory.
Level	3
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of pre-conditioning and preserving test samples <ul style="list-style-type: none"> • Describe the nature and characteristics of different types of samples. • Identify sample pre-conditioning methods and techniques. • Employ sample preservation techniques for maintaining the integrity of samples. 2. Pre-condition test samples <ul style="list-style-type: none"> • Select workplace for pre-conditioning samples. • Undertake procedures for prevention of contamination of samples. • Undertake procedures for preservation of samples, e.g.: <ul style="list-style-type: none"> • refrigeration, • freezing, • chemical addition such as acidification, • shielding from direct sunlight, • filtration. • Control environmental conditions such as temperature, humidity. • Select sample storage containers after conditioning. • Determine the maximum permissible retention period of pre-conditioned samples before testing. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain the integrity of samples after conditioning. • Ensure samples are kept properly under specific environmental conditions.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • pre-condition and preserve test sample by applying appropriate techniques and procedures to maintain the integrity of sample prior to testing in the laboratory, • store the pre-conditioned sample in an appropriate storage container and determine the maximum permissible retention period of pre-conditioned sample.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Handle and transport samples
Code	105778L3
Range	This unit of competency (UoC) covers the abilities to handle and transport samples in accordance with procedures designed to ensure that subsequent test results reflect the state of a sample source at the time it was sampled.
Level	3
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of handling and transporting samples <ul style="list-style-type: none"> • Describe the relationship between effective communication with clients and the laboratory • Describe the need for appropriate and timely transport. • Identify the nature, characteristics and deterioration of samples. • Identify possible contaminations of samples. • Describe the need for maintenance of equipment used in the processes of handling and transporting samples. 2. Handle and transport samples <ul style="list-style-type: none"> • Apply laboratory requirements to the transport of collected samples. • Alert laboratory personnel to any special needs that are identified on sample documents. • Complete required documentation at pickup point. • Place samples at the required environments in the specified transport containers. • Deliver samples to reception point in accordance with standard operating procedures. • Record details of sample exchange in relevant sections of chain of custody forms. • Clean up spills using appropriate techniques to protect personnel, work area and environment. • Maintain state of transport containers to ensure they are fit for purpose. • Report any misadventures to supervisor. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain security and traceability of samples at all times.
Assessment Criteria	<p>The integrated outcome requirements of this UoC is the ability to:</p> <ul style="list-style-type: none"> • handle label and transport collected samples by selecting and using appropriate techniques and equipment according to the nature and characteristics of the samples.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare samples for testing
Code	105986L3
Range	This unit of competency (UoC) covers the ability to prepare samples suitable for testing in the laboratory in accordance with standard operating procedures.
Level	3
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of sample preparation <ul style="list-style-type: none"> • Describe the procedures for preparation and sub-sampling of samples. • Apply the knowledge of the relationship between specific sample preparation and associated tests. • Determine the requirements of specified sample types for specific tests. 2. Prepare samples for testing <ul style="list-style-type: none"> • Perform physical separation of the samples as required. • Prepare the required number of sub-samples. • Perform chemical separation of the samples as required. • Place prepared samples in appropriate transport media. • Control sample conditions before, during and after processing. 3. Exhibit professionalism <ul style="list-style-type: none"> • Use appropriate protective equipment to ensure personal safety when sampling or processing samples. • Clean up splashes and spillages of samples immediately using appropriate techniques and precautions.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • prepare samples suitable for testing in accordance with test requirements and standard operating procedures.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Establish procedures for handling of test / inspection items and samples
Code	105775L4
Range	This unit of competency (UoC) covers the ability to establish procedures for proper and safe handling of test / inspection items and samples in testing laboratories or during on-site operation by analysing requirements in international standards and applying appropriate documentation process.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of procedures for handling of test / inspection items and samples <ul style="list-style-type: none"> • Apply the concepts of identification, record and document of test / inspection items and samples. • Analyse the accreditation requirements of proper and safe handling of test/ inspection items and samples. • Explain the sample reception and documentation processes. • Identify appropriate facilities used for avoiding deterioration, loss or damage to the test / inspection items and samples. 2. Establish procedures for handling of test / inspection items and samples <ul style="list-style-type: none"> • Prepare procedures for handling of test / inspection items and samples. • Prepare procedures for the containment and cleanup of spillages and breakages. • Specify maintenance requirements of equipment and facilities used in the processes of handling of test / inspection items and samples. • Disseminate the importance of sample and item handling to relevant personnel. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the established procedures for handling of test / inspection items and samples meet the criteria of relevant international standards.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • establish procedures for proper and safe handling of test / inspection items and samples that can meet the criteria of relevant international standards in testing laboratories or during on-site operation.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection

Unit of Competency**Functional Area: Testing Operations**

Title	Apply cleansing methods for labware
Code	105799L2
Range	This unit of competency (UoC) covers the abilities to apply suitable cleansing methods and procedures for various labware in testing laboratories.
Level	2
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge and working principles of a selected range of cleansing agents/equipment and their respective cleansing procedures and techniques</p> <ul style="list-style-type: none"> • Identify cleansing methods and the respective working mechanisms, e.g. decontamination. • Identify cleansing agents and equipment involved in cleansing work, e.g.: <ul style="list-style-type: none"> • acids / bases, • detergents, • cleansing machines. • Outline compulsory steps in cleansing activities. • Describe the techniques and uses of various cleansing agents based on different circumstances. • Identify appropriate drying techniques for various types of glassware (e.g. general glassware, volumetric glassware) after cleansing. • Describe the importance of cleaned glassware in the accuracy and precision of chemical testing results. <p>2. Perform cleansing on labware by applying defined cleansing methods and procedures</p> <ul style="list-style-type: none"> • Apply appropriate cleansing methods and procedures according to the nature of labware and contamination. • Apply appropriate cleansing agents and equipment on the labware in accordance with appropriate cleansing methods and procedures. • Carry out cleansing activities and drying for the labware according to pre-determined procedures. • Store the cleaned labware under good conditions in designated locations. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure the quality of the cleaned labware suitable for testing purposes.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out cleansing activities and drying for labware by applying appropriate cleansing agents and equipment according to the methods and procedures, • store the cleaned labware properly and maintain the cleanliness of labware in the workplace of the testing laboratory.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Conduct laboratory / field work
Code	105987L2
Range	This unit of competency (UoC) covers the ability to complete the assigned tasks individually or in a team context. The tasks involve the established routine work and procedures using allocated resources and following guidelines and advice from supervisors in the laboratory or in the field.
Level	2
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of conducting routine work in the laboratory/field <ul style="list-style-type: none"> • Describe established procedures for performing routine technical work. • Identify the requirements of quality in conducting laboratory/field work. • Apply problem solving skills, interpersonal communication skills and conflict resolution techniques. • Describe ethical issues relevant to the nature of the work, e.g. data and information confidentiality. 2. Conduct laboratory/field work <ul style="list-style-type: none"> • Clarify allocated work activities and identify required resources. • Locate relevant workplace procedures for required tasks. • Undertake and complete tasks by following established routine work related sequences. • Identify problems or opportunities for improved work performance. • Access appropriate sources to resolve work problems. 3. Exhibit professionalism <ul style="list-style-type: none"> • Cooperate with team members to achieve agreed outcomes within timelines. • Keep abreast of up-to-date knowledge and skills for personal development opportunities.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • undertake laboratory/field work by following established workplace procedure to achieve quality outcomes within agreed timeframe.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Maintain laboratory/workplace fit for purpose
Code	105988L2
Range	This unit of competency (UoC) covers the abilities to perform general cleaning of work surfaces, cleaning and storage of equipment and keep laboratory stocks under direct supervision.
Level	2
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <p>1.Possess knowledge of laboratory/workplace maintenance</p> <ul style="list-style-type: none"> • Describe the established procedures for the cleaning of work preparation areas, materials and equipment. • Identify storage requirements for specific materials and equipment. • Describe the established procedures for minimisation and disposal of wastes. • Describe the established procedures for controlling laboratory stocks. <p>2.Maintain laboratory/workplace fit for purpose</p> <ul style="list-style-type: none"> • Clean work preparation areas using appropriate cleaning agents and equipment according to established procedures. • Collect and segregate wastes in accordance with established procedures. • Use appropriate agents and techniques to clean equipment. • Store clean equipment in the designated locations under appropriate storage conditions. • Check stocks of materials and equipment and maintain records of usage as directed. • Inform appropriate personnel of impending stock shortages to maintain adequate stock levels of material and equipment supply. <p>3.Exhibit professionalism</p> <ul style="list-style-type: none"> • Keep accurate and up-to-date records of material and equipment usage.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • maintain laboratory/workplace fit for purpose by following established procedures and guidelines to clean work areas and equipment and to check stocks of materials and equipment.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform basic chemical tests and procedures
Code	105791L3
Range	This unit of competency (UoC) covers the abilities to carry out chemical tests and measurements according to test methods to record data in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of metrology and chemical test methods <ul style="list-style-type: none"> • Apply the concepts of metrology including repeatability, precision, accuracy, significant figures, sources of error, uncertainty and traceability. • Describe the purpose of performing laboratory testing and the requirements of test method. • Apply the principles of basic analytical techniques and describe the operation of the equipment involved, e.g.: <ul style="list-style-type: none"> • gravimetric analysis, • titrimetric analysis, • basic separation methods including precipitation, filtration, gravity separation, distillation, solvent extraction and chromatography, • drying and ashing, • electrical conductivity and pH, • dissolved oxygen, • visual/optical tests of appearance, colour, texture, turbidity, refractive index. • Describe test method calibration procedures and method precision. • Describe calculation methods, including appropriate units, uncertainties, balancing equations, and the concentration of the solution given the chemical reaction for the titration. • Identify potential safety hazards associated with test procedures, operating equipment and handling chemicals and glassware. 2. Perform tests and/or measurements on samples using appropriate equipment <ul style="list-style-type: none"> • Apply the appropriate test method and equipment for performing the requested test. • Record sample description, ensure sample compliance with test method requirements, and handle discrepancies. • Set up and check the performance of equipment in accordance with test method requirements. • Check the calibration status of equipment and quarantine out of calibration equipment. • Carry out tests/procedures on all samples, calibration standards and quality control checks if appropriate, in accordance with specified or validated test methods. • Record, perform calculations and document test data in accordance with standard operating procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Complete all tests within the required timeline meeting quality, accuracy and safety requirements. • Maintain security, integrity and traceability of all samples, data and documentation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out chemical tests and procedures by using appropriate reagents and equipment according to the requirements of the test method and complete the tests within agreed time limit, • record and calculate test data accurately and legibly and document test data properly to maintain their security and traceability.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply separation and cleanup techniques to organic analysis
Code	105792L3
Range	This unit of competency (UoC) covers the abilities to apply suitable techniques and procedures on separation, chromatography and knowledge of column chemistry for sample cleanup to collect analytes ready and fit for organic analysis in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess knowledge of sample separation and cleanup techniques <ul style="list-style-type: none"> Apply basic principles and working mechanisms of various separation and cleanup methods for organic analysis, e.g.: <ul style="list-style-type: none"> column chromatography, gel permeation chromatography, thin layer chromatography (TLC), solid phase extraction. Apply the concepts of chromatographic separation, e.g.: <ul style="list-style-type: none"> use and choice of suitable mobile phase and washing buffers, operation and optimisation of chromatographic techniques. Describe column chemistry, temperature control and varying mobile phase composition for enhancing separation and detection of the required analyte species. Apply appropriate separation and cleanup techniques on samples in accordance with test requirements <ul style="list-style-type: none"> Identify test sample characteristics that may affect selection and application of separation and cleanup technique. Apply and operate suitable separating systems, e.g.: <ul style="list-style-type: none"> for chromatographic separation: sample injection / loading, mobile phase, sample preparation, washing of separated analyte, sample collection and detection, for solid phase extraction: solvent selection, sample preparation, solid phase cartridge, sample collection. Set operational parameters in accordance with specified methods/procedures for analyte separation and cleanup, e.g.: <ul style="list-style-type: none"> sample injection temperature, flow rate, resolution. Separate, cleanup and collect the analyte in a sample for organic analysis by using suitable separation / chromatographic procedures. Exhibit professionalism <ul style="list-style-type: none"> Ensure separated analytes are ready and fit for organic analysis.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> carry out sample separation and cleanup procedures on the sample by applying appropriate separation and/or chromatographic techniques according to the test requirements, separate and collect analytes ready and fit for organic analysis.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply extraction techniques to organic analysis
Code	105793L3
Range	This unit of competency (UoC) covers the abilities to apply suitable extraction techniques to extract analytes from samples to be ready and fit for organic analysis in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1.Possess knowledge of extraction techniques</p> <ul style="list-style-type: none"> • Describe the theory and application of extraction efficiency. • Apply the working principles of various extraction techniques, e.g.: <ul style="list-style-type: none"> • liquid-liquid extraction, • continuous solid-liquid extraction such as Soxhlet extraction, • supercritical fluid extraction. • Describe the applications and limitations of various extraction techniques according to different characteristics of samples. • Describe the criteria for the selection of extracting fluids according to the sample nature. • Identify the equipment required for various types of extraction and describe the operations of equipment for conducting extraction procedures. <p>2.Apply appropriate extraction techniques on samples in accordance with test requirements</p> <ul style="list-style-type: none"> • Identify sample characteristics that may affect selection and application of extraction techniques. • Apply suitable extraction techniques with appropriate extracting fluid on the sample in accordance with test requirements and sample characteristics. • Extract and collect the analytes in a sample for organic analysis by carrying out the extraction procedures. <p>3.Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure the collected extract is ready and fit for organic analyses
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out extraction procedures on the sample by applying suitable extraction techniques with appropriate extracting fluid according to the test requirements and sample characteristics, • extract and collect analytes ready and fit for organic analysis.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply sample treatment techniques to chemical testing
Code	105794L3
Range	This unit of competency (UoC) covers the abilities to apply suitable treatment techniques to prepare the samples ready and fit for chemical testing in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess knowledge of sample treatment techniques <ul style="list-style-type: none"> Apply the theory and working principles of common sample treatment procedures / techniques, e.g.: <ul style="list-style-type: none"> concentration / dilution, stabilisation / activation, purification and separation, digestion, purge and trap. Differentiate sample treatment methods for inorganic and organic determinants. Specify the use of laboratory apparatus / equipment / reagents for the respective sample treatment according to different characteristics of samples, e.g.: <ul style="list-style-type: none"> volumetric glassware, chemical agents, spinning machine / centrifugation, purge and trap concentrator, enzymes. Identify the advantages and disadvantages of various sample treatment methods for a range of testing situations. Apply suitable treatment techniques on samples in accordance with test requirements <ul style="list-style-type: none"> Identify sample characteristics that may affect selection and application of sample treatment methods and conditions. Apply suitable techniques and/or equipment for sample treatment and preparation according to test requirements. Confirm the treated sample is ready and fit for further chemical testing by using appropriate standards or reference materials as validation checks for the treated sample. Exhibit professionalism <ul style="list-style-type: none"> Ensure a representative analytical portion of the laboratory sample can be obtained for both quantitative and/or qualitative purpose
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> apply suitable treatment techniques to obtain a representative portion of sample for quantitative and/or qualitative chemical testing according to test requirements and standard operating procedures, confirm the readiness of treated sample against appropriate standards or reference materials.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare standard solutions
Code	105795L3
Range	This unit of competency (UoC) covers the abilities to follow defined procedures and instructions to prepare and standardise solutions to be used in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess practical knowledge of standard solution preparation <ul style="list-style-type: none"> Apply solution terminology and concepts of metrology, e.g.: <ul style="list-style-type: none"> acid / base solutions, buffers, redox reactions, concepts of mass and volume measurements, concepts of volumetric chemistry. Identify the grades of glassware and chemicals required by the test method and describe their uses. Describe the usage of primary and secondary standards and indicators. Describe calculation methods including appropriate units, uncertainties, balancing equations, the concentration of solution given the chemical reaction for the titration. Determine the factors affecting the shelf-life of the standard solutions Prepare standard solutions <ul style="list-style-type: none"> Apply appropriate procedure for solution preparation. Apply suitable laboratory apparatus, chemicals and solvent of specified purity for the preparation of standard solutions, e.g.: <ul style="list-style-type: none"> volumetric glassware of appropriate grade, balances, pH meters. Calculate and measure appropriate quantities of chemicals and solvents for standard solution preparation and record data. Prepare standard solutions to achieve homogeneous mix of the specified concentration. Standardise the solutions to the required specified range and precision by using volumetric titration with suitable primary standards and indicators. Calculate the concentrations of the standard solutions. Estimate the shelf-life of the standard solutions. Label clearly and store properly the standard solutions in the laboratory. Exhibit professionalism <ul style="list-style-type: none"> Maintain the quality of the prepared standard solutions by performing usability checking, e.g. pH check, visual examination, date of expiry.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> prepare standard solutions by using suitable laboratory apparatus, glassware, and chemicals in accordance with the requirements of test methods, standardise the solutions and calculate the concentrations of the standard solutions accurately, label and store the standard solutions properly in the laboratory to maintain their quality and integrity within the shelf-life.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare working solutions and reagents
Code	105796L3
Range	This unit of competency (UoC) covers the abilities to follow defined procedures and instructions to prepare working solutions and reagents in testing laboratories.
Level	3
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess basic theoretical and practical knowledge of wet chemistry <ul style="list-style-type: none"> • Apply solution terminology and concepts of metrology, e.g.: <ul style="list-style-type: none"> • acid / base solutions, buffers, redox reactions, • concepts of mass and volume measurements. • Identify the grades of glassware and chemicals required by the test method and describe their uses. • Describe calculation methods including appropriate units, uncertainties and concentration of the solution. 2. Prepare chemical solutions and reagents <ul style="list-style-type: none"> • Apply appropriate laboratory apparatus and chemicals of specified purity for preparation of working solutions and reagents, e.g.: <ul style="list-style-type: none"> • volumetric glassware of appropriate grade, • balances, • pH meters. • Calculate and measure appropriate quantities of chemicals and solvents for solution and reagent preparation and record data. • Apply laboratory skills (e.g. dilution, mixing) to prepare solutions or reagents according to the defined procedures and instructions. • Calculate the concentrations of the solutions and estimate their shelf-life. • Label and store the working solutions and reagents properly in the laboratory according to standard operating procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain the quality of the prepared solutions by performing usability checking, e.g. pH check, visual examination, date of expiry.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • prepare working solutions and reagents by using suitable laboratory apparatus, glassware and chemicals in accordance with the requirements of test method, • calculate the concentrations of solutions accurately, • label and store the working solutions and reagents properly in the laboratory to maintain their quality and integrity within the shelf-life.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare laboratory materials, equipment and facilities for chemical testing
Code	105797L3
Range	This unit of competency (UoC) covers the abilities to identify customer requirements and prepare laboratory materials, equipment and facilities required for carrying out chemical tests in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Identify customer requirements for test request</p> <ul style="list-style-type: none"> • Describe the standard operating procedures of the laboratory and identify relevant records and safety requirements of the laboratory materials, equipment and facilities. • Identify the requirements from the customers, e.g.: <ul style="list-style-type: none"> • test standards/methods, • statutory limits and regulatory directives. • Describe the maintenance checks and calibration procedures for laboratory equipment and facilities. • Describe the serviceable conditions of laboratory materials, equipment and facilities for carrying out chemical tests. • Apply the recording and documentation system in the laboratory. <p>2. Prepare required laboratory materials, equipment and facilities</p> <ul style="list-style-type: none"> • Carry out serviceability pre-/after-use checks on equipment according to appropriate standard operating procedures. • Carry out material selection and estimation for the chemical test, e.g.: <ul style="list-style-type: none"> • types of equipment required, • number of equipment required, • facilities being occupied, • types and grades of materials required. • Check whether the laboratory items are in the correct working order for the chemical test. • Prepare all the ready-to-use materials for the test in accordance with the test requirements, e.g.: <ul style="list-style-type: none"> • solutions and reagents, • disposable materials, • cleaned labware. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Maintain and update the after-test records / relevant information such as use of materials and equipment. • Check the conditions of the equipment and facilities after the test according to standard operating procedures.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • estimate types and number of laboratory materials, equipment and facilities required for the chemical test according to the requirements of test standards/methods and standard operating procedures, • prepare required materials correctly, configure equipment in accordance with standard operating procedures, and check laboratory facilities in good working conditions, • maintain, check, clean and record all the laboratory materials, equipment and facilities for their continuous uses after the chemical test.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Handle chemicals, solutions and reagents
Code	105798L3
Range	This unit of competency (UoC) covers the abilities to handle chemicals, solutions and reagents safely in testing laboratories, workplace or work sites and work safely at all times to protect oneself and other people during daily operation.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of chemical hazards and safety precautions in handling chemicals <ul style="list-style-type: none"> • Identify chemical hazards and safety measures for handling chemicals. • Describe various ways of chemicals entering human bodies. • Classify general chemical substances from chemical labels and risk symbols according to local regulatory requirements and common international standards, e.g. codes and standards of National Fire Protection Association (NFPA). • Describe the use of personal protective clothing and equipment for handling hazardous chemical substances. • Extract safety information from the chemical labels, risk symbols, and material safety data sheet (MSDS). • Describe the procedures for handling incidents involving chemicals including chemical spills. 2. Handle chemicals, solutions and reagents <ul style="list-style-type: none"> • Use appropriate personal protective clothing and equipment to handle chemicals. • Use fume cupboard to handle toxic and other hazardous chemicals properly. • Follow chemical handling procedures when carrying out work tasks. • Safely store, transport and dispose of chemicals, solutions and reagents properly to avoid contamination and accidents. • Minimise the impact to the environment during the disposal of chemicals and reagents. • Implement the established procedures for handling chemical incidents, e.g. chemical spill control and cleanup. • Identify, report and record incident and emergency situations according to standard operating procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Observe chemical safety rules and follow procedures to handle chemicals and incidents. • Maintain personal safety and protect other people during daily operation in the laboratory, workplace or work sites.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • handle chemicals, solutions and reagents safely to prevent chemical hazards and accidents, • handle, report and record chemical incidents (e.g. chemical spills) appropriately according to the standard operating procedures, • work safely at all times to protect oneself and other people during daily operation in the laboratory, workplace or worksites.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply chromatographic techniques to chemical testing
Code	105784L4
Range	This unit of competency (UoC) covers the abilities to optimise and operate chromatographic instruments independently, record and analyse test data accurately for chemical analysis by applying the principles of chromatography in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of chromatographic techniques <ul style="list-style-type: none"> • Apply the principles of chromatographic separation, chromatography concepts and calculations. • Describe the construction and operation of the following chromatographic instruments: <ul style="list-style-type: none"> • gas chromatograph (GC) including headspace sample preparation technique, • liquid chromatograph (LC), • ion chromatograph (IC). • Describe the operation, construction, selectivity, sensitivity, linear range and typical applications of chromatographic systems including injectors, columns and commonly used detectors except mass selective detector. • Identify the statutory requirements of operating chromatographic instruments, e.g.: <ul style="list-style-type: none"> • use of radioactive substances in electron capture detector (ECD). • Describe the procedures of carrying out routine performance check of chromatographic instruments. • Outline the steps of applying chromatographic techniques for identifying and quantifying analytes to give results in appropriate accuracy, precision, uncertainty and units. • Differentiate the applications of various types of chromatographic techniques according to the nature and characteristics of samples and analytes. • Apply the concepts of uncertainty and instrument calibration to chromatographic analysis. 2. Apply and operate chromatographic instruments for chemical analysis <ul style="list-style-type: none"> • Determine the test request and identify sample characteristics that may affect the chemical analysis. • Select appropriate test method and chromatographic instrument in compliance with test requirements. • Carry out routine performance check of the selected chromatographic instrument according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical analysis. • Set up the chromatographic instrument and optimise its performance by using appropriate calibration standards and adjusting instrumental operating parameters. • Carry out chromatographic analysis on the sample independently according to the test method by measuring analyte responses for standards, validation and quality control checks, and the sample. • Record accurate and reliable chromatographic data by conducting sufficient measurements. • Analyse chromatographic data for chemical analysis. 3. Exhibit professionalism <ul style="list-style-type: none"> • Troubleshoot analytical procedures or chromatographic instruments in case of any atypical observations/data/results being identified during sample analysis or performance check. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• apply, optimise and operate the chromatographic instrument independently to carry out chemical analysis of the sample according to the test method and sample characteristics,• record accurate and reliable chromatographic data by conducting sufficient measurements,• analyse chromatographic data by verifying validation and quality control check data.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply atomic spectrometric techniques to chemical testing
Code	105785L4
Range	This unit of competency (UoC) covers the abilities to optimise and operate atomic spectrometric instruments independently, record and analyse test data accurately for chemical analysis by applying the principles of atomic spectrometry in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of atomic spectrometric techniques <ul style="list-style-type: none"> • Apply the principles and concepts of atomic spectrometric techniques to chemical analysis. • Describe the construction and explain the functions of key components (e.g. sources, monochromators, sample holders, detectors) of atomic spectrometric instruments including atomic absorption spectrometer (AAS) and atomic emission spectrometer (AES) and/or X-ray fluorescence spectrometer (XRF). • Describe the operation, selectivity, sensitivity, linear range, typical applications and interferences (e.g. spectral interferences) of atomic spectrometric instruments. • Describe the procedures of carrying out routine performance check of atomic spectrometric instruments. • Outline the steps of applying atomic spectrometric techniques for identifying and quantifying analytes to give results in appropriate accuracy, precision, uncertainty and units. • Differentiate the applications of various types of atomic spectrometric techniques for qualitative and quantitative analysis according to the nature and characteristics of samples and analytes. • Apply the concepts of uncertainty and instrument calibration to atomic spectrometric analysis. 2. Apply and operate atomic spectrometric instruments for chemical analysis <ul style="list-style-type: none"> • Determine the test request and identify sample characteristics that may affect the chemical analysis. • Select appropriate test method and atomic spectrometric instrument in compliance with test requirements. • Carry out routine performance check of the selected atomic spectrometric instrument according to manufacturer's instruction and/or relevant international standard (e.g. OIML R100) to ensure it is ready for chemical analysis. • Set up the atomic spectrometric instrument and optimise its performance by using appropriate calibration standards and adjusting instrumental operating parameters. • Carry out atomic spectrometric analysis on the sample independently according to the test method by measuring analyte responses for standards, validation and quality control checks, and the sample. • Record accurate and reliable atomic spectrometric data by conducting sufficient measurements. • Analyse atomic spectrometric data for chemical analysis. 3. Exhibit professionalism <ul style="list-style-type: none"> • Troubleshoot analytical procedures or atomic spectrometric instruments in case of any atypical observations/data/results being identified during sample analysis or performance check. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• apply, optimise and operate the atomic spectrometric instrument independently to carry out chemical analysis of the sample according to the test method and sample characteristics,• record accurate and reliable atomic spectrometric data by conducting sufficient measurements,• analyse atomic spectrometric data by verifying validation and quality control check data.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply inductively coupled plasma spectroscopic techniques to chemical testing
Code	105786L4
Range	This unit of competency (UoC) covers the abilities to optimise and operate instruments associated with inductively coupled plasma (ICP) independently, record and analyse test data accurately for chemical analysis by applying the ICP spectroscopic principles and techniques in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess knowledge of working mechanisms of ICP techniques, procedures and its precautions <ul style="list-style-type: none"> Apply the principles of atomisation, ionisation and excitation mechanisms within inductively coupled plasma. Describe the construction of ICP instruments including: <ul style="list-style-type: none"> inductively coupled plasma-atomic/optical emission spectrometer (ICP-AES/OES), inductively coupled plasma-mass spectrometer (ICP-MS). Explain the functions of key components of ICP-MS instruments, e.g. plasma torch, collision cell, interface, mass analyser, mass detector. Describe the operation, interface, selectivity, sensitivity, linear range, typical applications and interferences (e.g. spectral interferences) of ICP-AES/OES and ICP-MS instruments. Describe the procedures of carrying out routine performance check of ICP instruments. Identify the maintenance requirements of mass spectrometer in ICP-MS instrument. Outline the steps of applying ICP spectroscopic techniques for identifying and quantifying analytes to give results in appropriate accuracy, precision, uncertainty and units. Differentiate the applications of various types of ICP spectroscopic techniques for qualitative and quantitative analysis according to the nature and characteristics of samples and analytes. Identify risks, hazards, safety equipment and control measures associated with the use of ICP and the test method. Apply the concepts of uncertainty and instrument calibration to ICP spectroscopic analysis Apply and operate ICP-AES/OES and/or ICP-MS systems for chemical analysis <ul style="list-style-type: none"> Determine the test request and identify sample characteristics that may affect the chemical analysis. Select appropriate test method and ICP instrument in compliance with test requirements. Carry out routine performance check of the selected ICP instrument according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical analysis. Set up the ICP instrument by configuring the sample introduction, plasma torch and detector sub-systems and check vacuum pressures, gas flow and torch cooling before igniting the torch. Optimise the performance of the ICP instrument to achieve the required specification by using appropriate calibration standards and adjusting instrumental operating parameters. Determine the appropriateness of the sample for the ICP instrument. Carry out ICP spectroscopic analysis on the sample independently and safely according to the test method by measuring analyte responses for standards, validation and quality control checks, and the sample. Record accurate and reliable ICP spectroscopic data by conducting sufficient measurements. Analyse ICP spectroscopic data for chemical analysis. Exhibit professionalism <ul style="list-style-type: none"> Troubleshoot analytical procedures or ICP instruments in case of any atypical observations/data/results being identified during sample analysis or performance check. Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

<p>Assessment Criteria</p>	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply, optimise and operate the inductively coupled plasma spectroscopic instrument independently and safely to carry out chemical analysis of the sample according to the test method and sample characteristics, • record accurate and reliable ICP spectroscopic data by conducting sufficient measurements, • analyse ICP spectroscopic data by verifying validation and quality control check data.
<p>Remark</p>	<p>Practitioners are required to have prior knowledge of the following UoCs:</p> <ul style="list-style-type: none"> • Apply atomic spectrometric techniques to chemical testing (TCTETO406A) • Apply mass spectrometric and hyphenated techniques to chemical testing (TCTETO545A)

Unit of Competency**Functional Area: Testing Operations**

Title	Apply molecular spectrometric techniques to chemical testing
Code	105787L4
Range	This unit of competency (UoC) covers the abilities to optimise and operate molecular spectrometric instruments independently, record and analyse test data accurately for chemical analysis by applying the principles of molecular spectrometry in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of molecular spectrometric techniques</p> <ul style="list-style-type: none"> • Apply the principles and concepts of molecular spectrometric techniques to chemical analysis. • Describe the construction and explain the functions of key components (e.g. sources, monochromators, sample holders, detectors) of molecular spectrometric instruments including: <ul style="list-style-type: none"> • ultraviolet/visible (UV/Vis) spectrometer, • Fourier Transform infrared (FT-IR) spectrometer, • molecular fluorescence spectrometer. • Describe the operation, selectivity, sensitivity, linear range, typical applications and interferences (e.g. spectral interferences) of molecular spectrometric instruments. • Describe the procedures of carrying out routine performance check of molecular spectrometric instruments. • Outline the steps of applying molecular spectrometric techniques for identifying and quantifying analytes to give results in appropriate accuracy, precision, uncertainty and units. • Differentiate the applications of various types of molecular spectrometric techniques for qualitative and quantitative analysis according to the nature and characteristics of samples and analytes. • Apply the concepts of uncertainty and instrument calibration to molecular spectrometric analysis. <p>2. Apply and operate molecular spectrometric instruments for chemical analysis</p> <ul style="list-style-type: none"> • Determine the test request and identify sample characteristics that may affect the chemical analysis. • Select appropriate test method and molecular spectrometric instrument in compliance with test requirements. • Carry out routine performance check of the selected molecular spectrometric instrument according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical analysis. • Set up the molecular spectrometric instrument and optimise its performance by using appropriate calibration standards and adjusting instrumental operating parameters. • Carry out molecular spectrometric analysis on the sample independently according to the test method by measuring analyte responses for standards, validation and quality control checks, and the sample. • Record accurate and reliable molecular spectrometric data by conducting sufficient measurements. • Analyse molecular spectrometric data for chemical analysis. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Troubleshoot analytical procedures or molecular spectrometric instruments in case of any atypical observations/data/results being identified during sample analysis or performance check. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• apply, optimise and operate the molecular spectrometric instrument independently to carry out chemical analysis of the sample according to the test method and sample characteristics,• record accurate and reliable molecular spectrometric data by conducting sufficient measurements,• analyse molecular spectrometric data by verifying validation and quality control check data.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform chemical tests on construction materials
Code	105788L4
Range	This unit of competency (UoC) covers the abilities to carry out chemical tests on construction materials independently by applying knowledge of analytical chemistry, record accurate test data and conclude test results in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <p>1.Possess knowledge of analytical chemistry and properties of construction materials</p> <ul style="list-style-type: none"> • Apply the principles and concepts underpinning chemical analysis for construction materials. • Identify construction materials and corresponding test methods routinely used in testing laboratories including: <ul style="list-style-type: none"> • purpose and principles of test, • properties of construction materials under test, • key preparation/measurement steps in test method, • calculation steps to give results in appropriate accuracy, precision, units and uncertainty, • expected values for sample type. • Describe the operation of equipment and apparatus used for chemical analysis of selected construction materials, e.g.: <ul style="list-style-type: none"> • concrete and its constituent materials, • soil and rock, • asphalt and bituminous materials, • aggregates. • Describe the procedures for ensuring traceability of samples, test pieces, test data and results. • Describe the procedures for equipment calibration and performance check. <p>2.Perform chemical tests on construction materials</p> <ul style="list-style-type: none"> • Determine the test request and identify sample characteristics that may affect selection and application of test methods and conditions. • Apply appropriate test method and conditions in compliance with test requirements on selected type of construction materials. • Prepare a representative analytical portion of the laboratory sample to reduce the sample complexity and eliminate matrix effects. • Carry out routine performance check of equipment/instrument according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical tests on construction materials. • Set up and check the calibration status of laboratory equipment and apparatus for measurements to suit sample/test requirements. • Carry out appropriate chemical tests on selected construction material independently by measuring analyte response for calibration standards, validation and quality control checks, and samples according to requirements of test method. • Conduct sufficient measurements to obtain accurate and reliable data and/or observations. <p>3.Exhibit professionalism</p> <ul style="list-style-type: none"> • Troubleshoot analytical procedures or equipment in case of any atypical observations/data/results being identified during sample analysis or performance check. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out chemical tests on selected construction material independently by applying appropriate testing equipment and test conditions according to the requirements of relevant test method, • record accurate test data and observations and conclude test results to confirm the compliance of the construction material.
Remark	<p>Practitioners are required to have prior knowledge of the following UoCs:</p> <ul style="list-style-type: none"> • Perform basic chemical tests and procedures (TCTETO304A) • Perform complex chemical tests to measure chemical properties of materials. (TCTETO411A)

Unit of Competency

Functional Area: Testing Operations

Title	Perform on-site indoor air quality measurement and analysis
Code	105789L4
Range	This unit of competency (UoC) covers the abilities to carry out indoor air quality analysis independently by applying the knowledge of indoor air quality (IAQ) objectives and measuring analytes of IAQ parameters in the premises under investigation and in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <p>1.Possess knowledge of indoor air quality (IAQ) objectives, physical / chemical natures of indoor air-borne particles and their measurement principles</p> <ul style="list-style-type: none"> • Identify the IAQ objectives for offices and public places and general guidelines for setting indoor sampling and monitoring locations. • Specify the sampling requirements for indoor air quality measurements. • Identify relevant types of air handling unit (AHU) system and possess knowledge of air-conditioning engineering. • Describe the assessment methods for IAQ including real-time measurements and integrated sampling with subsequent laboratory analysis. • Apply the measurement principles of individual IAQ parameters. • Describe physical properties (e.g. sizes) of various air-borne particles including respirable suspended particulates (RSPs). • Identify the chemical nature and properties (e.g. density, water solubility) of various air-borne particles including: <ul style="list-style-type: none"> • total volatile organic compounds (TVOC), • formaldehyde, • carbon dioxide (CO₂), carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), • radon, • other air-borne particles as required by international and/or national standards. • Describe the working principles and operation of equipment used for indoor air quality measurements, e.g.: <ul style="list-style-type: none"> • psychrometer / hygrometer / anemometer for measurement of temperature, relative humidity and air movement, • real-time monitors / analysers for CO₂, CO, NO₂, O₃ and radon, • microbial air samplers, • air sampler for RSPs, • active or passive sampling followed by HPLC analysis for formaldehyde, • air sampling (by passivated canisters or solid sorbents) followed by mass selective detector (MSD) for TVOC, • active or passive sampling followed by FIA analysis for NO₂, • other equipment as required by international and/or national standards. • Apply the concepts of uncertainty and equipment calibration IAQ measurements. <p>2.Perform indoor air quality measurement and analysis</p> <ul style="list-style-type: none"> • Determine the number of sampling points and identify the monitoring sites within the premises under investigation according to the guidelines. • Apply appropriate test methods and measuring equipment in compliance with IAQ measurement requirements. • Carry out routine performance and calibration checks of equipment according to manufacturer's instruction and/or relevant standard to ensure they are ready for IAQ measurements. • Operate appropriate air sampling equipment and real-time monitors / analysers to carry out indoor air quality analysis independently in each monitoring site within the premises. • Monitor all the IAQ parameters (except air movement) outdoors in close proximity to the fresh air intakes of the investigation areas for evaluating the indoor air measurement data. • Record accurate and reliable IAQ measurement data by conducting sufficient measurements to determine the indoor air quality of the premises. <p>3.Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure integrity and confidentiality of measurement data and information by observing the relevant code of conduct.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• determine the number and locations of monitoring sites within the premises under investigation according to the general guidelines,• carry out indoor air quality measurement and analysis independently by applying appropriate measuring equipment and air sampling followed by analysis in a testing laboratory,• record accurate and reliable measurement data to determine the indoor air quality in compliance with current IAQ standards and limits.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform complex tests to measure chemical properties of materials
Code	105790L4
Range	This unit of competency (UoC) covers the abilities to isolate analytes from complex matrices, carry out multi-stage and/or multi-component analysis on the analytes independently by applying knowledge of analytical chemistry, and record and analyse test data accurately in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <p>Possess knowledge of analytical chemistry to perform complex tests</p> <ul style="list-style-type: none"> • Apply the principles and concepts underpinning the analysis, e.g.: <ul style="list-style-type: none"> • interference on analyte behaviour such as ionisation, complexation, precipitation, masking, • quantification methods such as internal standards, standard additions, recovery checks. • Identify the test methods and principles for inorganic analysis. • Identify the test methods and principles for organic analysis. • Describe the functions of key components of equipment, e.g. ion selective electrodes, thin layer chromatography, spectrometer, polarimeter. • Apply the equipment calibration, maintenance and troubleshooting techniques. • Describe sampling, sub-sampling and sample preparation procedures. • Describe the steps for calculating analyte concentrations with appropriate accuracy, precision, units and uncertainty. <p>2. Perform multi-staged and/or multi-component analysis</p> <ul style="list-style-type: none"> • Determine the test request and identify sample characteristics that may affect selection and application of test conditions and methods. • Apply appropriate test method and conditions in compliance with test requirements. • Prepare a representative analytical portion of the laboratory sample to reduce the sample complexity and for validation checks. • Set up and optimise equipment for measurements to suit sample/test requirements. • Carry out routine performance check of equipment according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical tests • Measure analyte response for calibration standards, validation and quality control checks, and samples independently according to requirements of test method. • Conduct sufficient measurements to obtain accurate and reliable test data. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Troubleshoot analytical procedures or equipment in case of any atypical observations/data/results being identified during sample analysis or performance check. • Maintain security, integrity and traceability of test data, samples and documentation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out multi-stage preparation and pre-treatment of the sample, • set up, optimise and operate equipment to carry out multi-stage and/or multi-component analysis on the sample independently according to the test method, • record and analyse accurate and reliable test data by conducting sufficient measurements and verifying validation and quality control check data.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply mass spectrometric and hyphenated techniques to chemical testing
Code	105780L5
Range	This unit of competency (UoC) covers the abilities to optimise and operate hyphenated instruments associated with mass spectrometer independently, record accurate test data, and interpret mass spectrometric data for chemical analysis by applying the mass spectrometric principles and concepts in testing laboratories.
Level	5
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of hyphenated techniques with mass spectrometer</p> <ul style="list-style-type: none"> • Employ the principles and concepts of hyphenated techniques. • Apply the principles and concepts of mass spectrometric techniques and their applications to chemical testing. • Describe the construction and explain the functions of key components of hyphenated instruments associated with mass spectrometer including: <ul style="list-style-type: none"> • gas chromatography-mass spectrometer (GC-MS), • liquid chromatography-mass spectrometer (LC-MS). • Describe the operation, interface, selectivity, sensitivity, linear range, typical applications and interferences (e.g. spectral interferences) of hyphenated mass spectrometric instruments. • Explain the routine performance check and mass tuning of hyphenated mass spectrometric instruments. • Outline the steps of applying hyphenated mass spectrometric techniques for identifying and quantifying analytes to give results in appropriate accuracy, precision, uncertainty and units. • Differentiate the applications of various types of hyphenated techniques for qualitative and quantitative analyses according to the nature and characteristics of samples and analytes. • Apply the concepts of uncertainty and instrument calibration to mass spectrometric analysis. <p>2. Apply and operate hyphenated mass spectrometric instruments for chemical analysis</p> <ul style="list-style-type: none"> • Determine the test request and identify sample characteristics that may affect the chemical analysis. • Select appropriate test method and hyphenated mass spectrometric instrument in compliance with test requirements. • Carry out routine performance check of the selected hyphenated mass spectrometric instrument according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical analysis. • Set up the hyphenated mass spectrometric instrument and optimise its performance by using appropriate calibration standards and adjusting instrumental operating parameters. • Carry out hyphenated mass spectrometric analysis on the sample independently according to the test method by measuring analyte responses for standards, validation and quality control checks, and the sample. • Record accurate and reliable mass spectrometric data by conducting sufficient measurements. • Interpret mass spectrometric data for chemical analysis. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Troubleshoot analytical procedures or hyphenated mass spectrometric instruments in case of any atypical observations/data/results being identified during sample analysis or performance check. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply, optimise and operate the hyphenated mass spectrometric instrument independently to carry out chemical analysis of the sample according to the test method and sample characteristics, • record and verify mass spectrometric data by conducting sufficient measurements and analysing validation and quality control check data, • interpret mass spectrometric data for chemical analysis.
Remark	<p>Practitioners are required to have prior knowledge of the following UoC:</p> <ul style="list-style-type: none"> • Apply chromatographic techniques to chemical testing (TCTETO405A)

Unit of Competency

Functional Area: Testing Operations

Title	Perform chemical analysis on food
Code	105781L5
Range	This unit of competency (UoC) covers the abilities to carry out various chemical tests independently to analyse the nutrients, ingredient composition, preservatives and additives of foods and critically evaluate the compliance of food against regulatory requirements in testing laboratories. This UoC also includes the identification and quantification of chemical contaminants in food products.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of various tests for analysing food nutrients, chemical composition of common food and beverages, food preservatives and additives, and chemical contaminants in food <ul style="list-style-type: none"> • Explain the functional structures and properties of proteins, lipids, carbohydrates, vitamins, minerals and fibre. • Identify the chemical composition of food and search for appropriate test methods that can determine their chemical composition. • Describe the properties of common food additives and preservatives and identify appropriate methods for their identification and quantification. • Determine possible chemical food contaminants (e.g. heavy metals and pesticides) and their detection methods. • Specify local food safety ordinance and food labelling regulations and describe their implications for nutritional claims. • Identify international standards (e.g. Codex Alimentarius) and regulatory requirements on foods. • Employ the principles and concepts related to instrument performance check and operation, material preparation and testing of foods. • Describe the sampling and sub-sampling procedures for food testing. • Outline the steps in identifying and quantifying the analytes of food testing to give results in appropriate accuracy, precision, uncertainty and units. • Apply the concepts of uncertainty and instrument calibration to food testing. 2. Perform chemical analysis on food <ul style="list-style-type: none"> • Evaluate the test request and sample characteristics. • Apply appropriate test method/standard in compliance with requirements of the test request and sample characteristics. • Select appropriate analytical instrument according to the test method/standard. • Carry out routine performance check of the selected analytical instrument according to manufacturer's instruction and/or relevant standard to ensure it is ready for food testing. • Set up the selected analytical instrument and optimise its performance by using appropriate calibration standards and adjusting instrumental operating parameters to suit sample and test requirements. • Evaluate the appropriateness of the sample for food testing. • Carry out appropriate test on the analyte in the food sample independently by measuring analyte response for standards, validation and quality control checks, and the sample. • Conduct sufficient measurements to record accurate and reliable test data with appropriate accuracy, precision and units. • Evaluate test results critically to confirm the compliance of food sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Troubleshoot analytical procedures or analytical instruments in case of any atypical observations/data/results being identified during sample analysis or performance check. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

<p>Assessment Criteria</p>	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select and apply suitable test method/standard and analytical instrument for food testing by analysing the test request from the customer, • set up, optimise and operate the analytical instrument independently to carry out chemical analysis on food product independently according to the test method/standard and sample characteristics, • evaluate test results critically for the compliance of food product against relevant standards and regulatory requirements.
<p>Remark</p>	<p>Practitioners are required to have prior knowledge of the following UoCs:</p> <ul style="list-style-type: none"> • Apply atomic spectrometric techniques to chemical testing (TCTETO406A) • Apply chromatographic techniques to chemical testing (TCTETO405A) • Apply inductively coupled plasma spectroscopic techniques to chemical testing (TCTETO407A) • Apply mass spectrometric and hyphenated techniques to chemical testing (TCTETO545A) • Apply molecular spectrometric techniques to chemical testing TCTETO408A) • Perform complex chemical tests to measure chemical properties of materials (TCTETO411A)

Unit of Competency**Functional Area: Testing Operations**

Title	Perform chemical analysis on pharmaceutical products
Code	105782L5
Range	This unit of competency (UoC) covers the abilities to carry out chemical analysis on pharmaceutical products independently by applying knowledge of analytical chemistry and instrumental analysis, record accurate test data and critically evaluate test results in testing laboratories.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess knowledge of analytical chemistry and assays of pharmaceutical products <ul style="list-style-type: none"> Apply the principles and concepts of chemical analysis for pharmaceutical products. Specify the identification and assays of selected pharmaceutical products in relevant pharmacopoeia / test standards, e.g.: <ul style="list-style-type: none"> British Pharmacopoeia (BP), United States Pharmacopoeia (USP), European Pharmacopoeia (EP), Pharmacopoeia of the People's Republic of China (ChP). Determine pharmaceutical products and corresponding test methods routinely used in testing laboratories including: <ul style="list-style-type: none"> purpose and principles of test, properties of pharmaceutical products under test, key preparation/measurement steps in test method, calculation steps to give results in appropriate accuracy, precision, units and uncertainty, expected values for sample type. Explain the operation of equipment used for chemical analysis of selected pharmaceutical products, e.g. chromatography, spectrometry, electrochemical instruments. Explain the importance of traceability of samples, test pieces, test data and results. Describe the procedures for equipment calibration and performance check. Perform chemical analysis on pharmaceutical products <ul style="list-style-type: none"> Evaluate the test request and analyse sample characteristics that may affect selection and application of test methods. Select and apply appropriate assay method and equipment in compliance with test requirements for selected pharmaceutical products. Prepare a representative analytical portion of the laboratory sample to reduce the sample complexity and eliminate matrix effects. Carry out routine performance check of equipment according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical tests of pharmaceutical products. Set up, optimise and check the calibration status of equipment for measurements to suit sample/test requirements. Carry out appropriate chemical tests on selected pharmaceutical product independently by measuring analyte response for calibration standards, validation and quality control checks, and the sample according to the requirements of test method. Record accurate and reliable data and/or observations and evaluate test results for the compliance of pharmaceutical product. Exhibit professionalism <ul style="list-style-type: none"> Troubleshoot analytical procedures or equipment in case of any atypical observations/data/results being identified during sample analysis or performance check. Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

<p>Assessment Criteria</p>	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out chemical tests on selected pharmaceutical product independently by applying appropriate assay method and testing equipment according to the requirements of test request, • verify test results and observations by data validation, • critically evaluate test results to confirm the compliance of the pharmaceutical product against relevant specifications of test standard/method.
<p>Remark</p>	<p>Practitioners are required to have prior knowledge of the following UoCs:</p> <ul style="list-style-type: none"> • Apply atomic spectrometric techniques to chemical testing (TCTETO406A) • Apply chromatographic techniques to chemical testing (TCTETO405A) • Apply inductively coupled plasma spectroscopic techniques to chemical testing (TCTETO407A) • Apply mass spectrometric and hyphenated techniques to chemical testing (TCTETO545A) • Apply molecular spectrometric techniques to chemical testing (TCTETO408A) • Perform complex chemical tests to measure chemical properties of materials (TCTETO411A)

Unit of Competency**Functional Area: Testing Operations**

Title	Perform chemical analysis on Chinese medicine
Code	105783L5
Range	This unit of competency (UoC) covers the abilities to carry out chemical analysis on Chinese medicine independently by applying knowledge of analytical chemistry and instrumental analysis, record accurate test data and critically analyse test results in testing laboratories.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess knowledge of analytical chemistry and chemical tests of Chinese medicine <ul style="list-style-type: none"> Apply the principles and concepts of chemical analysis for Chinese medicine including proprietary Chinese medicine and Chinese Materia Medica (CMM). Specify the requirements of chemical tests of selected Chinese Materia Medica in relevant categories of standards, e.g.: <ul style="list-style-type: none"> Hong Kong Chinese Materia Medica (HKCMM) Standards, Pharmacopoeia of the People's Republic of China (ChP), other national and international standards. Identify the test methods routinely used for chemical tests of proprietary Chinese medicine and Chinese Materia Medica for identification and contamination, e.g.: <ul style="list-style-type: none"> pesticide residues, toxic elements, aflatoxins, adulteration with western drugs, foreign matter. Identify the techniques for sample preparation of Chinese medicine. Outline the key steps for identifying and quantifying analytes in Chinese medicine to give results in appropriate accuracy, precision, uncertainty and units. Explain the operation of instruments used for chemical analysis of Chinese medicines, e.g. chromatography, hyphenated mass spectrometry, atomic spectrometry, inductively coupled plasma spectrometry. Explain the importance of traceability of samples, test pieces, test data and results. Describe the procedures for instrument calibration and performance check. Perform chemical analysis on Chinese medicine <ul style="list-style-type: none"> Evaluate the test request and analyse sample characteristics that may affect selection and application of test method. Apply appropriate test method and instrument in compliance with test requirements for Chinese medicine. Prepare a representative analytical portion of the laboratory sample of Chinese medicine to reduce the sample complexity and eliminate matrix effects. Carry out routine performance check of instrument according to manufacturer's instruction and/or relevant standard to ensure it is ready for chemical tests of Chinese medicines. Set up, optimise and check the calibration status of instrument for measurements to suit sample/test requirements. Carry out appropriate chemical tests on Chinese medicine sample independently by measuring analyte response for calibration standards, validation and quality control checks, and the sample according to the requirements of test method. Verify test data and/or observations and analyse test results critically. Exhibit professionalism <ul style="list-style-type: none"> Troubleshoot analytical procedures or instrument in case of any atypical observations/data/results being identified during sample analysis or performance check. Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.

Unit of Competency

Functional Area: Testing Operations

<p>Assessment Criteria</p>	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out chemical tests on Chinese medicine sample independently by applying appropriate test method and testing instrument according to the requirements of test request, • Verify test data and/or observations and analyse test results critically to confirm the compliance of the Chinese medicine against relevant specifications of test method/standard.
<p>Remark</p>	<p>Practitioners are required to have prior knowledge of the following UoCs:</p> <ul style="list-style-type: none"> • Apply atomic spectrometric techniques to chemical testing (TCTETO406A) • Apply chromatographic techniques to chemical testing (TCTETO405A) • Apply inductively coupled plasma spectroscopic techniques to chemical testing (TCTETO407A) • Apply mass spectrometric and hyphenated techniques to chemical testing (TCTETO545A) • Perform complex chemical tests to measure chemical properties of materials (TCTETO411A)

Unit of Competency**Functional Area: Testing Operations**

Title	Select test methods and measuring instruments (chemical testing)
Code	105779L6
Range	This unit of competency (UoC) covers the abilities to select suitable test methods and instruments with justification by critically evaluating test request and relevant test standards for carrying out chemical testing activities in laboratories.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of test methods and instruments for chemical testing <ul style="list-style-type: none"> • Apply a broad range of test methods and test standards available for chemical testing. • Interpret the requirements of analytical instruments in relevant test methods and test standards. • Formulate criteria for selection of test methods and analytical instruments in terms of accuracy, resolution, tolerance and measurement uncertainty. • Explain the principles, operation and typical applications of analytical instruments related to chemical testing. • Consolidate the knowledge and skills required to operate the instrument safely and reliably in the laboratory. • Differentiate conformity of instruments from non-conformity within a narrow range of measured values. 2. Select test methods and instruments for chemical testing <ul style="list-style-type: none"> • Evaluate customer's test request critically and determine sample characteristics and factors to justify the selection of test method and analytical instrument. • Select appropriate test method in accordance with relevant test standard and test request from the customer. • Verify the performance the selected test method. • Select the most suitable analytical instrument in accordance with the test method and/or test standard. • Set up the analytical instrument and optimise its performance by adjusting appropriate instrumental conditions. • Evaluate the performance verification and stability checks of the instrument and take appropriate actions if any signal drift or drift in performance is identified. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain efficient communication with customers. • Ensure appropriate measures are implemented to minimise the health and safety risks associated with analytical instruments and test methods.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select and justify appropriate test method by critically evaluating the test request from the customer and interpreting relevant test standard, • select appropriate analytical instrument for a particular chemical test by evaluating the requirements of relevant test method/standard and sample characteristics, • evaluate the performance and stability of the instrument to ensure it is ready and safe for use in chemical testing activities.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Apply cleansing methods for microbiological testing labware
Code	105992L2
Range	This unit of competency (UoC) covers the abilities to apply suitable cleansing methods and procedures for labware used in microbiological testing laboratories.
Level	2
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and working principles of a selected range of cleansing agents/equipment and cleansing techniques for labware contaminated with infectious materials <ul style="list-style-type: none"> • Identify cleansing methods and the respective working mechanisms, e.g. decontamination. • Identify cleansing agents and equipment involved in cleansing work, e.g. detergents, cleansing machines. • Outline compulsory steps in cleansing activities. • Describe the techniques and uses of various cleansing agents based on the nature of infectious materials. • Describe the importance of cleaned glassware in the accuracy and precision of microbiological testing. • Apply the basic safety concept on handling infectious wastes. 2. Perform cleansing on microbiological testing labware by applying defined cleansing methods and procedures <ul style="list-style-type: none"> • Apply appropriate cleansing methods and procedures according to the nature of labware and contamination with infectious materials. • Apply appropriate cleansing agents and equipment on the labware in accordance with appropriate cleansing methods and procedures. • Carry out cleansing activities for the labware according to cleansing procedures. • Store the cleaned labware under good conditions in designated locations. • Handle and dispose of infectious wastes properly according to the procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality of the cleaned labware suitable for testing purposes.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out cleansing activities for microbiological testing labware by applying appropriate cleansing agents and equipment according to the methods and procedures, • store the cleaned labware properly and maintain the cleanliness of labware in the workplace of the microbiological testing laboratory.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare biological samples
Code	105806L3
Range	This unit of competency (UoC) covers the abilities to apply suitable techniques and equipment to prepare, separate and collect biological samples for biological tests in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of biological sample preparation techniques <ul style="list-style-type: none"> • Describe the working principles of biological sample preparation procedures, e.g.: <ul style="list-style-type: none"> • extraction, • separation, • precipitation, • concentration. • Apply storage, transferring and handling techniques on biological samples to achieve sample integrity, e.g. freezing/thawing, quenching. 2. Prepare adequate amount of the desired cell/organelle/bio-molecule for further biological tests <ul style="list-style-type: none"> • Apply appropriate techniques for biological sample preparation , e.g.: <ul style="list-style-type: none"> • lipid / protein extraction, • DNA purification. • Prepare suitable reagents and operate suitable equipment for biological sample preparation, e.g.: <ul style="list-style-type: none"> • centrifuge, • buffer solutions and solvents. • Collect, store and handle the prepared biological sample according to established procedures to prevent sample contamination and maintain sample integrity. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quantity and purity of the prepared biological sample for further laboratory tests.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply appropriate techniques for biological sample preparation, • use suitable reagents and equipment to prepare sufficient quantity of sample for biological tests, • maintain the integrity and purity of biological sample by using suitable means of laboratory practices.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare microbiological samples
Code	105807L3
Range	This unit of competency (UoC) covers the abilities to prepare pure microbiological cell / tissue culture aseptically for further microbiological tests in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of cell culturing techniques <ul style="list-style-type: none"> • Apply the working principles of cell culturing techniques, e.g.: <ul style="list-style-type: none"> • inoculation, • incubation, • isolation, • streaking of sample. • Employ storage, transferring, handling and aseptic techniques on microbiological samples to achieve sample integrity and purity, e.g.: <ul style="list-style-type: none"> • primary culturing, • sub-culturing, • cell seeding, • cell freezing/thawing. 2. Prepare adequate amount of the desired cell/culture type for further microbiological tests <ul style="list-style-type: none"> • Apply appropriate cell isolation/separation techniques on microbiological samples, e.g.: <ul style="list-style-type: none"> • differential centrifugation, • ultrasonic equipment. • Operate laboratory equipment for microbiological sample preparation, e.g.: <ul style="list-style-type: none"> • centrifuge, • ultrasonic equipment, • cell freezer, • water bath, • cell counter, • incubator. • Collect, store and handle the prepared microbiological sample with aseptic procedures to prevent sample contamination and maintain sample integrity. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quantity and quality of the prepared microbiological sample for further laboratory tests.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply appropriate techniques for microbiological sample preparation, • use suitable reagents and equipment to prepare microbiological sample, • maintain the integrity and purity of cell sample by using suitable laboratory practices including aseptic techniques.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform sterilisation and aseptic techniques
Code	105808L3
Range	This unit of competency (UoC) covers the abilities to perform sterilisation and aseptic techniques to maintain the integrity and purity of both the sample source and the sample and disinfect work area and equipment in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of disinfection and sterilisation methods <ul style="list-style-type: none"> • Describe relevant methods and technologies of disinfection and sterilisation including: <ul style="list-style-type: none"> • bleaching agents, • autoclaving, • UV radiation. • Describe various precautions and techniques when handling, transferring and disposing of samples in an aseptic manner. 2. Perform sterilisation and aseptic techniques <ul style="list-style-type: none"> • Apply appropriate disinfection and sterilisation techniques, and use appropriate equipment and materials for performing aseptic procedures. • Undertake various disinfection / sterilisation procedures with precautions in handling, transferring and disposing of samples. • Clean and disinfect work area and equipment after use. 3. Exhibit professionalism <ul style="list-style-type: none"> • Take responsibilities for personal hygiene to prevent cross-contamination.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply appropriate disinfection and sterilisation methods according to the type of aseptic experiments and standard operating procedures, • handle, transfer and dispose of samples aseptically by using appropriate equipment and materials, • clean and disinfect work area and equipment to prevent cross-infection and contamination.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Prepare culture media and solutions
Code	105809L3
Range	This unit of competency (UoC) covers the abilities to prepare culture media and solutions which are free of contamination to facilitate optimal growth of organisms and cells for biological / microbiological tests in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of natures / properties of cultures and culture media <ul style="list-style-type: none"> • Apply the basic biochemistry of various components in culture media and solutions, e.g.: <ul style="list-style-type: none"> • purpose / function, • content / composition / specific ingredient(s). • Describe the purpose, content and features of culture media and the relationship between the correct preparation of culture media and the optimal growth of organisms or cells. • Describe the nature, properties and use of a range of biological media. • Outline compulsory steps in the preparation of culture media aseptically. • Describe the use of various laboratory apparatus for culture media preparation. 2. Prepare culture media and solutions <ul style="list-style-type: none"> • Apply appropriate laboratory apparatus and procedures for culture media preparation. • Accurately calculate and measure the content for a specified ingredient in culture media. • Mix the media and solvent to ensure dissolution and even settling of heat soluble materials. • Sterilise culture media and solutions according to manufacturer's requirements to achieve sterilisation at the required settings. • Perform post-sterilisation quality check of culture media/solutions in conformance with manufacturer's requirements or test standard, e.g. pH measurement, selectivity check, quantitative evaluation, using appropriate control organisms. • Label and store culture media/solutions to maximise shelf life and minimise contamination. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality of culture media and solutions by performing quality control checks, e.g. visual inspection for deterioration and expiry, at regular intervals for conformance to required standards.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • prepare the culture media and solutions aseptically by using appropriate laboratory equipment, apparatus and procedures, • perform post-sterilisation quality check of culture media/solutions using appropriate control organisms, • label and store the prepared media/solutions properly with periodic checking for visual deterioration and expiry for conformance to required standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Follow bio-safety rules and precautions
Code	105810L3
Range	This unit of competency (UoC) covers the abilities to follow established rules and apply precautionary measures to maintain bio-safety by preventing the occurrence of bio-hazards in the workplace environment.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of biological hazards and the relevant health and safety requirements <ul style="list-style-type: none"> • Identify biological hazards in the laboratory and testing environment: <ul style="list-style-type: none"> • bio-hazards, • environmental hazards. • Characterise the nature and the property of hazards, e.g.: <ul style="list-style-type: none"> • causes and consequences, • respective preventive/protective measures. • Apply the knowledge of workplace health and safety requirements. 2. Follow established bio-safety rules and operate appropriate equipment for bio-hazard elimination <ul style="list-style-type: none"> • Follow the standard operating procedures on taking precautions against bio-hazards, e.g.: <ul style="list-style-type: none"> • disinfect work area regularly, • handle sharps waste properly. • Operate equipment to prevent and eliminate the outbreak of bio-hazards at different circumstances in the laboratory, e.g.: <ul style="list-style-type: none"> • transfer of bio-hazardous wastes, • disposal of bio-hazardous wastes. • Use proper personal protective equipment when handling bio-hazardous wastes. 3. Exhibit professionalism <ul style="list-style-type: none"> • Periodically check the validity and efficiency of the bio-safety measures in the workplace environment. • Take responsibilities for safety of oneself and other people working in the laboratories.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • follow the established rules and apply precautionary measures correctly on handling bio-safety issues, • handle, transfer and dispose of biological samples safely by using appropriate equipment, • clean and disinfect the work area and equipment to prevent cross-infection and contamination.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Prepare equipment and facilities for biological / microbiological testing
Code	105811L3
Range	This unit of competency (UoC) covers the abilities to prepare equipment and facilities required for carrying out biological / microbiological tests in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of the requirements of equipment and facilities for biological / microbiological testing</p> <ul style="list-style-type: none"> • Identify relevant standard operating procedures (SOPs) of equipment and facilities for biological / microbiological testing. • Describe the specifications and requirements of equipment and facilities, e.g.: <ul style="list-style-type: none"> • autoclave, • hot-air oven, • incubator, • freezer, • biohazard hood or laminar flow cabinet, • clean room. • Describe the maintenance checks and calibration procedures for the selected equipment and/or facilities. • Describe the serviceable conditions of equipment and facilities for carrying out biological/ microbiological tests. • Apply the recording and documentation system in the laboratory. <p>2. Prepare required equipment and facilities</p> <ul style="list-style-type: none"> • Identify the types and number of equipment and facilities according to the requirements of biological / microbiological test. • Carry out serviceability pre-/after-use checks on equipment and facilities according to appropriate SOPs. • Check whether the equipment and facilities are in the correct working order for the test, e.g.: <ul style="list-style-type: none"> • calibration status and requirements, • maintenance, • operating conditions. • Check the performance and precision of equipment and facilities in compliance with the specifications of the test. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Maintain and update the records / relevant information such as use of equipment and facilities. • Check the conditions of the equipment/facilities after the test according to manufacturer's instructions or SOPs.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • estimate types and number of equipment and facilities required for the biological / microbiological test according to specific test method, requirements and procedures, • prepare required items of equipment and facilities by configuring and checking the working conditions of these items in accordance with the specifications of the test, • maintain, check, clean and record the equipment/facilities for their continuous uses after the biological / microbiological test.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform microbiological tests
Code	105802L4
Range	This unit of competency (UoC) covers the abilities to carry out microbiological tests independently for qualifying and/or quantifying the samples aseptically by applying appropriate microbiological procedures and skills in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of theories and practical procedures on microbiological tests <ul style="list-style-type: none"> • Employ basic theories of aseptic procedures, cell biology, biochemistry and microbiology. • Apply technical principles on handling and processing of samples containing micro-organisms, e.g.: <ul style="list-style-type: none"> • culturing and sub-culturing, • separation, isolation and identification. 2. Perform microbiological tests on samples <ul style="list-style-type: none"> • Determine appropriate test methods based on the nature of sample. • Carry out appropriate processing techniques on microbiological specimens for qualifying sample, e.g.: <ul style="list-style-type: none"> • smearing and streaking, • staining, • biochemical and serological identification. • Carry out appropriate processing techniques on microbiological specimens for quantifying sample, e.g.: <ul style="list-style-type: none"> • cell seeding, • culturing and sub-culturing. • Prepare and use appropriate pure control organisms for microbiological work and aseptic applications. • Carry out tests on pure cultures independently to assist in the biochemical and immunological identification of micro-organisms. • Record the number and/or size of micro-organisms in samples accurately and analyse test results with an estimation of measurement uncertainty. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all microbiological laboratory works are carried out in a safe and clean environment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out microbiological test on the sample independently by applying appropriate microbiological procedures and aseptic technique and using appropriate control organisms, • record test data and observations accurately, • analyse test results for characterisation of the sample for further laboratory works.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform biological and biochemical tests
Code	105803L4
Range	This unit of competency (UoC) covers the abilities to carry out tests on biological samples independently for qualitative and quantitative analysis on different cell types, species and biologically active compounds by applying appropriate biological procedures and skills in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of theories and laboratory techniques on manipulation of cell / tissues <ul style="list-style-type: none"> • Employ theories of cell biology, molecular biology and biochemistry. • Identify relevant laboratory techniques on manipulation of organelles/ cells/ tissues, e.g.: <ul style="list-style-type: none"> • cell fractionation, • solvent extraction, • bio-molecule detection. • Explain physical and biochemical characteristics of cells. 2. Perform biological and biochemical tests on samples <ul style="list-style-type: none"> • Determine and follow appropriate test methods based on the nature of samples. • Prepare appropriate solutions and reagent for biological / biochemical tests, e.g.: <ul style="list-style-type: none"> • buffer solutions, • reagents in detection kits, extraction kits. • Apply suitable techniques for the classification of a cell or species. • Apply suitable techniques for analysing biological activity. • Operate suitable equipment for carrying out biological and biochemical tests independently, e.g.: <ul style="list-style-type: none"> • polymerase chain reaction (PCR) instrument, • flow cytometer. • Adjust testing parameters of equipment based on nature of samples. • Record test data accurately and document measurement uncertainty. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all biological / biochemical laboratory works are carried out accurately in a safe and clean environment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out biological / biochemical test on the sample safely and independently by applying appropriate biological procedures and equipment, • record test data and observations accurately, • analyse test results for characterisation of the sample for further laboratory works.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform microscopic examination
Code	105804L4
Range	This unit of competency (UoC) covers the abilities to set up and adjust the settings of a microscope based on the sample nature for optimum resolution, and operate the microscope to identify and report the sample characteristics in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of different types of microscopes <ul style="list-style-type: none"> • Employ the basic optics and working principles of various types of microscopes including light-, fluorescence- or electronic-microscopes, and different features of specimen slides. • Identify the components of the microscope and describe their functions for optimisation of the microscope performance. • Explain the operation and application of various microscopes. 2. Perform microscopic examination <ul style="list-style-type: none"> • Review the test request to identify the sample to be examined, and the test method and equipment required for microscopic examination. • Select a suitable microscope based on the nature of sample and specific requirements of the test method. • Set up and optimise the resolution of the examined image by adjusting the settings of various components of the microscope, including: <ul style="list-style-type: none"> • magnifying lenses (e.g. eyepieces and objectives), • filters, • alignment of the light path. • Place sample correctly on the stage and observe through the microscope to identify and report amount of species present in the sample and their significant characteristics / features. 3. Exhibit professionalism <ul style="list-style-type: none"> • Handle the specimen slide properly to prevent false signal/examination.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select a suitable microscope according to the nature of sample and the requirements of the test method, • set up the selected microscope and adjust its settings for optimal resolution and performance, • operate the microscope to identify and report significant microscopic characteristics / features of the sample accurately.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform staining techniques
Code	105805L4
Range	This unit of competency (UoC) covers the abilities to select and apply appropriate staining technique on a specimen for microscopic examination in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess theory of cell biology and knowledge of the purpose and mechanisms of staining <ul style="list-style-type: none"> • Describe the structure, function and biochemical properties of prokaryotic and eukaryotic cells and various organelles in cells. • Demonstrate basic cell biology laboratory techniques such as sectioning and fixing of specimen. • Identify cell staining techniques and mechanisms. • Differentiate the chemical natures and uses of staining dyes. 2. Select and apply staining techniques on the specimen <ul style="list-style-type: none"> • Determine the sample nature and test requirements to select appropriate staining technique for the specimen. • Undertake appropriate techniques for sample preparation and staining in accordance with standard operating procedures / protocols, e.g. sectioning, smearing, labelling, mounting / fixing. • Adjust staining parameters for optimum resolution of stained specimen, e.g.: <ul style="list-style-type: none"> • concentration of the dyes, • duration of staining and/or washing steps. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the staining procedures are carried out independently and safely by observing the laboratory safety rules and precautions.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select and apply appropriate staining technique according to the sample nature and test requirements, • undertake procedural staining on prepared specimen safely and independently by adjusting staining parameters for optimum resolution of specimen.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Evaluate microbiological quality
Code	105801L5
Range	This unit of competency (UoC) covers the abilities to evaluate the microbiological quality of samples by critically analysing and interpreting test results on specific microbiological species/strain in testing laboratories.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess theory of microbiology and statistical analysis <ul style="list-style-type: none"> • Employ the knowledge of cell biology, biochemistry, molecular biology, and microbiology. • Apply the working principles of laboratory techniques in cell biology and microbiology, e.g.: <ul style="list-style-type: none"> • microbiological pour plate method, • aseptic techniques, • microscopic examination. • Explain the microbiological and biochemical tests applicable to selected samples, e.g.: <ul style="list-style-type: none"> • food and beverages and their packaging materials and receptacles, • Chinese medicine, • pharmaceutical products. • Explain the use of statistical and data analytical software. 2. Evaluate microbiological quality of samples <ul style="list-style-type: none"> • Characterise individual cell or microbe species/strain in the samples. • Manipulate and analyse data from different microbiological tests, e.g.: <ul style="list-style-type: none"> • cell staining and/or other microscopic examinations, • cell counting, calculation / estimation of the sample population size by using appropriate cell counting methods. • Compare the samples with the reference/control species/strain if necessary. • Precisely determine and judge particular species/strain(s) that the sample contains/belongs to, by comprehending information obtained from various tests or unique parameter. • Evaluate the microbiological quality of samples based on microbiological test results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Objectively identify and distinguish the sample species/strain without subjective bias.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • undertake scientific and informative analysis for microbiological sample identification and quantification without bias using statistical-sound tools or methods, • determine and judge the nature/characteristics of the sample by critically analysing data from microbiological tests, • evaluate the microbiological quality of the sample based on test results.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Select test methods and measuring instruments (biological / microbiological testing)
Code	105800L6
Range	This unit of competency (UoC) covers the abilities to select suitable test methods and equipment/instruments/reagents with justification by critically evaluating test request and relevant test standards for carrying out biological / microbiological testing activities in laboratories.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of test methods and equipment/instruments/reagents for biological / microbiological testing</p> <ul style="list-style-type: none"> • Apply a broad range of test methods available for biological / microbiological testing. • Interpret the requirements of equipment/instruments/reagents in relevant test standard. • Formulate criteria for selection of methods and equipment/instruments/reagents in terms of accuracy, resolution, tolerance, limitations and measurement uncertainty. • Explain the principles, operation and typical applications of equipment/instruments/reagents related to biological / microbiological testing. • Consolidate the knowledge and skills required to operate the equipment/instrument and handle test reagents aseptically, safely and reliably in the laboratory. <p>2. Select test methods and instruments/equipment/reagents for biological / microbiological testing</p> <ul style="list-style-type: none"> • Evaluate customer's test request critically and determine sample characteristics and factors to justify the selection of test method and instrument/equipment/reagent. • Select appropriate test method in accordance with relevant test standard and test request from the customer. • Select the most suitable equipment/instrument/reagents in accordance with the test method and/or test standard. • Set up the equipment/instrument and optimise its performance by adjusting appropriate operating conditions. • Critically evaluate the performance verification and stability checks of the equipment/instrument/reagents and take appropriate actions if any drift in performance is identified. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Maintain efficient communication with customers. • Ensure appropriate measures are implemented to minimise the health and safety risks associated with biological / microbiological samples and related equipment/instruments/reagents.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select and justify appropriate test method by critically evaluating the test request from the customer and interpreting relevant test standard, • select appropriate equipment/instrument/reagent for a particular biological / microbiological test by evaluating the requirements of relevant test method/standard and the sample characteristics, • critically evaluate the performance and stability of the equipment/instrument/reagent appropriate for biological / microbiological testing.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform on-site testing
Code	105816L3
Range	This unit of competency (UoC) covers the abilities to carry out the required on-site tests by applying appropriate equipment and record accurate test data according to test methods and procedures.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and procedures of carrying out on-site tests <ul style="list-style-type: none"> • Describe sampling methods and requirements of sample conditions. • Describe the operation of equipment and apparatus used for on-site testing. • Identify the requirements of environmental conditions for carrying out on-site testing. • Apply the concepts and requirements of equipment calibration and performance check. 2. Perform on-site testing <ul style="list-style-type: none"> • Apply appropriate measuring equipment according to the test method/standard in compliance with test request. • Apply appropriate ambient conditions for carrying out measurements. • Set up and check the calibration status of equipment and apparatus for measurements to suit sample/test requirements. • Carry out on-site tests and measurements to record accurate test data and/or observations. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the relevant code of conduct. • Ensure all testing activities comply with good industry practices and relevant standards. • Observe safe work practices and use appropriate personal protective equipment at the testing site.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out required on-site tests by applying appropriate testing equipment and test conditions according to the requirements of relevant test method/standard, • record accurate test data and/or observations by checking equipment calibration status.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform environmental testing (microbiological)
Code	105814L4
Range	This unit of competency (UoC) covers the abilities to carry out microbiological tests on environmental samples independently and record accurate test data to evaluate the compliance of environmental samples against relevant regulatory limits.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of microbiological parameters for environmental testing <ul style="list-style-type: none"> • Employ the principles and concepts underpinning microbiological tests for environmental samples, e.g.: <ul style="list-style-type: none"> • water, wastewater and cooling tower water: E. coli count, heterotrophic plate count, total coliform count, faecal coliform count, Legionellae bacteria count, • air: airborne bacteria count. • Identify test methods/standards for carrying out microbiological tests on different environmental samples. • Describe the working principles and operation of equipment and apparatus used for microbiological tests on environmental samples. • Describe the sampling requirements and sample preparation techniques with appropriate culture media and reagents for environmental testing. • Specify the requirements of microbiological tests for environmental samples as stipulated in test standards/methods, regulatory limits and guidelines. 2. Perform microbiological tests on environmental samples <ul style="list-style-type: none"> • Prepare a representative test portion of the selected environmental sample to reduce the sample complexity and eliminate matrix effects. • Apply appropriate test methods/standards, equipment, culture media and reagents for microbiological tests on selected environmental sample. • Apply appropriate conditions to testing equipment. • Carry out routine performance check of equipment according to manufacturer's instruction and/or relevant standard. • Set up and optimise the equipment for microbiological tests on the environmental sample. • Carry out appropriate microbiological tests on selected environmental sample and reference culture independently according to the requirements of test methods/standards. • Record accurate and reliable test data and/or observations for evaluating the compliance of microbiological parameters in the environmental sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure microbiological tests are carried out in a safe and clean environment. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out microbiological tests on selected environmental sample independently by applying appropriate microbiological techniques and equipment according to the requirements of relevant test methods/standards, • record and document accurate test data and/or observations by verifying quality control check data, • conclude the compliance of microbiological contaminants in selected environmental sample against the relevant specifications of regulatory limits.
Remark	<p>Practitioners are required to have prior knowledge of the following UoCs:</p> <ul style="list-style-type: none"> • Perform microbiological tests (TCTETO412A) • Perform microscopic examination TCTETO414A) • Prepare microbiological samples (TCTETO313A)

Unit of Competency

Functional Area: Testing Operations

Title	Perform environmental testing (physical)
Code	105815L4
Range	This unit of competency (UoC) covers the abilities to carry out physical measurements on sound level and air particulate matters and physical tests on water and/or solid waste samples independently at the selected testing site, and conclude test results of physical parameters of the environment in compliance with regulatory limits.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical parameters for environmental testing <ul style="list-style-type: none"> • Employ the principles of sound theory, addition and subtraction of sound levels and basic types of sound field microphones. • Apply the methods and principles of sound measurements, e.g. low frequency and residual sound; area sensitivity rating; base noise level; most affected noise sensitive receiver; units of sound measurements; A weighted, C weighted, equivalent continuous, instantaneous and maximum sound pressure level. • Describe the effects of weather and conditions that are favourable to sound propagation. • Identify different types of particulate matters in air. • Describe the methods for air sampling and measurement of air particulate matters. • Describe the methods and principles of physical tests of water and and/or solid waste, e.g. suspended solids, moisture. • Describe the requirements of measuring environmental noise and air particulate matters and physical tests of water and/or solid waste in test methods/standards, regulatory limits and guidance. • List the precautions and safety measures for on-site environmental testing. • Describe the operation and calibration requirements of equipment for measuring physical parameters of the environment. 2. Perform physical measurements for environmental testing <ul style="list-style-type: none"> • Select the testing site and operating conditions that are statistically representative the noise, air and water pollution and solid waste. • Apply appropriate test methods/standards and test plans for physical measurements of the environment. • Apply appropriate testing equipment for physical measurements. • Apply appropriate conditions to the sound measuring equipment, e.g.: <ul style="list-style-type: none"> • distances from reflecting surface, • location of microphone, • measurement time interval. • Apply appropriate conditions to the air sampler and testing equipment for measuring air particulate matters. • Apply appropriate conditions to testing equipment for measuring physical parameters of water and/or solid waste. • Carry out physical measurements of the environment independently according to the test methods/standards. • Carry out appropriate equipment calibration checks to confirm the requirements are met. • Record and document test data, measurement mode and conditions accurately to conclude the compliance of environmental test results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices. • Ensure integrity and confidentiality of measurement data by observing the relevant code of conduct. • Ensure safe work practices and use appropriate personal protective equipment at the measuring site.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out physical measurements of the environment independently by applying appropriate conditions to the testing equipment according to the requirements of relevant test methods/standards,• record and document accurate test data by verifying equipment calibration status,• conclude the compliance of noise level, amount of air particulate matters and physical parameters of water and/or solid waste in the testing site against the relevant standards and/or regulatory limits.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Design and supervise complex environmental field surveys
Code	105812L5
Range	This unit of competency (UoC) covers the abilities to establish and manage complex field surveys for a range of environmental testing. This UoC describes the competencies to evaluate survey requirements, design and conduct complex field surveys, and supervise subordinates to conduct the field survey according to a defined operational plan to achieve the purpose of the survey for environmental testing.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of general and specific field monitoring and survey practices and techniques <ul style="list-style-type: none"> • Clarify with all stakeholders the purpose and objectives of the field survey activities within the context of the overall environmental testing. • Identify and accurately interpret all external statutory requirements and survey protocols that relate to the defined field survey activities. • Comprehend specific field survey practices and techniques. • Explain the principles and procedures of field survey. • Determine all resources required to implement the environmental field survey. 2. Design environmental field survey activities and supervise subordinates to conduct the field survey <ul style="list-style-type: none"> • Develop and document details of the field survey methodology. • Establish different phases of an environmental field survey. • Design an operational plan for environmental field survey and organise various activities, with sequential workflow, in each phase of the field survey. • Coordinate and allocate specified activity held in the environmental field survey to individual subordinates. • Supervise all field survey and associated activities. • Monitor the survey work and data quality according to the field survey plan. 3. Exhibit professionalism <ul style="list-style-type: none"> • Optimise and monitor various resources to achieve the targeted operational performance in the environmental field survey. • Ensure all survey work is performed safely with minimal impact on the environment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • design complex environmental field survey by establishing and organising activities within the operational plan of field survey, • supervise subordinates to conduct field survey and associated activities, • coordinate and optimise the work by allocating resources in the environmental field survey in accordance with the operational plan.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform environmental testing (chemical)
Code	105813L5
Range	This unit of competency (UoC) covers the abilities to carry out chemical tests on environmental samples independently in the testing laboratories and critically evaluate test results for the compliance of environmental samples against relevant regulatory limits.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of chemical parameters for environmental testing <ul style="list-style-type: none"> • Employ the principles and concepts underpinning chemical tests for environmental samples, e.g.: <ul style="list-style-type: none"> • water and wastewater: pH, chemical oxygen demand (COD), biochemical oxygen demand (BOD), chloride, residual chlorine, phosphorus, sulphide, cyanide, ammonia, nitrate and nitrite, oil and grease, total Kjeldahl nitrogen (TKN), water contaminants (such as volatile organic compounds (VOC), semi-VOC, heavy metals), total organic carbon (TOC), phenols, surfactants, • air: VOC, semi-VOC, ozone depleting chemicals (CFCs and HCFCs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), • sediment: heavy metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs). • Identify test methods/standards of chemical tests for different environmental samples. • Explain the working principles and operation of equipment used for chemical tests of environmental samples. • Describe the sampling requirements and sample preparation techniques of chemical tests for environmental samples. • Specify the requirements of chemical tests for environmental samples as stipulated in test methods/standards, regulatory limits and guidelines. • Examine the calibration requirements of equipment for environmental testing. 2. Perform chemical tests on environmental samples <ul style="list-style-type: none"> • Prepare a representative test portion of the selected environmental sample to reduce the sample complexity and eliminate matrix effects. • Apply appropriate test methods/standards and testing equipment for chemical tests on selected environmental sample. • Apply appropriate conditions to testing equipment. • Carry out routine performance check of equipment according to manufacturer's instruction and/or relevant standard. • Set up, optimise and check the calibration status of equipment for chemical tests of the environmental sample. • Carry out appropriate chemical tests for the environmental sample independently by measuring analyte responses of calibration standards, validation and quality control checks, and the sample according to the requirements of test methods/standards. • Conduct sufficient measurements to obtain accurate and reliable test data and/or observations. • Critically evaluate test results for the compliance of chemical contaminants in the environmental sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Troubleshoot analytical procedures or equipment in case of any atypical observations/data/results being identified during sample analysis or performance and validation checks. • Ensure integrity and confidentiality of laboratory data and information by observing the relevant code of conduct.

Unit of Competency

Functional Area: Testing Operations

<p>Assessment Criteria</p>	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out appropriate chemical tests for selected environmental sample independently by applying appropriate conditions to the testing equipment according to the requirements of relevant test methods/standards, • record and document accurate test data by verifying equipment calibration status and validation check, • critically evaluate the compliance of chemical contaminants in the environmental sample by analysing test results against the relevant specifications of regulatory limits / test standards.
<p>Remark</p>	<p>Practitioners are required to have prior knowledge of the following UoCs:</p> <ul style="list-style-type: none"> • Apply atomic spectrometric techniques to chemical testing (TCTETO406A) • Apply chromatographic techniques to chemical testing (TCTETO405A) • Apply inductively coupled plasma spectroscopic techniques to chemical testing (TCTETO407A) • Apply molecular spectrometric techniques to chemical testing (TCTETO408A) • Perform complex chemical tests to measure chemical properties of materials (TCTETO411A) • Perform basic chemical tests and procedures (TCTETO304A)

Unit of Competency**Functional Area: Testing Operations**

Title	Follow laboratory electrical safety rules
Code	105830L3
Range	This unit of competency (UoC) covers the ability to observe electrical safety rules when working in the electrical testing laboratory. Practitioners should be able to identify potential electrical related hazards and implement preventive measures so as to protect themselves and other people during daily operation.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of laboratory electrical safety <ul style="list-style-type: none"> • Identify the potential hazards of working in the electrical testing laboratory, e.g. electric shock and energy hazards, thermal, radiation, mechanical, fire, corrosive hazards. • Identify the hazards in relation to different types of electrical measurements and equipment. • Describe the types, utilisation, maintenance and limitations of personal protective equipment for electrical hazards, e.g. eye protector, safety shoes, insulating gloves, protective guard, helmet and ear plug. • Describe the safety procedures, including the use of general protective equipment, for working in the electrical testing laboratory. • Describe general first aid measures, etc. in case of accidents occurred in the electrical testing laboratory. • Specify the legal regulations and requirements on observing electrical safety rules. 2. Follow laboratory electrical safety rules <ul style="list-style-type: none"> • Use appropriate personal protective equipment correctly by following systematic safety procedures for the best protection. • Maintain personal protective equipment properly according to safety guidelines and procedures. • Apply protective equipment to conduct electrical and flammability measurements according to safety procedures and relevant legal regulations. • Report and record incident and emergency situations according to standard operating procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure safety rules and legal regulations and/or requirements are followed and observed to protect the people working in laboratories.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify potential hazards related to electrical tests and measurements, • follow safety rules and procedures to work safely in the electrical testing laboratory, • apply appropriate personal protective equipment when conducting electrical and electronic product testing to ensure the safety of oneself and other people.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform electric shock and energy hazard tests
Code	105820L4
Range	This unit of competency (UoC) covers the abilities to carry out electrical and energy tests on electrical and electronic products independently by applying the knowledge of electric shock and energy hazard and record accurate test data in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of electric shock and energy hazard <ul style="list-style-type: none"> • Employ the principles of electric shock and energy hazard in relation to: <ul style="list-style-type: none"> • hazardous live, • accessible parts, • dielectric strength, • resistance of protective earthing conductors by voltage drop, • cross-sectional area of conductors of terminals/supply cord, protective earthing conductors and protective bonding conductors. • Identify the potential electric shock and energy hazards of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • household and similar electrical appliances, • information technology equipment, • luminaires. • Employ the principles of evaluating electric shock and energy hazards of selected electrical and electronic products. • Describe the effects of ingress of object, dust and moisture, abnormal operation and endurance tests on potential electric shock. • Specify the requirements of electric shock and energy hazard of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Specify the regulatory requirements of electric shock and energy hazard of electrical and electronic products in selected countries or regions, e.g. China, EU. • Describe the principles and operation of instruments used for electric shock and energy hazard tests. • Apply the concepts of uncertainty and instrument calibration to the electric shock and energy hazard tests. 2. Perform electric shock and energy hazard tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test conditions, and simulation of normal and/or fault operations for electric shock and energy hazard tests. • Apply appropriate testing instruments and test site for the tests. • Apply appropriate conditions to the sample under test, e.g.: <ul style="list-style-type: none"> • force applied and test probe/pin used for accessibility of hazardous live, • test voltages and conditioning for electric strength based on peak working voltages, • test current and period of resistance of earthing capacitor, • test voltage of impulse test, • operation modes of samples, normal and/or fault conditions. • Carry out electric shock and energy hazard tests on the sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements are met. • Record accurate test data and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good industry practices and relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out the electric shock and energy hazard test on selected electrical and electronic product independently by applying appropriate instrument and testing conditions according to the requirements of relevant test methods/standards,• record accurate and reliable test data by data validation and verifying instrument calibration status,• conclude test results to confirm the compliance of electric shock and energy hazard of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Evaluate electrical insulation properties by electrical measurements
Code	105821L4
Range	This unit of competency (UoC) covers the abilities to carry out electrical measurements on electrical and electronic products independently, record accurate test data and evaluate electrical insulation properties of the products by applying the knowledge of electrical insulation in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of electrical insulation properties and electrical measurements <ul style="list-style-type: none"> • Employ the principles of electrical insulation, pollution degree and overvoltage category. • Identify the potential electrical hazards of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • household and similar electrical appliances, • information technology equipment, • luminaires. • Describe how the material, construction and thickness of insulating layers affect the insulation properties, e.g. insulation resistance, electric strength, touch and protective impedance. • Employ the principles of evaluating electrical insulation properties by electrical measurements. • Specify the requirements of electrical insulation properties of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Specify the regulatory requirements of electrical insulation properties of electrical and electronic products in selected countries or regions, e.g. China, EU. • Describe the principles and operation of instruments used for the evaluation of electrical insulation by electrical measurements. • Apply the concepts of uncertainty and instrument calibration to the electrical measurements for evaluating electrical insulation properties. 2. Evaluate electrical insulation properties by electrical measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for electrical measurements. • Apply appropriate testing instruments and test site for electrical measurements. • Apply appropriate conditions to testing instruments, e.g.: <ul style="list-style-type: none"> • test voltage for insulation resistance, permittivity and volume resistivity, • test voltage, arc current set up and time for the cycle for dry arc resistance, • value of high ac / dc current with low test voltage for ground continuity, • frequency, RMS and peak value measurement of touch current. • Apply appropriate conditions to the sample under test, e.g.: <ul style="list-style-type: none"> • conditioning, thermal cycling, abrasion resistance test, surge and/or impulse test before dielectric strength test, • water absorption for permittivity and volume resistivity. • Carry out electrical measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements are met. • Record accurate test data and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out electrical measurements on electrical insulation properties of selected electrical and electronic product independently by applying appropriate instruments and testing conditions according to the requirements of relevant test methods/standards,• record accurate and reliable test data by data validation and verifying instrument calibration status,• conclude test results to confirm the compliance of electrical insulation of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Evaluate electrical insulation properties by physical measurements
Code	105822L4
Range	This unit of competency (UoC) covers the abilities to carry out physical measurements on electrical and electronic products independently, record accurate test data and evaluate electrical insulation properties of the products in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of electrical insulation properties and physical measurements <ul style="list-style-type: none"> • Employ the principles of clearance and creepage distances. • Identify the material group based on pollution degree and comparative tracking index and describe the requirements of creepage distances of different material groups. • Identify basic, functional, supplementary and reinforced insulation. • Describe the effects of ingress of water and abnormal operation on clearance and creepage distances and how these distances affect electrical insulation properties. • Differentiate clearance and creepage distances. • Identify the potential electrical hazards of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • household and similar electrical appliances, • information technology equipment, • luminaires. • Employ the principles of evaluating electrical insulation properties by: <ul style="list-style-type: none"> • measuring the clearance and creepage distance of different parts of the test samples, • proof tracking tests. • Specify the requirements of electrical insulation properties of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Specify the regulatory requirements of electrical insulation properties of electrical and electronic products in selected countries or regions, e.g. China, EU. • Describe the principles and operation of instruments used for the evaluation of electrical insulation by physical measurements. • Apply the concepts of uncertainty and instrument calibration to the physical measurements for evaluating the electrical insulation properties. 2. Evaluate electrical insulation properties by physical measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for physical measurements. • Apply appropriate testing instruments for clearance and creepage measurement, e.g. calliper and/or length/gap. • Apply appropriate conditions to testing instruments for the proof tracking test, e.g.: <ul style="list-style-type: none"> • concentration of ammonium chloride, • space of electrodes, • force applied, • volume of drops. • Carry out physical measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements are met. • Record accurate test data and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out physical measurements on electrical insulation properties of selected electrical and electronic product independently by applying appropriate instruments and testing conditions according to the requirements of relevant test methods/standards,• record accurate and reliable test data by data validation and verifying instrument calibration status,• conclude test results to confirm the compliance of electrical insulation of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Evaluate energy efficiency of electrical and electronic products
Code	105823L4
Range	This unit of competency (UoC) covers the abilities to carry out energy and power consumption measurements on electrical and electronic products independently, record accurate measurement data and evaluate the energy efficiency of the products in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of energy efficiency <ul style="list-style-type: none"> • Employ the principles of energy efficiency and minimum energy performance standards (MEPS) of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio and video equipment, • horizontal drum type household washing machine, • lamps and light fittings, • household refrigerating appliances. • Employ the principles of evaluating the energy efficiency and performance of selected electrical and electronic products, e.g. energy and power consumption, power factor, crest factor and efficiency grading. • Identify energy labelling schemes/programmes and/or standards, e.g.: <ul style="list-style-type: none"> • The Hong Kong Voluntary Energy Efficiency Labelling Scheme, • Mandatory Energy Efficiency Labelling Scheme – Code of Practice on Energy Labelling of Products, • US EPA Energy Star Program, • EU ErPs 2009/125/EC. • Specify the requirements of energy efficiency for selected electrical and electronic products. • Describe the principles and operation of instruments used for evaluation of energy efficiency. • Apply the concepts of uncertainty and instrument calibration to energy efficiency measurements. 2. Perform energy and power consumption measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for measuring energy efficiency. • Apply appropriate testing instruments for the measurements. • Apply appropriate mode of operation, loading, duration and power to the sample under test. • Carry out energy and power consumption measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system, facility and instrumental requirements are met. • Record accurate measurement data, configuration and conditions, and conclude the results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried in compliance with good industry practices and relevant energy efficiency schemes or international standards. • Ensure integrity and confidentiality of laboratory data and information by observing the relevant code of conduct.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out energy and power consumption measurements on selected electrical and electronic product independently by applying appropriate instruments and testing conditions according to the requirements of relevant test methods/standards, • record accurate and reliable measurement data and configuration by data validation and verifying instrument calibration status, • conclude the results to confirm the compliance of energy grading and marking of the product against the specifications of relevant energy labelling schemes and/or standards.
Remark	4.3-90

Unit of Competency

Functional Area: Testing Operations

Title	Perform radiation tests
Code	105824L4
Range	This unit of competency (UoC) cover the abilities to carry out radiation tests on electrical and electronic products independently, record accurate test data and evaluate the radiation hazards of the products in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of radiation hazards <ul style="list-style-type: none"> • Identify and differentiate various types of radiation, e.g.: <ul style="list-style-type: none"> • ionisation, • ultraviolet (UV) including UVA, UVB, UVC, • classification of laser and laser products, maximum accessible emission for each class of laser products, • irradiance and radiance. • Identify the potential radiation hazards of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • information technology equipment, • luminaires. • Employ the principles of measuring different types of radiation. • Specify the requirements of evaluating radiation hazards of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international and national standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Specify the regulatory requirements of radiation hazards of electrical and electronic products in selected countries or regions, e.g. China, EU. • Describe the principles and operation of instruments used for the radiation tests. • Apply the concepts of uncertainty and instrument calibration to the radiation tests. 2. Perform radiation tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test conditions and accessories for radiation tests. • Apply appropriate testing instruments for the radiation measurements, e.g.: <ul style="list-style-type: none"> • Geiger counter for measuring ionisation radiation, • scanning spectrograph. • Carry out radiation measurements on the test sample independently by applying appropriate test conditions, procedures and operation mode, e.g.: <ul style="list-style-type: none"> • ionisation radiation: normal operating and fault conditions, • laser radiation: exposure time, accessible emission levels including start-up, stabilised emission and shut-down of the laser product, accessories that may increase the radiation hazard (e.g. collimating optics), operation mode (continuous or pulse), • UV radiation: UV protection shield inspection, inspection on marking and labelling of UV radiation on the product, maximum exposure time per day, spectral irradiance or specific effective radiant UV power, maximum illuminance. • Carry out required validation checks to confirm the system and instrumental requirements are met. • Record accurate test data and observations and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant international standards. • Ensure appropriate measures have been taken to minimise the health and safety risks of radiation hazards during the measurements. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out radiation tests on selected electrical and electronic product independently by applying testing instruments with appropriate test conditions and operation mode according to the requirements of relevant test methods/standards,• record accurate and reliable test data by data validation and verifying instrument calibration status,• conclude test results to confirm the compliance of radiation hazards of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform thermal hazard related tests
Code	105825L4
Range	This unit of competency (UoC) covers the abilities to carry out thermal hazard related tests on electrical and electronic products independently, record accurate test data and evaluate the thermal hazards of the products in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of thermal hazards <ul style="list-style-type: none"> • Employ the principles of thermal hazards. • Describe the pre-conditioning of samples. • Describe the temperature of materials in relation to thermal hazard particularly for plastic and comprehend the classification of winding insulation. • Identify the potential thermal hazards of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • household and similar electrical appliances, • information technology equipment, • luminaires. • Employ the principles of evaluating thermal hazard of selected electrical and electronic products, particular for temperature rise, softening temperature measurement, ball pressure test, endurance and thermal test. • Identify relevant categories of thermal hazard standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Specify the regulatory requirements of thermal hazards of electrical and electronic products in selected countries or regions, e.g. China, EU. • Describe the principles and operation of instruments used for the thermal hazard related tests, e.g. thermocouples, winding resistance method. • Apply the concepts of uncertainty and instrument calibration to the thermal hazard related tests. 2. Perform thermal hazards related tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test conditions and accessories for thermal hazard related tests. • Apply appropriate testing instruments, e.g. thermocouple or voltmeter, to measure temperature or voltage for temperature rise measurements. • Apply appropriate winding resistance method for temperature rise of winding. • Apply appropriate conditions to testing instruments, e.g.: <ul style="list-style-type: none"> • conditioning temperature for carrying out the heating process, • appropriate force of the ball pressure tests. • Apply appropriate conditions to the sample under test, e.g.: <ul style="list-style-type: none"> • number of cycle and operation time, • location of thermocouples according to the construction site, • definition of thermal stable conditions. • Carry out the tests on the sample independently according to the test methods/standards, e.g.: <ul style="list-style-type: none"> • temperature rise test, • softening temperature test, • ball pressure test. • Carry out required validation checks to confirm the system and instrumental requirements (e.g. mass of ball pressure tests) are met. • Record accurate test data and observations and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out thermal hazard tests on selected electrical and electronic product independently by applying appropriate instrument and testing conditions according to the requirements of relevant test methods/standards,• record accurate and reliable test data by data validation and verifying instrument calibration status,• conclude test results to confirm the compliance of thermal hazards of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform flammability tests (electrical and electronic products)
Code	105826L4
Range	This unit of competency (UoC) covers the abilities to carry out flammability tests on electrical and electronic products independently by applying the knowledge of flammability behaviour of materials used in the products, and record accurate test data and observations in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of flammability behaviour of materials used in electrical and electronic products</p> <ul style="list-style-type: none"> • Employ the principles of flammability category and describe the flammability behaviour of different materials used in selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • household and similar electrical appliances, • information technology equipment, • luminaires. • Employ the principles and methods of flammability tests, e.g.: <ul style="list-style-type: none"> • sequence of performing flammability tests, • needle flame test, • vertical and horizontal flame test, • hot wire test, • glow wire test, • high current arcing test. • Specify the requirements of flammability behaviour of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Specify the regulatory requirements of flammability behaviour of electrical and electronic products in selected countries or regions, e.g. China, EU. • Describe the principles and operation of instruments used for flammability tests. • Apply the concepts of uncertainty and instrument calibration to the flammability tests. <p>2. Perform flammability tests</p> <ul style="list-style-type: none"> • Select appropriate test methods/standards, test conditions and test site for flammability tests. • Apply appropriate testing instrument, test assembly and ignition source for the flammability tests. • Carry out the flammability test on the test sample independently in appropriate testing environment/chamber according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements (e.g. temperature of the glow wire) are met. • Record accurate test data and observations on the surrounding environment and/or materials and conclude test results to confirm the compliance of the test sample. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant categories of standards. • Ensure testing activities comply with corporate environmental policies by taking appropriate measures to minimise the pollution to the environment. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out the flammability test on selected electrical and electronic product independently by applying appropriate testing instrument and test conditions according to the requirements of relevant test methods/standards,• record accurate and reliable test data and observations by data validation and verifying instrument calibration status,• conclude test results to confirm the compliance of flammability behaviour of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform electromagnetic field measurements
Code	105827L4
Range	This unit of competency (UoC) covers the ability to carry out electromagnetic field measurements on electrical and electronic products independently and record accurate test data in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of electromagnetic field <ul style="list-style-type: none"> • Identify the hazards of electromagnetic field to human body and describe basic restrictions of current density and magnetic flux density to head, trunk and the whole body. • Define the magnetic flux density with appropriate units and coupling factor and explain how the coupling factor affects the evaluation of magnetic flux density. • Employ the principles for measuring the electromagnetic field of selected electrical and electronic products. • Specify the requirements of measuring electromagnetic field of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Describe the principles and operation of instruments and sensors used for measuring magnetic flux. • Apply the concepts of uncertainty and instrument calibration to the electromagnetic field measurements. 2. Perform electromagnetic field measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards, measuring distances, sensor locations and test conditions (e.g. temperature and frequency) for electromagnetic field measurements. • Apply appropriate testing instrument and test site for the measurements. • Apply appropriate conditions to the sample under test and estimate the coupling factor by determining the extent of hot spot, equivalent coil and factor k. • Carry out electromagnetic field measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements are met. • Record accurate measurement data and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant international standards. • Ensure appropriate measures have been taken to minimise the health and safety risks of electromagnetic field arising from the measurements. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out the electromagnetic field measurement on selected electrical and electronic product independently by applying appropriate testing instrument and test conditions according to the requirements of relevant test methods/standards, • record accurate and reliable measurement data by data validation and verifying instrument calibration status, • conclude test results to confirm the compliance of electromagnetic field of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform photometric measurements
Code	105828L4
Range	This unit of competency (UoC) covers the abilities to carry out photometric measurements on electrical and electronic products independently by applying photometric knowledge and record accurate test data in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of photometric measurements <ul style="list-style-type: none"> • Describe the photometric properties of electrical and electronic products, e.g. luminous flux, luminous intensity, correlated colour temperature, colour rendering index, lumen maintenance, lamp life, lumen values, standard deviation of colour matching, chromatic shift, light generation mechanism from various light sources. • Differentiate luminance and illuminance measurements. • Employ the principles of measuring photometric properties of selected electrical and electronic products. • Specify the requirements of measuring photometric properties of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. • Describe the principles and operation of optical measuring instruments used for photometric measurements, e.g.: <ul style="list-style-type: none"> • integrating sphere photometer, • box photometer, • goniophotometer, • illuminance meter. • Apply the concepts of uncertainty and instrument calibration to the photometric measurements. 2. Perform photometric measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for photometric measurements. • Apply appropriate optical instruments for photometric measurements. • Apply appropriate test conditions to the sample under test, e.g. ageing, mounting height, measurement axis and attitude. • Carry out photometric measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements are met. • Record accurate measurement data and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant international standards. • Ensure appropriate measures are taken to minimise the health and safety risks of photobiological hazards due to the blue light, UV and infrared radiations associated with photometric measurements. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out photometric measurements on selected electrical and electronic product independently by applying appropriate optical instruments and test conditions according to the requirements of relevant test methods/standards,• record accurate and reliable measurement data by data validation and verifying instrument calibration status,• conclude test results to confirm the compliance of photometric properties of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform radio-frequency measurements
Code	105829L4
Range	This unit of competency (UoC) covers the abilities to carry out radio-frequency measurements on electrical and electronic products independently by applying suitable testing instruments and conditions and record accurate test data in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of radio-frequency (RF) measurements <ul style="list-style-type: none"> • Employ the operating principles of transmitter and receiver and identify relevant types of radio-frequency measurements. • Employ the principles of transmitter tests, e.g. carrier power, frequency error, frequency deviation, adjacent channel power, and spurious emissions. • Employ the principles of receiver tests, e.g. usable sensitivity, amplitude characteristic, co-channel rejection, adjacent channel selectivity, intermodulation response rejection, blocking or desensitisation, spurious response rejection and receiver spurious emissions. • Describe the methods of measuring radio-frequency of selected electrical and electronic product. • Identify relevant categories of standards in relation to radio-frequency measurements, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, CISPR, EN, ANSI, ETSI, GB, HKTA, OFCA, AS/NZS. • Describe the principles and operation of instruments used for transmitter and receiver tests, e.g. artificial antenna and frequency meter, spectral analyser, modulating signal generator, power measuring receiver, distortion factor/SINAD meter, acoustic coupler, rms voltmeter, oscilloscope, psophometric weighting network. • Apply the basic mathematical concepts, e.g. decibel usage, linear scale, log scale, units in the measurement. • Apply the concepts of uncertainty and instrument calibration to radio-frequency measurements. 2. Perform radio-frequency measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards, test plans, test conditions, and accessories for radio-frequency measurements. • Apply appropriate testing instruments and test site for the measurements. • Apply appropriate conditions to the testing instruments, e.g.: <ul style="list-style-type: none"> • normal and extreme operating conditions specified in product standards such as temperature and humidity, required accessories. • Apply appropriate conditions to the sample under test, e.g.: <ul style="list-style-type: none"> • test voltage and power, • number of measurements and measurement arrangement, • period of measurement for transient frequency behaviour, frequency with modulation. • Carry out radio-frequency measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements (e.g. elimination of unwanted signal) are met. • Record accurate measurement data, test configuration and conditions and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant categories of standards. • Ensure appropriate measures have been taken to minimise the health and safety risks of radio-frequency arising from the test procedures and testing instruments. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out radio-frequency measurements on selected electrical and electronic product independently by applying appropriate testing instruments and test conditions according to the requirements of relevant test methods/standards,• record accurate and reliable measurement data by data validation and verifying instrument calibration status• conclude test results to confirm the compliance of radio-frequency of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform electromagnetic compatibility (emission) tests
Code	105818L5
Range	This unit of competency (UoC) covers the abilities to carry out suitable emission and disturbance tests on electrical and electronic products independently and evaluate test results critically by applying the knowledge of electromagnetic compatibility in testing laboratories.
Level	5
Credit	8 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of electromagnetic compatibility and related emission tests <ul style="list-style-type: none"> • Employ the principles of electromagnetic compatibility (EMC) and electromagnetic interferences (EMI). • Employ the principles of emission tests, e.g. conducted interference, radiated disturbance, harmonic current, voltage changes, fluctuation and flicker. • Explain the methods of measurements for emission tests. • Specify the requirements of emission tests related to selected electrical and electronic products. • Identify relevant categories of EMC standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, CISPR, EN, ANSI, ETSI, GB, FCC, IEEE, AS/NZS. • Explain the principles and operation of instruments used for the emission tests, e.g. screened room quasi-peak measuring receivers, artificial mains network, impedance stabilisation network, absorbing clamp, flickermeter, requirement of normalised site attenuation. • Employ the basic mathematical concepts, e.g. decibel usage, linear scale, log scale, units in the measurement. • Apply the concepts of uncertainty and instrument calibration to the emission tests. 2. Perform electromagnetic compatibility (emission) tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test plans, test conditions, accessories, loading and simulation of normal operations for emission tests. • Select appropriate testing instrument and test site for the measurements. • Apply appropriate conditions to the testing instrument, e.g.: <ul style="list-style-type: none"> • test voltage and angle between fundamental voltages of a three phase supply, • test duration and test observation period, • worst test configuration and worst mode with appropriate accessory, loading and simulator. • Apply appropriate conditions to the sample under test, e.g.: <ul style="list-style-type: none"> • normal operating conditions specified in product standards such as measurement circuit of single phase and three phase equipment, required simulation accessories, environmental conditions. • Carry out emission measurements independently for the established observation period according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements such as site validation, differential voltages are met. • Record accurate test data, configuration and conditions, and evaluate test results critically by exercising appropriate judgement. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant categories of standards. • Ensure appropriate measures have been taken to minimise the health and safety risks of EMI arising from the test procedures and testing instrument. • Ensure all measurements comply with the uncertainty and calibration requirements for a testing laboratory.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• select and apply appropriate conditions to the testing instrument and the electrical and electronic product under the emission test ,• carry out the emission test independently and safely to record accurate data according to the requirements of relevant test methods/standards,• evaluate test results critically by exercising appropriate judgement to confirm the compliance of electromagnetic compatibility (emission) of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform electromagnetic compatibility (immunity) tests
Code	105819L5
Range	This unit of competency (UoC) covers the abilities to carry out suitable immunity tests on electrical and electronic products independently and evaluate test results critically by applying the knowledge of electromagnetic compatibility in testing laboratories.
Level	5
Credit	8 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of electromagnetic compatibility and related immunity tests <ul style="list-style-type: none"> • Employ the principles of electromagnetic compatibility (EMC). • Employ the principles of immunity tests, e.g. electrostatic discharge (ESD), conducted immunity, radiated immunity, fast transient burst, surge, harmonic and voltage fluctuation immunity, magnetic field immunity. • Explain the methods of measurements for immunity tests. • Specify the requirements of immunity tests related to selected electrical and electronic products. • Identify relevant categories of EMC standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, CISPR, EN, ANSI, ETSI, GB, FCC, IEEE, AS/NZS. • Explain the principles and operation of instruments used for the immunity tests, e.g. uniformity test of fully anechoic chamber, surge and burst generator, coupler/decoupler network, capacitive coupling clamp, test bench, electrostatic discharge gun, artificial hand. • Employ the basic mathematical concepts, e.g. decibel usage, linear scale, log scale, units in the measurement. • Apply the concepts of uncertainty and instrument calibration to the immunity tests. 2. Perform electromagnetic compatibility (immunity) tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test plans, test conditions, accessories, loading and simulation of normal operations for immunity tests. • Select appropriate testing instrument and test site for the measurements. • Apply appropriate conditions to the testing instrument, e.g.: <ul style="list-style-type: none"> • test levels of the instrument such as ESD voltage for both air and contact electrostatic discharge, field immunity levels for radio frequency electromagnetic fields, • rise time/hold time and repetition frequency for fast transient burst, • test waveform characteristics such as rise time, pulse duration, repetition frequency, test modulation, number of dips, period of voltage fluctuations. • Apply appropriate conditions to the sample under test, e.g.: <ul style="list-style-type: none"> • normal operating conditions specified in product standards such as wiring arrangement, required simulation accessories, environmental conditions, • input and output to enclosure parts such as supply voltage, loading conditions. • Carry out immunity measurements independently according to the test methods/standards. • Carry out required validation checks to confirm the system and instrumental requirements such as site validation, differential voltages of surge probes are met. • Record accurate test data, configuration and conditions, and evaluate test results critically by exercising appropriate judgement. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant categories of standards. • Ensure all measurements comply with the uncertainty and calibration requirements for a testing laboratory.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• apply appropriate conditions to the testing instrument and the electrical and electronic product under the immunity test,• carry out the immunity test independently and safely to record accurate data according to the requirements of relevant test methods/standards,• evaluate test results critically by exercising appropriate judgement to confirm the compliance of electromagnetic compatibility (immunity) of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Select test methods and measuring instruments (electrical and electronic testing)
Code	105817L6
Range	This unit of competency (UoC) covers the abilities to select suitable test methods and measuring instruments with justification by critically evaluating test request and relevant test standards for carrying out electrical and electronic testing activities in laboratories.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of test methods and measuring instruments for electrical and electronic testing</p> <ul style="list-style-type: none"> • Interpret the requirements of test methods and measuring instruments in relevant international standards. • Interpret the requirements of electrical measuring instruments in test methods. • Formulate criteria for selection of test methods and measuring instruments in terms of accuracy, resolution, tolerance, limitations and measurement uncertainty. • Explain the principles, operation and typical applications of electrical measuring instruments and systems. • Explain the principles, operation and typical applications of supplementary testing equipment used in conjunction with electrical measuring instruments. • Differentiate conformity of instruments from non-conformity within a narrow range of measured values. <p>2. Select test methods, testing envelopment and measuring instruments for electrical and electronic testing</p> <ul style="list-style-type: none"> • Evaluate the customer's test request critically and determine sample characteristics and factors to justify the selection of test method and measuring instrument. • Select appropriate test method in accordance with relevant test standard, specifications and test request from the customer. • Select appropriate testing envelopment for on-site electrical and electronic testing. • Select the most suitable measuring instrument or system in accordance with the test method/standard. • Set up the electrical measuring instrument or system and optimise its performance by adjusting appropriate scale and measurement mode. • Evaluate the performance verification and stability checks of the instrument or system and take appropriate actions if any drift in performance is identified. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Maintain efficient communication with customers. • Assess any health and safety risks associated with electrical measuring instruments to instrument operator, other laboratory personnel and the environment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select and justify appropriate test method and/or test envelopment at the site by critically evaluating the test request from the customer and interpreting relevant test standard, • select appropriate electrical measuring instrument for a particular test by evaluating the requirements of relevant test method/standard and sample characteristics, • evaluate the performance, stability and risks of the instrument to ensure it is ready and safe for use in electrical and electronic testing activities.
Remark	<p>The relevant international standard involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

Unit of Competency

Functional Area: Testing Operations

Title	Perform physical and mechanical tests on concrete and its constituent materials
Code	105837L3
Range	This unit of competency (UoC) covers the abilities to carry out physical and mechanical tests on selected hardened concrete and its constituent materials such as aggregate, cement, water, admixture, PFA, GGBS, silica fume and other additives, and record test data in testing laboratories.
Level	3
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical and mechanical tests applicable to concrete and its constituent materials <ul style="list-style-type: none"> • Describe the principles of test methods for determining physical and mechanical properties of concrete and its constituent materials. • Identify the specification requirements of testing concrete and its selected constituent materials. • Identify sampling requirements in test methods, e.g. selection of samples, minimum sample size / mass. • Identify the testing and environmental conditions under specified requirements of testing concrete and its constituent materials, e.g. laboratory temperature and relative humidity. • Describe the principles and operation of equipment used for physical and mechanical tests on concrete and its constituent materials. • Specify the calibration requirement of equipment. 2. Perform physical and mechanical tests on concrete and its constituent materials <ul style="list-style-type: none"> • Apply appropriate test methods/standards and testing equipment for physical and mechanical tests on selected concrete and its constituent materials. • Carry out appropriate tests on selected concrete or its constituent material sample according to the requirements of relevant test methods/standards, e.g.: <ul style="list-style-type: none"> • density, strength, modulus, permeability of hardened concrete, • particle size and shape, density, accelerated mortar bar test, foreign materials content, crushing and impact test of aggregate, • suitability of water for mixing concrete, • fineness, density, setting time, soundness, moisture content, flexural and compressive strength of cementitious materials or additives, e.g. PFA, GGBS, silica fume and admixture, • density, fineness, setting times, soundness, standard consistence, flexural and compressive strength of cement. • Maintain testing and environmental conditions under specified requirements of the test. • Carry out required calibration checks on testing equipment. • Record test data for reporting. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use personal protective equipment to ensure personal safety and that of other laboratory personnel, e.g. proper practices of lifting/handling concrete cube sample.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out physical and mechanical tests on selected concrete or its constituent material by applying appropriate testing equipment according to the requirements of test methods/standards and test specifications, • record accurate test data by verifying equipment calibration status.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform physical and mechanical tests on mortar and grout
Code	105839L3
Range	This unit of competency (UoC) covers the abilities to carry out physical and mechanical tests on mortar, repair mortar and grout materials, and record accurate test data in testing laboratories.
Level	3
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical and mechanical tests applicable to mortar, repair mortar and grout <ul style="list-style-type: none"> • Describe the physical and mechanical properties of mortar and grout, e.g. mortar, repair mortar, non-shrink grout and polymer modified materials. • Describe the principles and concepts underpinning test methods for mortar, repair mortar and grout. • Identify the specification requirements of testing mortar, repair mortar and grout. • Identify the testing and environmental conditions under specified requirements of testing mortar, repair mortar and grout, e.g. laboratory temperature and relative humidity. • Describe the principles and operation of equipment used for physical and mechanical tests on mortar, repair mortar and grout. • Specify the calibration requirement of equipment. 2. Perform physical and mechanical tests on mortar, repair mortar and grout <ul style="list-style-type: none"> • Apply appropriate test methods/standards and testing equipment for physical and mechanical tests on mortar, repair mortar and grout. • Carry out physical and mechanical tests on selected mortar, repair mortar and grout specimen according to test methods/standards, e.g.: <ul style="list-style-type: none"> • expansion and bleeding, changes in height, flow, setting time, compressive strength of grout, • density, compressive strength, flexural strength, adhesive strength, consistence, air content of mortar, • compressive strength, flexural strength, tensile strength, bond strength, air permeability (modified Figg test), Coutinho Ring test (shrinkage cracking), long term shrinkage, modulus of elasticity test of repair mortar. • Carry out required calibration checks on testing equipment. • Record test data for reporting. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use personal protective equipment to ensure personal safety and that of other laboratory personnel.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out physical and mechanical tests on selected mortar, repair mortar and grout specimen by applying appropriate testing equipment according to the requirements of test methods/standards and test specifications, • record accurate test data by verifying equipment calibration status.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform physical and mechanical tests on building components
Code	105840L3
Range	This unit of competency (UoC) covers the abilities to carry out physical and mechanical tests on building components and record accurate test data in testing laboratories.
Level	3
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical and mechanical tests applicable to building components <ul style="list-style-type: none"> • Describe the principles of test methods for determining physical and mechanical properties of building components, e.g. wooden doors, aluminium windows, door closer, door locks, metal gates, skylight frame. • Identify the specification requirements of testing building components. • Describe the principles and operation of equipment used for physical and mechanical tests on building components. • Specify the calibration requirement of equipment. 2. Perform physical and mechanical tests on building components <ul style="list-style-type: none"> • Apply appropriate test methods/standards, testing equipment and test/environmental conditions for physical and mechanical tests on selected building component. • Carry out physical and mechanical tests on selected building component specimen according to test methods/standards, e.g.: <ul style="list-style-type: none"> • door – resistance to closing against an obstruction, resistance to impact, resistance to torsion, • door closer – mechanical performance and durability test of overhead door closer, • gateset – operation test, slamming closed test, heavy body impact test, endurance performance test, • window and curtain wall – wind resistance test, water penetration test, • cooking bench and sink unit. • Carry out required calibration checks on testing equipment. • Record test data for reporting. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use appropriate personal protective equipment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out physical and mechanical tests on selected building component specimen by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards and test specifications, • record accurate test data by verifying equipment calibration status.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform physical and mechanical tests on glass and glazing materials
Code	105841L3
Range	This unit of competency (UoC) covers the abilities to carry out physical and mechanical tests on glass and glazing materials and record test data accurately in testing laboratories.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical and mechanical tests applicable to glass and glazing materials <ul style="list-style-type: none"> • Identify the impact performance requirements of flat safety glass used in buildings. • Describe the principles and concepts underpinning test methods for physical and mechanical tests of glass and glazing materials. • Describe the principles and operation of equipment used for physical and mechanical tests on glass and glazing materials. • Specify the calibration requirement of equipment. 2. Perform physical and mechanical tests on glass and glazing materials <ul style="list-style-type: none"> • Apply appropriate test methods/standards, testing equipment and test conditions for physical and mechanical tests on selected glass and glazing material. • Carry out physical and mechanical tests on selected glass / glazing material according to test methods/standards, e.g.: <ul style="list-style-type: none"> • impact performance test of flat safety glass, • resistance to impact, • boil test for laminated glass, • fragmentation test for heat soaked thermally toughened soda lime silicate safety glass. • Carry out required calibration checks on testing equipment. • Record test data for reporting. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use appropriate personal protective equipment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out physical and mechanical tests on selected glass / glazing material by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards and test specifications, • record accurate test data by verifying equipment calibration status.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform visual examination on welds
Code	105843L3
Range	This unit of competency (UoC) covers the abilities to inspect and identify surface defects on welds by visual examination at the building / construction sites, and record and document inspection results accurately.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of visual examination on welds <ul style="list-style-type: none"> • Describe basic features of welding, e.g.: <ul style="list-style-type: none"> • different types of welds, • basic joint and welds, • equipment for welding works, • welding procedures, • imperfection of welding. • Describe the procedures for visual inspection on welds. • Describe the sampling method and the requirements of sample condition. • Identify the specification requirements of weld examination. 2. Perform visual examination on welds <ul style="list-style-type: none"> • Apply appropriate inspection procedures/standards for visual examination on welds. • Inspect and examine for surface defects on welds according to inspection procedures/standards. • Record and document inspection results accurately according to applicable code and standards. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of inspection results by observing the relevant code of conduct. • Follow established safe work practices and use appropriate personal protective equipment at testing sites.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • inspect and identify surface defects on welds safely by visual examination according to the requirements of inspection procedures/standards, • record and document inspection results accurately according to the established procedures.
Remark	Practitioners should possess good near-vision acuity (e.g. reading a minimum of Times Roman N4.5 or equivalent letters at not less than 30 cm with one or both eyes) and colour vision.

Unit of Competency

Functional Area: Testing Operations

Title	Perform construction site measurements
Code	105844L3
Range	This unit of competency (UoC) covers the abilities to carry out site measurements at construction sites and record measurement data accurately.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Prepare for site measurement <ul style="list-style-type: none"> • Confirm the purpose, priority and nature of measurements required. • Identify sampling and testing locations, and parameters to be measured on site according to customer's requirements. • Apply the concepts of metrology and units of measurements. • Identify the specification requirements of site measurements. • Describe the procedures for site measurement. • Describe the principles and operation of equipment used for site measurements, e.g. tapes, steel ruler, level, coating thickness gauges, vibrograph, sound level meter. • Specify the calibration requirement of equipment. 2. Perform site measurements <ul style="list-style-type: none"> • Locate measurement points and services at the site. • Apply appropriate methods/procedures and measuring equipment for site measurements. • Carry out site measurements according to selected methods/procedures. • Carry out required calibration checks on measurement equipment. • Record measurement data with appropriate accuracy, precision and units. • Record construction site conditions and any other observations that may impact on data quality. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of measurement data by observing the relevant code of conduct. • Follow established safe work practices and use appropriate personal protective equipment at testing sites.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out required measurements at construction sites by applying appropriate measuring equipment in accordance with the methods/procedures, • record measurement data and site conditions accurately by verifying equipment calibration status.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform basic physical and mechanical tests
Code	105845L3
Range	This unit of competency (UoC) covers the abilities to conduct pre-use and calibration checks on equipment and perform routine physical and mechanical tests on samples to record test data in testing laboratories.
Level	3
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of basic physical and mechanical tests <ul style="list-style-type: none"> • Employ the physical and mechanical principles and concepts underpinning the selected test/procedure, e.g.: <ul style="list-style-type: none"> • mass, weight, forces, pressure, energy, friction, • cohesive/adhesive forces, hydrostatic pressure, fluid flow, viscosity, friction and slip resistance, • elasticity, hardness, ductility, malleability, strength of materials, elastic limit, elastic modulus, ultimate stress, plasticity, permeability and dispersion. • Describe the principles, operation and function of key components of testing equipment. • Specify the calibration requirement of equipment. • Apply the concepts of metrology. 2. Check equipment before use and carry out routine physical and mechanical tests on samples <ul style="list-style-type: none"> • Identify sampling requirements in test methods, e.g. selection of samples, minimum sample size. • Set up equipment in accordance with test method requirements. • Perform pre-use and safety checks in accordance with relevant operating procedures. • Check equipment calibration using specified procedures, if applicable. • Operate equipment in accordance with test method requirements. • Carry out physical and mechanical tests on samples in accordance with specified methods. • Record accurate test data. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use appropriate personal protective equipment to ensure personal safety and that of other laboratory personnel.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • set up testing equipment and check equipment calibration, • operate testing equipment safely to carry out routine physical and mechanical tests on the sample in accordance with test method requirements, • record accurate test data by checking the equipment calibration status.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform sampling and basic field tests on fresh concrete and on-site curing on concrete cubes
Code	105846L3
Range	This unit of competency (UoC) covers the abilities to carry out sampling and basic field tests on fresh concrete and on-site curing on concrete cubes by following prescribed procedures and record reliable test data at testing sites.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and procedures of carrying out sampling and field tests on fresh concrete <ul style="list-style-type: none"> • Describe sampling methods for fresh concrete, casting and curing concrete specimens and identify the requirements of sample conditions. • Command the principles and operation of equipment and apparatus used for field tests, e.g. slump cone, flow table, flow cone, cube mould, tamping rod, thermometer. • Describe the requirements of environmental conditions for carrying out field tests. • Describe the requirements of equipment calibration and performance check for field tests. 2. Perform field sampling and tests on fresh concrete <ul style="list-style-type: none"> • Perform site sampling according to specified requirements, e.g. sampling frequency, selection of samples, minimum sample size. • Follow appropriate test methods and apply testing equipment according to the prescribed procedures. • Apply appropriate ambient conditions for carrying out field tests. • Set up and check the calibration status of equipment and apparatus according to test requirements. • Carry out field tests and measurements on fresh concrete, e.g.: <ul style="list-style-type: none"> • slump test, • flow table test, • flow cone test, • temperature of placing concrete, • casting test specimen. • Record and document reliable field test data. • Cure specimens of concrete cubes on site according to specified curing regime. • Monitor site curing facilities and record curing conditions regularly. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the relevant code of conduct. • Observe safe work practices and use appropriate personal protective equipment at the sampling and testing site.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out basic sampling and field tests on fresh concrete by applying appropriate testing equipment according to the prescribed procedures, • perform on-site curing of concrete cubes and monitor site curing facilities, • record and document reliable test data by checking the calibration status of equipment.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform basic non-destructive tests on welds
Code	105832L4
Range	This unit of competency (UoC) covers the abilities to carry out basic non-destructive tests (NDT) on welds including magnetic particle test and/or liquid penetrant test by applying appropriate NDT techniques and equipment, and analyse test data to examine the conditions of welds.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of basic non-destructive tests (NDT) applicable to welds <ul style="list-style-type: none"> • Employ the principles and concepts of basic non-destructive tests and identify test methods used for examining welds, e.g.: <ul style="list-style-type: none"> • magnetic particle test, • liquid penetrant test. • Define limitations of applying test methods. • Translate NDT codes, standards, specifications and procedures into NDT instructions adapted to actual working conditions. • Explain the principles and operation of equipment used for basic non-destructive tests on welds. • Specify the calibration requirement of equipment. 2. Perform basic non-destructive tests on welds <ul style="list-style-type: none"> • Prepare NDT instructions. • Apply appropriate NDT techniques and testing equipment for basic non-destructive tests on welds. • Set up the testing equipment and verify equipment settings. • Carry out magnetic particle test and/or liquid penetrant test on welds according to test methods and NDT instructions. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Analyse test data according to applicable codes, standards, specifications or procedures to examine the conditions of welds. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the relevant code of conduct. • Ensure safe work practices and use appropriate personal protective equipment at testing sites.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out basic non-destructive tests on welds independently and safely by applying appropriate NDT techniques and testing equipment according to the requirements of test methods and test specifications, • analyse test data to examine the condition of welds by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods.
Remark	Practitioners should possess good near-vision acuity (e.g. reading a minimum of Times Roman N4.5 or equivalent letters at not less than 30 cm with one or both eyes) and colour vision.

Unit of Competency**Functional Area: Testing Operations**

Title	Perform basic physical and mechanical tests on soil and rock
Code	105835L4
Range	This unit of competency (UoC) covers the abilities to carry out basic physical and mechanical tests on soil and rock materials, record and analyse test data in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of basic physical and mechanical tests applicable to soil and rock <ul style="list-style-type: none"> • Describe the fundamental physical and mechanical properties of soil and rock. • Employ the principles of test methods for determining fundamental physical and mechanical properties of soil and rock, e.g. classification test. • Identify sample conditions required in test methods, e.g. selection of samples, minimum sample size/ mass for different grains. • Describe sample preparation and handling procedures for soil and rock, e.g. sieving, drying, mechanical disaggregation, subdividing. • Identify the specification requirements of soil and rock testing. • Explain the principles and operation of equipment used for basic physical and mechanical tests on soil and rock. • Specify the calibration requirement of equipment. 2. Perform basic physical and mechanical tests on soil and rock <ul style="list-style-type: none"> • Apply appropriate test methods/standards and testing equipment for basic physical and mechanical tests on soil and rock sample. • Carry out sample preparation according to test methods/standards. • Carry out physical and mechanical tests, such as moisture content, particle size distribution, density test, atterberg limits, point load test, unconfined compressive strength, on selected soil and rock sample according to test methods/standards. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Record and analyse test data for reporting. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use appropriate personal protective equipment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out basic physical and mechanical tests on selected soil and rock specimen by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards and test specifications, • record and analyse test data by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform physical and mechanical tests on steel
Code	105836L4
Range	This unit of competency (UoC) covers the abilities to carry out physical and mechanical tests on steel materials, record and analyse test data in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical and mechanical tests applicable to steel materials <ul style="list-style-type: none"> • Describe the physical and mechanical properties of steel materials, e.g. yield strength, ultimate tensile strength, proof load, elongation, strain and modulus. • Employ the principles of test methods for determining physical and mechanical properties of different types of steel materials, e.g. hot-rolled reinforcement steel bars, structural steel, pre-stressed steel wires, cold-drawn steel wires. • Identify the requirements on sample preparation, e.g. selection and condition of test specimens. • Identify the number of test specimens required for each type of tests. • Explain the principles and operation of equipment used for physical and mechanical tests on steel. • Specify the calibration requirement of equipment. 2. Perform physical and mechanical tests on steel materials <ul style="list-style-type: none"> • Apply appropriate test methods/standards and conditions for different types of steel materials. • Apply and operate appropriate testing equipment, e.g. universal testing machine, Charpy impact tester, bending test machine. • Carry out appropriate tests on selected steel specimen according to the requirements of relevant test methods/standards, e.g.: <ul style="list-style-type: none"> • tensile test and re-bend test on reinforcing steel bars, • tensile test on bolt and nut, • tensile and impact test on structural steel, • hardness test on metal. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Record and analyse test data for reporting. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use appropriate personal protective equipment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out physical and mechanical tests on selected steel specimen by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards, • record and analyse test data by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform physical and mechanical tests on bituminous materials
Code	105838L4
Range	This unit of competency (UoC) covers the abilities to carry out physical and mechanical tests on bituminous paving materials and other constituent materials, aggregate and binder, and analyse test data in testing laboratories.
Level	4
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical and mechanical tests applicable to asphaltic concrete, bitumen, polymer modified bitumen and aggregate <ul style="list-style-type: none"> • Command the principles and concepts underpinning physical and mechanical tests of bituminous materials. • Employ the principles of test methods for determining physical and mechanical properties of bituminous materials. • Identify the specification requirements of testing bituminous materials. • Explain the principles and operation of equipment used for physical and mechanical tests on bituminous materials. • Specify the calibration requirement of equipment. 2. Perform physical and mechanical tests on bituminous materials <ul style="list-style-type: none"> • Identify required sample conditions and check against test requirements. • Apply appropriate test methods/standards and testing equipment for physical and mechanical tests on bituminous material. • Carry out appropriate tests on selected bituminous material according to the requirements of relevant test methods/standards, e.g.: <ul style="list-style-type: none"> • aggregate grading, • bulk specific gravity and theoretical maximum specific gravity, • air void content, • binder content, • penetration resistance, • softening point. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Record and analyse test data for reporting. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Follow established safe work practices and use appropriate personal protective equipment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out physical and mechanical tests on selected bituminous material by applying appropriate testing equipment according to the requirements of test methods/standards and test specifications, • record and analyse test data by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform basic structural diagnostic tests on concrete structures
Code	105842L4
Range	This unit of competency (UoC) covers the abilities to carry out basic structural diagnostic tests on concrete structures in the building / infrastructure sites by applying appropriate non-destructive (NDT) techniques and evaluate test data to determine the condition of concrete structures.
Level	4
Credit	8 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of NDT techniques applicable to concrete structures <ul style="list-style-type: none"> • Explain the corrosion mechanism of reinforcement steel. • Apply the principles and concepts of NDT techniques and identify test methods/standards used for examining concrete structures. • Specify the concrete strength and quality requirements. • Identify sampling requirements in test methods, e.g. selection of samples, minimum sample size. • Explain the principles and operation of equipment used for NDT tests on concrete structures. • Specify the calibration requirement of equipment. 2. Perform basic structural diagnostic tests on concrete structures <ul style="list-style-type: none"> • Apply appropriate NDT techniques and testing equipment for non-destructive tests on concrete structures, e.g.: <ul style="list-style-type: none"> • electromagnetic covermeter survey, • ultrasonic pulse velocity (Pundit) test, hammer tapping survey or carbonation test, • Schmidt rebound hammer, • half-cell potential mapping, concrete resistivity test. • Optimise equipment settings in accordance with test methods/standards. • Carry out NDT tests on concrete structures according to test methods/standards. • Carry out visual inspection on reinforced concrete structure and record visible defects, e.g. cracking, pop-out, exposure of rebar, sign of water leakage. • Collect representative concrete samples by appropriate techniques such as taking cores and collecting powder samples for further physical and chemical laboratory tests. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Evaluate test data to determine the condition of concrete structures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the relevant code of conduct. • Follow established safe work practices and use appropriate personal protective equipment at testing sites.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out basic structural diagnostic tests on concrete structures by applying appropriate NDT techniques and testing equipment according to the requirements of test methods/standards and test specifications, • evaluate test data to determine the condition of concrete structures by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform advanced non-destructive tests on welds
Code	105993L4
Range	This unit of competency (UoC) covers the abilities to carry out advanced non-destructive tests (NDT) on welds including ultrasonic test and/or radiographic test by applying appropriate NDT techniques and equipment, and analyse test data to examine the conditions of welds.
Level	4
Credit	8 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of advanced non-destructive tests (NDT) applicable to welds <ul style="list-style-type: none"> • Employ the principles and concepts of advanced non-destructive tests and identify test methods used for examining welds, e.g.: <ul style="list-style-type: none"> • ultrasonic test, • radiographic test. • Define limitations of application of test methods. • Translate NDT codes, standards, specifications and procedures into NDT instructions adapted to actual working conditions. • Explain the principles and operation of equipment used for advanced non-destructive tests on welds. • Specify the calibration requirement of equipment. 2. Perform advanced non-destructive tests on welds <ul style="list-style-type: none"> • Prepare NDT instructions. • Apply appropriate NDT techniques and testing equipment for advanced non-destructive tests on welds. • Set up the testing equipment and verify equipment settings. • Carry out ultrasonic test and/or radiographic test on welds according to test methods and NDT instructions. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Analyse test data according to applicable codes, standards, specifications or procedures to examine the conditions of welds. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the relevant code of conduct. • Ensure safe work practices and use appropriate personal protective equipment at testing sites.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out advanced non-destructive tests on welds independently and safely by applying appropriate NDT techniques and testing equipment according to the requirements of test methods and test specifications, • analyse test data to examine the condition of welds by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods.
Remark	Practitioners should possess good near-vision acuity (e.g. reading a minimum of Times Roman N4.5 or equivalent letters at not less than 30 cm with one or both eyes) and colour vision.

Unit of Competency**Functional Area: Testing Operations**

Title	Perform foundation tests
Code	105831L5
Range	This unit of competency (UoC) covers the abilities to carry out tests on foundation piles independently at building construction sites and analyse test data to critically evaluate the bearing strength and integrity of piles.
Level	5
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of static and dynamic tests on foundation piles at building construction sites <ul style="list-style-type: none"> • Specify the bearing strength requirement of building structure foundation. • Differentiate the applications of piles. • Describe the soil properties and identify pile types. • Identify relevant piling mechanisms. • Employ the principles and concepts of foundation tests and identify test methods/standards used for examining foundation piles, e.g.: <ul style="list-style-type: none"> • ultrasonic cross-hole test, • pile integrity test, • dynamic pile test, • static loading test, • echo sounding test, • borehole inspection, • plate load test. • Identify the specification requirements of foundation tests. • Explain the principles and operation of equipment used for foundation tests. • Specify the calibration requirement of equipment. 2. Perform foundation tests <ul style="list-style-type: none"> • Apply appropriate test methods/standards and select testing equipment for foundation tests. • Set up the testing equipment and verify equipment settings in accordance with test methods/standards. • Carry out selected tests on foundation piles independently according to test methods/standards. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Analyse test data to critically evaluate the bearing strength and integrity of piles. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the relevant code of conduct. • Ensure safe work practices and use appropriate personal protective equipment at the testing site.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out dynamic / static tests on foundation piles independently and safely by selecting and applying appropriate testing equipment according to the requirements of test methods/standards and test specifications, • analyse test data accurately by verifying equipment calibration status and checking the validity of test data, • critically evaluate the bearing strength and integrity of piles.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform advanced structural diagnostic tests on concrete structures
Code	105833L5
Range	This unit of competency (UoC) covers the abilities to carry out advanced structural diagnostic tests independently by selecting and applying appropriate test methods and equipment, and analyse test data to critically evaluate near-surface defects inside and outside buildings or infrastructures.
Level	5
Credit	8 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of advanced structural diagnostic tests and concrete building structures <ul style="list-style-type: none"> • Examine the concrete components used and explain the construction method of building. • Specify the quality requirements of different building materials. • Employ the principles and concepts of advanced structural diagnostic tests. • Determine appropriate testing plan, e.g. scanning intervals. • Differentiate advanced non-destructive (NDT) techniques and test methods used for determining building defects. • Explain the principles and operation of equipment used for advanced structural diagnostic tests, e.g.: <ul style="list-style-type: none"> • infrared thermography, • penetration radar. • Specify the calibration requirement of equipment. 2. Perform advanced structural diagnostic tests <ul style="list-style-type: none"> • Evaluate the environmental conditions of testing site (e.g. windy, sunny or rainy) to select NDT techniques suitable for advanced structural diagnostic tests. • Apply appropriate test methods and select testing equipment for advanced structural diagnostic tests. • Set up the testing equipment and optimise equipment settings. • Carry out advanced structural diagnostic tests according to test methods. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Analyse test data to critically evaluate defects of the building or infrastructure. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Ensure safe work practices and use appropriate personal protective equipment at the testing site.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out advanced structural diagnostic tests on concrete structures independently by applying appropriate NDT techniques and testing equipment according to the requirements of test methods and test specifications, • record accurate test data by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods, • analyse test data to critically evaluate defects of the building or infrastructure.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform advanced physical and mechanical tests on soil and rock
Code	105834L5
Range	This unit of competency (UoC) covers the abilities to carry out physical and mechanical tests independently and critically evaluate the compressibility properties and shear strength of soil and rock materials by analysing test data in testing laboratories.
Level	5
Credit	8 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of advanced physical and mechanical tests applicable to soil and rock <ul style="list-style-type: none"> • Describe the physical and mechanical properties of soil and rock, e.g. compressibility properties, shear strength of jointed rock. • Employ the principles and concepts underpinning the test methods for advanced physical and mechanical tests of soil and rock, e.g. compressibility and strength tests for soil, strength and deformation test, lift-off test for rock anchor. • Determine the specification requirements of soil and rock testing. • Determine the testing and environmental conditions under specified requirements of soil and rock testing, e.g. laboratory temperature, pressure and force system. • Assess the sampling requirements (e.g. selection of samples, minimum sample size/ mass) and describe the sample preparation and handling procedures for soil and rock testing. • Explain the principles and operation of equipment used for advanced physical and mechanical tests on soil and rock. • Specify the calibration requirement of testing equipment. 2. Perform advanced physical and mechanical tests on soil and rock <ul style="list-style-type: none"> • Select and apply appropriate test methods/standards and testing equipment for physical and mechanical tests on soil and rock. • Set up, optimise and monitor the performance of testing equipment. • Prepare and treat the sample under test by applying appropriate conditions, e.g. drained or undrained condition for triaxial compression test, disturbed or undisturbed, saturated or unsaturated. • Carry out physical and mechanical tests, such as oedometer, triaxial compression test, shear strength of jointed rock, on selected soil and rock sample independently according to test methods/standards. • Maintain the testing and environmental conditions under specified requirements of the test. • Carry out required calibration checks on testing equipment and conduct validation checks on test data. • Record and analyse test data for reporting. • Evaluate critically the compliance of test results for the soil and rock sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure integrity and confidentiality of test data by observing the code of conduct of the laboratory. • Ensure safe work practices and use appropriate personal protective equipment.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out advanced physical and mechanical tests on selected soil and rock sample independently by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards and test specifications, • analyse accurate test data by verifying equipment calibration status and checking the validity of test data within the acceptable range specified in test methods/standards, • critically evaluate the compliance of test results against relevant specification requirements.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform stability and mechanical tests
Code	105847L4
Range	This unit of competency (UoC) covers the abilities to carry out stability and mechanical tests on electrical and electronic products independently by applying the knowledge of mechanical properties of the products and conclude test results in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of mechanical properties <ul style="list-style-type: none"> • Define the mechanical properties, e.g. mass, force, torque, stress, strain, vibration, angle, energy. • Identify the potential mechanical hazards of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • household and similar electrical appliances, • information technology equipment, • luminaires. • Employ the principles and methods of performing stability and mechanical tests. • Specify the requirements of stability and mechanical tests of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS • Explain the principles and operation of testing fixtures and equipment used for stability and mechanical tests, e.g. load cells, vibration generator and table, impact hammer, pull and push gauge. • Apply the concepts of uncertainty and equipment calibration to the stability and mechanical tests. 2. Perform stability and mechanical tests <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for stability and mechanical tests. • Apply appropriate testing fixtures and equipment for stability and mechanical tests. • Carry out stability and mechanical tests on the test sample independently by applying appropriate test conditions and environment according to the test methods/standards, e.g. degree of inclination of rigid support surface. • Carry out required validation checks to confirm the system and equipment requirements are met. • Record the stability behaviour and mechanical strength of the test sample. • Conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good industry practices and relevant international standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out stability and mechanical tests on selected electrical and electronic product independently by using appropriate testing fixtures and equipment according to the requirements of test methods/standards, • record accurate and reliable test data by data validation and verifying equipment calibration status, • conclude test results to confirm the compliance of stability and mechanical properties of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Evaluate the construction of products by visual inspection (electrical products)
Code	105848L4
Range	This unit of competency (UoC) covers the abilities to evaluate the marking and construction requirements of electrical and electronic products independently by visual inspection and conclude inspection results in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of product marking and construction <ul style="list-style-type: none"> • Identify the construction parts of selected electrical and electronic products, e.g.: <ul style="list-style-type: none"> • audio, video and similar electronic apparatus, • household and similar electrical appliances, • information technology equipment, • luminaries. • Employ the principles of construction requirements in relation to, e.g.: <ul style="list-style-type: none"> • insulation classification system, • IP rating, • mobility of electrical and electronic products, • types of power supply cord connection, • marking and instruction. • Specify the requirements of marking and construction of selected electrical and electronic products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS. 2. Perform visual inspection <ul style="list-style-type: none"> • Select appropriate test methods/standards for visual inspection on electrical and electronic products. • Select the parts of the test sample to be inspected for the evaluation of construction according to the test methods/standards. • Carry out visual inspection on the construction of the sample, e.g.: <ul style="list-style-type: none"> • supply cord, internal and external wiring, insulation, switch, handle, knobs, grips, levers and similar parts, separation of insulation, presence of sharp or ragged edges, pressurised design, protective devices against safety risk, • specific construction requirements. • Carry out visual inspection on marking and warning statement, e.g.: <ul style="list-style-type: none"> • use appropriate tests and reagents to verify that marks are legible and durable, • determine the suitability of location of marking, • examine the appropriateness and correctness of marking content. • Record observations and conclude inspection results to confirm the compliance of construction and marking of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all inspection activities are carried out in compliance with good industry practices and relevant international standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out visual inspection on selected electrical and electronic product independently by applying the knowledge of construction and marking according to the requirements of test methods/standards, • record observations and conclude inspection results to confirm the compliance of construction and marking of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform acoustic measurements (electrical products)
Code	105849L4
Range	This unit of competency (UoC) covers the abilities to carry out acoustic measurements on electrical and electronic products independently by applying suitable testing equipment and conclude test results in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of acoustic measurements <ul style="list-style-type: none"> • Employ the basic principles of acoustic measurements, e.g.: <ul style="list-style-type: none"> • sound theory and signal pattern, • addition and subtraction of sound levels, • components of human ear and ear coupler, • basic types of sound field microphones, • units of sound measurements. • Employ the principles of measuring acoustic properties of electrical and electronic products, e.g. A-weighted, C-weighted, continuous and instantaneous measurements. • Specify the requirements of measuring acoustic properties of electrical and electronic audio appliances in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards • international, national and industrial standards such as IEC, EN, GB, BS, UL, MS, SS, AS/NZS • Specify the regulatory requirements of acoustic measurements of electrical and electronic products in selected countries or regions, e.g. China, EU. • Explain the principles and operation of testing equipment and chamber for acoustic measurements. • Apply the concepts of uncertainty and equipment calibration to the acoustic measurements. 2. Perform acoustic measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for acoustic measurements. • Apply appropriate testing equipment and test site for the acoustic measurements. • Apply appropriate conditions to the testing equipment, e.g. positions of microphones, reference box. • Apply appropriate conditions to the sample under test, e.g. test signal, measurement distances, number of measurements. • Carry out acoustic measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and equipment requirements (e.g. background level, noise of accessories) are met. • Record accurate measurement data and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good industry practices and relevant international standards. • Maintain the conditions of chamber for acoustic measurements to ensure a sound proof environment according to test methods/standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out acoustic measurement on selected electrical and electronic product independently by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards,• record accurate and reliable measurement data by data validation and verifying equipment calibration status,• conclude test results to confirm the compliance of acoustic properties of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Design testing fixtures and tools to perform tests
Code	105850L4
Range	This unit of competency (UoC) covers the abilities to design suitable testing fixtures and tools by analysing the application of fixtures with the knowledge of design considerations to carry out physical and mechanical tests in testing laboratories or during on-site testing.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of design and applications of testing fixtures and tools <ul style="list-style-type: none"> • Describe the purposes of testing fixtures and tools for a particular physical or mechanical test. • Identify the types and applications of testing fixtures and tools. • Identify the factors in design considerations of testing fixtures hardware for the physical or mechanical test. • Employ the concepts and operating principles of automation system. • Explain the functions and operation of automation elements and controller. • Identify the limitations of different automation systems, e.g. speed, force, cleanliness, electromagnetic interference generated. 2. Design testing fixtures and tools <ul style="list-style-type: none"> • Analyse the test request and identify sample characteristics that may affect the choice and design of testing fixtures and tools. • Analyse the applications and settings of testing fixtures and tools, e.g. types of locators and clamping devices, types of workholding devices. • Design, produce and apply suitable testing fixtures and tools for carrying out the physical or mechanical test. • Select appropriate automation system, elements of automation and controller. • Review the design and application of testing fixtures and tools by analysing the test results against the required specifications of test standards/methods. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the testing fixtures and tools are designed and applied to produce reliable and reproducible test results.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • design and apply suitable testing fixtures and tools for carrying out physical or mechanical test by analysing their applications and considering design factors, • review the design and application of testing fixtures and tools to produce reliable and reproducible test results.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform flammability tests (toys and hardlines)
Code	105851L4
Range	This unit of competency (UoC) covers the abilities to carry out flammability tests on toys and hardlines independently by applying the knowledge of flammability behaviour of materials used in the products, and record accurate test data and observations to judge the compliance of the products in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of flammability behaviour of materials used in toys and hardlines <ul style="list-style-type: none"> • Define the flammability category and describe the flammability behaviour of different materials used in selected toy or hardline products, e.g.: <ul style="list-style-type: none"> • toys and children products, • hardline goods. • Define physical properties related to flammability test, e.g. flash point, boiling point, viscosity. • Employ the principles and methods of flammability tests, e.g. vertical test, horizontal test, ignitability test. • Specify the requirements of flammability behaviour of selected products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • international, national and industrial standards such as IEC, EN, AATCC, ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, JIS, BS, GB, US CPAI, • manufacturers' and/or clients' specifications. • Specify regulatory requirements of flammability tests for selected products, e.g.: <ul style="list-style-type: none"> • toys: 16 CFR 1500 & 1610, Canada Toys Regulations, • tents: US CPAI 84, Canada SOR/90-245, • sleeping bags: US CPAI 75. • Describe the sampling procedures for particular flammability tests. • Specify the requirements of sample preparation before tests, e.g. washing. • Explain the principles and operation of equipment used for flammability tests. • Apply the concepts of uncertainty and equipment calibration to the flammability tests. 2. Perform flammability tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test conditions and test site for flammability tests. • Apply appropriate testing equipment, test assembly and ignition source for the flammability tests. • Prepare appropriate toy or hardline test sample for particular flammability test. • Carry out the flammability test on the test sample independently in appropriate testing environment/chamber according to the test methods/standards. • Carry out required validation checks to confirm the system and equipment requirements are met. • Record accurate test data and observations on the surrounding environment and/or materials and judge test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure testing activities comply with corporate environmental policies by taking appropriate measures to minimise the pollution to the environment. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out the flammability test on selected toy or hardline product independently by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards,• record accurate and reliable test data and observations by data validation and verifying equipment calibration status,• judge test results to confirm the compliance of flammability behaviour of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform stability, physical and mechanical tests
Code	105852L4
Range	This unit of competency (UoC) covers the abilities to carry out stability, physical and mechanical tests on consumer products independently and record accurate test data to conclude the compliance of consumer products in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of stability and mechanical tests for consumer products <ul style="list-style-type: none"> • Employ the principles and methods of carrying out stability and safety tests for consumer products, e.g.: <ul style="list-style-type: none"> • furniture such as seating, tables, beds, storage units, • toys and children products. • Define the physical and mechanical properties, e.g. mass, force, velocity, energy, torque, tension, compression, flexure. • Identify potential physical and mechanical hazards of consumer products, e.g.: <ul style="list-style-type: none"> • toys and children products: sharp edges or points, ingestion, inhalation, bite tests, penetration of projectiles, • furniture such as seating tables, beds, storage units, • cookware and kitchenware. • Employ the principles and methods of carrying out physical and mechanical tests for consumer products, e.g. strength tests, durability tests, dynamic tests. • Specify the requirements of stability, physical and mechanical tests of selected consumer products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • basic/generic standards, product family standards, • international, national and industrial standards such as IEC, ISO, EN, GB, BS, UL, MS, SS, AS/NZS, ASTM, US CPSC. • Explain the principles and operation of testing fixtures and equipment used for stability and mechanical tests. • Apply the concepts of uncertainty and equipment calibration to the stability and mechanical tests. 2. Perform stability and mechanical tests <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for stability and/or physical and mechanical tests. • Apply appropriate testing fixtures and equipment. • Carry out stability and/or physical and mechanical tests on the test sample independently by applying appropriate test conditions and environment according to the test methods/standards. • Carry out required validation checks to confirm the system and equipment requirements are met. • Record the stability behaviour and/or physical and mechanical properties of the test sample. • Judge test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices and relevant international standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out stability and/or physical and mechanical tests on selected consumer product independently by using appropriate testing fixtures and equipment according to the requirements of test methods/standards,• record accurate and reliable test data by data validation and verifying equipment calibration status,• judge test results to confirm the compliance of stability and/or physical and mechanical properties of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Evaluate the construction of products by visual inspection (consumer products)
Code	105853L4
Range	This unit of competency (UoC) covers the abilities to evaluate the marking and construction requirements of consumer products independently by visual inspection and conclude inspection results in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of product marking and construction <ul style="list-style-type: none"> • Identify the construction parts of selected consumer products, e.g. toys and children products. • Identify the potential hazards due to the construction of products, e.g. entrapment, suffocation, strangulation. • Employ the principles of construction requirements in selected consumer products. • Specify the requirements of marking and construction of selected consumer products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • international and national standards such as IEC, ISO, EN, GB, BS, AS/NZS, ASTM, • manufacturers' and/or clients' specifications. 2. Perform visual inspection and construction check <ul style="list-style-type: none"> • Select appropriate test methods/standards for visual inspection on consumer products. • Select and use suitable equipment, templates, probes and gauges for inspection work. • Select the parts of the test sample to be inspected for the evaluation of construction according to the test methods/standards. • Carry out visual inspection on the construction of the sample. • Carry out visual inspection on marking and warning statement, e.g.: <ul style="list-style-type: none"> • use appropriate tests and reagents to verify that marks are legible and durable, • determine the suitability of location of marking, • examine the appropriateness and correctness of marking content. • Record observations and conclude inspection results to confirm the compliance of construction and marking of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all inspection activities are carried out in compliance with good laboratory practices and relevant international standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out visual inspection on selected consumer product independently by applying the knowledge of construction and marking according to the requirements of test methods/standards, • record observations and conclude inspection results to confirm the compliance of construction and marking of the product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform acoustic measurements (consumer products)
Code	105854L4
Range	This unit of competency (UoC) covers the abilities to carry out acoustic measurements on consumer products independently by applying suitable testing equipment and conclude test results in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of acoustic measurements <ul style="list-style-type: none"> • Employ the basic principles of acoustic measurements, e.g.: <ul style="list-style-type: none"> • sound theory and signal pattern, • addition, subtraction and averaging of sound levels, • components of human ear and ear coupler, • response of human ear and sound levels, • basic types of sound field microphones, • units and mathematics of sound measurements. • Employ the principles of measuring acoustic properties of consumer products. • Specify the requirements of measuring acoustic properties of consumer products in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • international and national standards such as IEC, ISO, EN, GB, BS, AS/NZS, ASTM, • manufacturers' and/or clients' specifications. • Specify the regulatory requirements of acoustic measurements of consumer products in selected countries or regions, e.g. China, EU. • Explain the principles and operation of testing equipment and chamber for acoustic measurements. • Apply the concepts of uncertainty and equipment calibration to the acoustic measurements. 2. Perform acoustic measurements <ul style="list-style-type: none"> • Select appropriate test methods/standards and test conditions for acoustic measurements. • Apply appropriate testing equipment and test site for the acoustic measurements. • Apply appropriate conditions to the testing equipment and measurement procedures in using the sound level meter, e.g. positions of microphones, reference box. • Apply appropriate conditions to the sample under test, e.g. test signal, measurement distances, number of measurements. • Carry out acoustic measurements on the test sample independently according to the test methods/standards. • Carry out required validation checks to confirm the system and equipment requirements (e.g. background level, noise of accessories) are met. • Record accurate measurement data and conclude test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all measurements are carried out in compliance with good laboratory practices and relevant international standards. • Maintain the conditions of chamber for acoustic measurements to ensure a sound proof environment according to test methods/standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards, regulations and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out acoustic measurement on selected consumer product independently by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards,• record accurate and reliable measurement data by data validation and verifying equipment calibration status,• conclude test results to confirm the compliance of acoustic properties of the consumer product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform fabric construction tests
Code	105856L4
Range	This unit of competency (UoC) covers the abilities to carry out suitable fabric construction tests on textile and garment products independently, record accurate test data and determine the fabric construction of the products in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of fabric construction and related tests <ul style="list-style-type: none"> • Employ the principles of construction of fabric and the relation to the performance of fabric and yarn. • Employ the principles and methods of carrying out fabric construction tests, e.g. thread per unit length, stitch density, yarn count, denier count, fabric weight, fabric width, fabric thickness, loop length of knitted fabric, crimp of yarn in woven fabric, type of cut pile, type of weave, terry to ground ratio (length ratio). • Specify the requirements of fabric construction tests to selected type of textile and garment product. • Identify relevant fabric construction test standards and specifications, e.g.: <ul style="list-style-type: none"> • international and national standards such as AATCC, ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, WOOLMARK, JIS, BS, GB, NF, • manufacturers' and/or clients' specifications. • Explain the principles and operation of equipment used for the fabric construction tests. • Apply the concepts of uncertainty and equipment calibration to the fabric construction tests. 2. Perform fabric construction tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test plans, environmental conditions, and accessories for fabric construction tests. • Apply appropriate conditions to the testing equipment. • Prepare the required size and number of sample. • Carry out fabric construction tests on the sample independently according to the test methods/standards. • Carry out required validation checks to confirm the environmental and equipment requirements are met. • Record accurate test data and judge test results to confirm the fabric construction performance of the test sample in compliance with the required specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out fabric construction tests on selected textile and garment product independently by applying appropriate testing equipment and environmental conditions according to the requirements of test methods/standards, • record accurate and reliable test data by data validation and verifying equipment calibration status, • judge test results to confirm the compliance of fabric construction performance of the product against the relevant specifications of test methods/standards and/or manufacturers/clients.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform fabric strength and performance tests
Code	105857L4
Range	This unit of competency (UoC) covers the abilities to carry out suitable fabric strength and performance tests on textile and garment products independently, record accurate test data and determine the fabric strength and performance of the products in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of fabric strength and performance and related tests <ul style="list-style-type: none"> • Describe the physical properties of woven fabric, knitted fabric and non-woven fabric. • Describe the importance of conditioning and water regain that affect the physical performance of fabric. • Employ the principles and methods of carrying out fabric strength and performance tests, e.g. tensile strength, tear strength, bursting strength, seam properties, bonding strength, abrasion resistance, pilling resistance, snagging resistance, wrinkle recovery, stretch recovery, air permeability, water repellency, water resistance. • Specify the requirements of fabric strength and performance tests to selected type of textile and garment product. • Identify relevant fabric strength and performance test standards and specifications, e.g.: <ul style="list-style-type: none"> • international and national standards such as AATCC, ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, WOOLMARK, JIS, BS, GB, • manufacturers' and/or clients' specifications. • Explain the principles and operation of testing equipment used for the physical performance tests, e.g., tensile tester, Elmendorf (tearing tester), bursting tester, inflated diaphragm (abrasion tester), Martindale (abrasion tester), ICI pilling box, random tumbler, Mace snag tester, rain tester, spray tester, hydrostatic tester, air permeability tester, wrinkle recovery tester, Fryma extension meter, temperature and humidity monitoring device. • Apply the concepts of uncertainty and equipment calibration to fabric strength and performance tests. 2. Perform fabric strength and performance tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, test plans, environmental conditions and test accessories for fabric strength and performance tests. • Apply appropriate conditions to the testing equipment, e.g.: <ul style="list-style-type: none"> • gauge length and force of tensile tester, • distance of clamps, distances between the axis and the top edges of the clamping jaws of Elmendorf tearing apparatus, • air flow of random tumble pilling tester, • rate of increase in water pressure for hydrostatic pressure test, • clamping distance of diaphragm bursting strength tester, • number of revolutions of pilling box, • pressure and diameter of abradant of Martindale (abrasion tester). • Prepare the required size and number of sample and apply appropriate conditioning atmosphere to the sample under test. • Carry out fabric strength and performance tests on the sample independently according to the test methods/standards. • Carry out required validation checks to confirm the environmental and equipment requirements are met. • Record accurate test data and judge test results to confirm the fabric strength and performance of the test sample in compliance with the required specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out fabric strength and performance tests on selected textile and garment product independently by applying appropriate testing equipment and environmental conditions according to the requirements of test methods/standards,• record accurate and reliable test data by data validation and verifying equipment calibration status,• judge test results to confirm the compliance of fabric strength and performance of the product against the relevant specifications of test methods/standards and/or manufacturers/clients.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform fibre analysis
Code	105858L4
Range	This unit of competency (UoC) covers the abilities to carry out fibre analysis on textile and garment products independently, record accurate test data, and determine the fibre types and fibre contents in textile and garment products in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of fibre analysis <ul style="list-style-type: none"> • Employ the principles of fibre analysis, fibre trademark and their composition and describe application of the fibre trademark to garments. • Identify the analysis methods for various types of fibre, e.g. qualitative method, quantitative methods including mechanical separation, chemical analysis and microscopic analysis, mercerisation of cotton. • Specify the requirements of fibre analysis to selected type of textile and garment products. • Identify relevant standards relating to fibre analysis, e.g.: <ul style="list-style-type: none"> • international and national standards such as AATCC, ASTM, BS, ISO, WOOLMARK, European Council Directive, JIS, GB, • manufacturers' and/or clients' specifications. • Explain the principles and operation of equipment used for fibre analysis, e.g. high power, comparison and polarity microscope, Fourier transform infrared spectrophotometer (FTIR), analytical balance. • Apply the concepts of uncertainty and equipment calibration to fibre analysis. 2. Perform fibre analysis <ul style="list-style-type: none"> • Select appropriate test methods/standards for fibre analysis. • Apply appropriate tests and environmental conditions to the sample under test, e.g.: <ul style="list-style-type: none"> • visual and microscopic identification, • microscopic and cross-section identification, • refractive index, • burning test, • density analysis, • solubility test using solvents, acids and alkalis, • drying twist analysis, • stain analysis, • melting analysis, • micro-FTIR. • Carry out fibre analysis on the sample with different types of fibre and colours independently according to the test methods/standards. • Carry out required validation checks to confirm equipment requirements such as daily check of balance are met and cross check with the supervisor. • Record accurate test data and judge test results to confirm the fibre types and fibre contents of the test sample in compliance with the required specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out fibre analysis on selected textile and garment product independently by applying appropriate tests and environmental conditions according to the requirements of test methods/standards,• record accurate and reliable test data by data validation and verifying equipment calibration status,• judge test results to confirm the compliance of fibre types and fibre contents of the product against the relevant specifications of test methods/standards and/or manufacturers/clients.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform care performance tests
Code	105859L4
Range	This unit of competency (UoC) covers the abilities to carry out suitable care performance tests on textile and garment products independently, record accurate test data and judge test results by employing knowledge of care label and care performance in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of care performance and related tests <ul style="list-style-type: none"> • Employ the principles of care label and care performance, e.g. dimensional stability and appearance after washing, home laundering, relaxation and felting, commercial dry-cleaning, free steaming, heating. • Describe the methods of measurements for care performance tests. • Specify the requirements of care performance tests to selected type of textile and garment product. • Identify relevant care performance standards and specifications, e.g.: <ul style="list-style-type: none"> • international and national standards such as AATCC, ISO, EN, DIN, AS/NZS, CAN/CGSB, WOOLMARK, JIS, BS, GB, NF, • manufacturers' and/or clients' specifications. • Explain the principles and operation of equipment used for the care performance tests, e.g. Wascator, automatic washer, automatic tumble dryer, dry-cleaning machine, wira steam cylinder, calliper, ruler. • Apply the concepts of uncertainty and equipment calibration to care performance tests. 2. Perform care performance tests <ul style="list-style-type: none"> • Select appropriate test methods/standards and environmental conditions for care performance tests. • Apply appropriate testing equipment for the care performance tests. • Apply appropriate conditions to the testing equipment, e.g.: <ul style="list-style-type: none"> • size of ballast, mass and type of detergent for home laundering, • washing programme, washing powder and loading of Wascator, automatic washer. • Apply appropriate conditioning requirements according to the washing methods and drying methods. • Carry out care performance tests independently according to the test methods/standards. • Carry out required validation checks to confirm the equipment requirements such as zero check of digital calliper are met. • Record accurate test data and judge test results to confirm the care performance of the test sample in compliance with the required specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out care performance tests on selected textile and garment product independently by applying appropriate testing equipment and environmental conditions according to the requirements of test methods/standards, • record accurate and reliable test data by data validation and verifying equipment calibration status, • judge test results to confirm the compliance of care performance of the product against the relevant specifications of test methods/standards and/or manufacturers/clients.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform colour fastness tests
Code	105860L4
Range	This unit of competency (UoC) covers the abilities to carry out suitable colour fastness tests on textile and garment products independently, record accurate observations and conditions of colour fastness tests of the products and judge test results in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of colour fastness <ul style="list-style-type: none"> • Identify different types of dyes and describe the ease of fastness of different colour dyes. • Employ the principles of colour fastness tests, e.g. colour fastness to light, washing, dry-cleaning, hot pressing, dry heat, perspiration, bleaching, colour migration into PVC coating, perborate, water spotting, acid spotting, alkaline spotting, chlorine bleach, non-chlorine bleach, chlorinated pool water, rubbing/crocking, seawater, saliva, organic solvent, burn gas fumes, ozone, phenolic yellowing, dye transfer, • List the method and requirements of colour fastness test to selected type of textile and garment product. • Identify relevant colour fastness standards and specifications, e.g.: <ul style="list-style-type: none"> • international and national standards such as AATCC, ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, WOOLMARK, JIS, BS, GB, • manufacturers' and/or clients' specifications. • Explain the principles and operation of equipment used for the colour fastness tests, e.g. crockmeter, dry-cleaning cylinder, fade-o-meter, accelerated laundering machine, automatic washer, automatic tumble dryer, perspiration tester, ozone exposure chamber, burnt gas exposure chamber, heating device. • Apply the concept of equipment calibration to colour fastness tests. 2. Perform colour fastness tests <ul style="list-style-type: none"> • Apply appropriate test methods/standards and environmental conditions • Apply appropriate testing equipment for colour fastness tests. • Apply appropriate conditions to the testing equipment, e.g.: <ul style="list-style-type: none"> • washing powder and loading of automatic washer and automatic tumble dryer, • distance, downward force of rubbing finger and travelling distance along the track and rubbing rate for crockmeter, • pressure, number and size of plates for perspiration tester, • pressure of heating devices, • temperature of fade-o-meter, accelerated laundering machine, drying oven and heating device, exposure chamber. • Prepare the required chemical stimulants as specified, e.g. seawater, perspiration, saliva, acid spotting, alkaline spotting. • Apply appropriate multi-fibre adjacent fabric and conditions to the specimen under test, e.g.: <ul style="list-style-type: none"> • ways of drying of specimen after tested, • test duration and cycle, • dimension of non-corrodible steel discs, solvent for dry-cleaning, • appropriate stimulants. • Carry out colour fastness tests according to the test methods/standards. • Carry out required quality control check specimens, e.g. blue wool, to confirm the instrumental requirements are met. • Record observations and conditions of colour fastness tests and judge test results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation. • Check colour sensitivity periodically using Munsell Hue test or equivalent.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out the colour fastness test on selected textile and garment specimen independently by applying appropriate testing equipment and environmental conditions according to the requirements of test methods/standards,• record observations and conditions of colour fastness tests accurately,• judge test results against the relevant specifications of test methods/standards.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform flammability tests (textiles and garments)
Code	105861L4
Range	This unit of competency (UoC) covers the abilities to carry out flammability tests on textiles and garments independently by applying the knowledge of flammability behaviour of materials used in the products, and record accurate test data and observations to judge the compliance of the products in testing laboratories.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of flammability behaviour of materials used in textiles and garments <ul style="list-style-type: none"> • Define the flammability category and describe the flammability behaviour of different materials used in selected products, e.g.: <ul style="list-style-type: none"> • textiles and garments, • tents, sleeping bags, • carpets. • Employ the principles and methods of flammability tests, e.g. vertical test, horizontal test, ignitability test. • Specify the requirements of flammability behaviour of selected textiles and garments in relevant categories of standards, e.g.: <ul style="list-style-type: none"> • international, national and industrial standards such as IEC, EN, AATCC, ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, JIS, BS, GB, US CPSC, • manufacturers' and/or clients' specifications. • Specify regulatory requirements of flammability tests for selected textile and garment products, e.g.: <ul style="list-style-type: none"> • textiles and garments: US CPSC 16 CFR 1610, US CPSC 16 CFR 1615 & 1616, UK Nightwear (Safety) regulation, • carpets: US CPSC 16 CFR 1630 & 1631. • Describe the sampling procedures for particular flammability tests. • Specify the requirements of sample preparation before tests, e.g. washing. • Explain the principles and operation of equipment used for flammability tests. • Apply the concepts of uncertainty and equipment calibration to the flammability tests. 2. Perform flammability tests <ul style="list-style-type: none"> • Select appropriate test methods/standards, environmental conditions and test site for flammability tests. • Apply appropriate testing equipment, test assembly and ignition source for the flammability tests. • Prepare appropriate textile and garment test sample for particular flammability test. • Carry out the flammability test on the test sample independently in appropriate testing environment/chamber according to the test methods/standards. • Carry out required validation checks to confirm the system and equipment requirements are met. • Classify burn code and sample flammability rating for textile and garment sample under test. • Record accurate test data and observations on the surrounding environment and/or materials and judge test results to confirm the compliance of the test sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure testing activities comply with corporate environmental policies by taking appropriate measures to minimise the pollution to the environment. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out the flammability test on selected textile and garment product independently by applying appropriate testing equipment and environmental conditions according to the requirements of test methods/standards,• record accurate and reliable test data and observations by data validation and verifying equipment calibration status,• judge test results to confirm the compliance of flammability behaviour of the textile and garment product against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform feather and down analysis
Code	105862L4
Range	This unit of competency (UoC) covers the abilities to carry out suitable speciation and properties tests on feather and down independently, record accurate test data and determine the properties of the feather and down in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of feather and down analysis <ul style="list-style-type: none"> • Employ the principles of speciation and composition and its relation to the properties of feather and down. • Command the principles and methods of carrying out feather and down analysis, e.g. speciation, composition labelling, feather length, filling power, net weight, oil and moisture content, oxygen number, turbidity, acidity. • Describe the importance of conditioning and water regain affecting the properties of feather and down. • Specify the requirements of properties of feather and down to selected type of garment product. • Identify relevant test standards and specifications for feather and down, e.g.: <ul style="list-style-type: none"> • international and national standards such as ASTM, EN, AS/NZS, CAN/CGSB, BS, GB, FZ, IDFB, US Fed. St. No. 148, • manufacturers' and/or clients' specifications. • Explain the principles and operation of equipment used for the feather and down analysis. • Apply the concepts of uncertainty and equipment calibration to feather and down analysis. 2. Perform feather and down analysis <ul style="list-style-type: none"> • Select appropriate test methods/standards, test plans, environmental conditions, and test accessories for feather and down analysis. • Apply appropriate conditions to the testing equipment. • Prepare the required size and number of sample. • Carry out feather and down analysis on the sample independently according to the test methods/standards. • Carry out required validation checks to confirm the environmental and equipment requirements are met. • Record accurate test data and judge test results to determine the properties of the feather and down sample in compliance with the required specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out composition and property tests on selected feather and down sample independently by applying appropriate testing equipment and environmental conditions according to the requirements of test methods/standards, • record accurate and reliable test data by data validation and verifying equipment calibration status, • judge test results to confirm the compliance of composition and property of the feather and down against the relevant specifications of test methods/standards and/or manufacturers/clients.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform garment trim tests
Code	105863L4
Range	This unit of competency (UoC) covers the abilities to carry out suitable physical strength and performance tests on garment trims independently, record accurate test data and determine the physical strength and performance of the garment trims in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of strength and performance of garment accessories and related tests <ul style="list-style-type: none"> • Describe the functions and the related physical performance of garment trims, e.g. sequins, beads, zippers, buttons, fasteners, embroidery, sewing thread, lace and frills, patchwork, buckles, embellishments, ribbons, hook and loop, hook and eye, hardware (rivets, grommets, snaps, tack buttons, sliders). • Describe the importance of conditioning affecting the physical performance of garment trims. • Employ the principles and methods of carrying out physical strength and performance tests, e.g.: <ul style="list-style-type: none"> • peel and longitudinal strength of fasteners, • curvature and selvedge of fasteners, • attachment, impact and compression strength of buttons, • pull-off and slippage resistance, slider deflection and recovery after pull, • crosswise chain, top and bottom stop holding and slider lock holding strength of zipper, • tensile and elongation strength of embroidery and sewing thread, • sharp points and edges of buttons or hardware, • hole rupture resistance of buckles, • attachment strength of buttons or hardware. • Specify the requirements of physical strength and performance tests to the selected type of garment trims. • Identify relevant physical strength and performance test standards and specifications for garment trims, e.g.: <ul style="list-style-type: none"> • international and national standards such as ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, JIS, BS, GB, • manufacturers' and/or clients' specifications. • Explain the principles and operation of equipment used for physical performance tests. • Apply the concepts of uncertainty and equipment calibration to performance tests for garment trims. 2. Perform physical strength and performance tests for garment trims <ul style="list-style-type: none"> • Select appropriate test methods/standards, environmental conditions and test accessories for physical strength and performance tests. • Apply appropriate conditions to the testing equipment, e.g.: <ul style="list-style-type: none"> • gauge length and force of tensile tester, • cross head speed. • Prepare the required size and number of garment trim sample and apply appropriate conditioning atmosphere to the sample under test. • Carry out physical strength and performance tests on the selected garment trim sample independently according to the test methods/standards. • Carry out required validation checks to confirm the environmental and equipment requirements are met. • Record accurate test data and judge test results to confirm the physical strength and performance of the garment trim sample in compliance with the required specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out physical strength and performance tests on selected garment trim independently by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards,• record accurate and reliable test data by data validation and verifying equipment calibration status,• judge test results to confirm the compliance of physical strength and performance of the garment trim against the relevant specifications of test methods/standards and/or manufacturers/clients.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Perform footwear tests
Code	105864L4
Range	This unit of competency (UoC) covers the abilities to carry out suitable physical strength and performance tests on footwear products independently, record accurate test data and determine the physical strength and performance of footwear in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical strength and performance of footwear and related tests <ul style="list-style-type: none"> • Describe the functions and the related physical performance of footwear and its components, e.g. zips, touch, close fasteners. • Describe the importance of conditioning affecting the physical performance of footwear. • Employ the principles and methods of carrying out physical strength and performance tests for footwear, e.g.: <ul style="list-style-type: none"> • slip and flex cracking resistance, • sole bond adhesion, seam, heel attachment strength, • peeling strength of upper and sole, • hardness of heels, • shank flexing strength, • abrasion-resistance of outsole, • component testing, • waterproof testing, • wear trials, • fit assessment, • raw material testing (e.g. pure leather or PU, shoestrings). • Specify the requirements of physical strength and performance tests to the selected type of footwear products. • Collect appropriate sample size from the submitted samples. • Identify relevant physical strength and performance test standards and specifications for footwear, e.g.: <ul style="list-style-type: none"> • international and national standards such as ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, JIS, BS, GB, SATRA, • manufacturers' and/or clients' specifications. • Explain the principles and operation of equipment used for physical performance tests. • Apply the concepts of uncertainty and equipment calibration to physical strength and performance tests. 2. Perform physical strength and performance tests for footwear <ul style="list-style-type: none"> • Select appropriate test methods/standards, environmental conditions and test accessories for physical strength and performance tests of footwear. • Apply appropriate conditions to the testing equipment. • Prepare the required size and number of footwear sample and apply appropriate conditioning atmosphere to the sample under test. • Carry out physical strength and performance tests on the footwear sample independently according to the test methods/standards. • Carry out required validation checks to confirm the environmental and equipment requirements are met. • Record accurate test data and judge test results to confirm the physical strength and performance of the footwear sample in compliance with the required specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by observing the code of conduct as required by the standards and the organisation.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out strength and performance tests on selected footwear product independently by applying appropriate testing equipment and test conditions according to the requirements of test methods/standards,• record accurate and reliable test data by data validation and verifying equipment calibration status,• judge test results to confirm the compliance of physical strength and performance of the footwear against the relevant specifications of test methods/standards and/or manufacturers/clients and/or regulatory requirements.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform evaluation tests
Code	105855L5
Range	This unit of competency (UoC) covers the abilities to evaluate results of care performance, fabric performance and colour fastness tests, assess the changes in properties of textile and garment products independently by applying the knowledge of evaluation tests, and critically evaluate test results in testing laboratories.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of evaluation tests <ul style="list-style-type: none"> • Command the principles, methods and equipment for carrying out care performance, colour fastness and/or fabric performance tests. • Command the principles of evaluation to different types of tests, e.g. colour change and colour staining of colour fastness tests, appearance of durable press, seam and crease after repeated home laundering, pilling tests, water repellency test, wrinkle tests, snagging resistance tests. • Describe the methods of evaluation including conditions and environment such as lighting and background for conducting the evaluation. • Identify relevant evaluation standards and specifications, e.g.: <ul style="list-style-type: none"> • international and national standards such as AATCC, ASTM, ISO, EN, DIN, AS/NZS, CAN/CGSB, WOOLMARK, JIS, BS, GB, • manufacturers' and/or clients' specifications. • Specify the verification system including minimum number of raters or assessors and the maximum allowable differences between their assessment results. • Apply the concepts of equipment calibration and traceability to evaluation tests, e.g.: <ul style="list-style-type: none"> • Gray Scale or Chromatic Transference Scale for colour change and colour staining of colour fastness tests, • durable press replicas for appearance of durable press after repeated home laundering, • photographic comparative ratings for single and double needle seams for appearance of seams after repeated home laundering, • photographic comparative ratings for crease retention for appearance of crease after repeated home laundering, • photographic pilling standards for pilling tests, • spray test rating chart for water repellency test, • wrinkle recovery replicas for wrinkle recovery of fabrics. 2. Perform evaluation tests <ul style="list-style-type: none"> • Apply appropriate test methods/standards and environmental conditions for evaluation tests, e.g.: <ul style="list-style-type: none"> • angle and distance between the eye and the specimen for pilling test, • dark environment for wrinkle, crease and seams rating, • angle and dark chamber for colour fastness assessment. • Apply appropriate reference standards for the comparative evaluation. • Carry out evaluation tests independently according to the test methods/standards. • Justify the evaluation results normally in the range of 1 to 5. • Critically evaluate the results with another rater or assessor. • Take corrective actions by exercising appropriate judgement when the difference exceeds the defined criteria. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all evaluations are carried out in compliance with good laboratory practices under relevant categories of standards. • Ensure integrity and confidentiality of laboratory data and information by implementing the code of conduct as required by the standards and the organisation. • Check colour sensitivity periodically using Munsell Hue test or equivalent.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out evaluation tests independently by applying appropriate test and environmental conditions and reference standards according to the requirements of test methods/standards,• verify evaluation results with another rater or assessor,• critically evaluate test results against the relevant specifications of test methods/standards.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform physical tests on pharmaceutical products
Code	105866L4
Range	This unit of competency (UoC) covers the abilities to carry out physical tests on pharmaceutical products independently by applying suitable equipment and conditions, and judge test results in testing laboratories.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of physical tests for pharmaceutical products <ul style="list-style-type: none"> • Employ the principles and concepts underpinning physical tests for pharmaceutical products, e.g.: <ul style="list-style-type: none"> • hardness, • dissolution, • disintegration, • moisture. • Identify types of physical tests required for selected pharmaceutical products in relevant test standards / pharmacopoeia, e.g.: <ul style="list-style-type: none"> • British Pharmacopoeia (BP), • United States Pharmacopoeia (USP). • Describe the test method routinely used for performing physical test of pharmaceutical products including: <ul style="list-style-type: none"> • properties of pharmaceutical products under test, • key preparation/measurement steps in test method, • calculation steps to give results in appropriate accuracy, precision, units and uncertainty, • expected values for sample type. • Describe the operation of equipment used for physical tests of selected pharmaceutical products. • Describe the procedures for ensuring traceability of samples, test pieces, test data and results. • Apply the concepts of equipment calibration and performance check to physical tests. 2. Perform physical tests on pharmaceutical products <ul style="list-style-type: none"> • Determine the test request and identify sample characteristics that may affect selection and application of test methods. • Apply appropriate test method, testing equipment and test conditions. • Prepare a representative portion of the laboratory sample of selected pharmaceutical product to reduce the sample complexity and eliminate matrix effects. • Carry out routine performance check of equipment according to manufacturer's instruction to ensure it is ready for physical tests on pharmaceutical products. • Set up, optimise and check the calibration status of equipment. • Carry out physical tests on the sample independently using the calibrated equipment and specified conditions. • Conduct sufficient measurements to obtain accurate and reliable test data and/or observations and judge test results against relevant specifications. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all tests are carried out in compliance with good laboratory practices and relevant categories of international standards. • Ensure integrity and confidentiality of laboratory data and information by observing the relevant code of conduct.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• carry out physical tests on selected pharmaceutical product independently by applying appropriate test method, testing equipment and test conditions according to the requirements of test request,• record accurate test data and observations and judge test results to confirm the compliance of the pharmaceutical product against relevant specifications of test standard.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Select test methods and measuring instruments (physical and mechanical testing)
Code	105865L6
Range	This unit of competency (UoC) covers the abilities to select suitable test methods and measuring instruments with justification by critically evaluating test request and relevant test standards for carrying out physical and mechanical testing activities in laboratories.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of test methods and measuring instruments for physical and mechanical testing <ul style="list-style-type: none"> • Apply a broad range of test methods and test standards available for physical and mechanical testing. • Interpret the requirements of measuring instruments in relevant test standard. • Formulate criteria for selection of measuring instruments in terms of accuracy, resolution, tolerance and measurement uncertainty. • Explain the principles, operation and typical applications of measuring instruments. • Consolidate the knowledge and skills required to operate the instruments safely and reliably in the laboratory. • Differentiate conformity of instruments from non-conformity within a narrow range of measured values. 2. Select test methods and measuring instruments for physical and mechanical testing <ul style="list-style-type: none"> • Evaluate customer's test request critically and determine sample characteristics and factors to justify the selection of test method and measuring instrument. • Select the appropriate test method in accordance with relevant test standard and test request from the customer. • Select the most suitable physical / mechanical measuring instrument or system in accordance with the test method and/or test standard. • Set up the physical / mechanical measuring instrument and optimise its performance by adjusting appropriate scale and measurement mode. • Evaluate the performance verification and stability checks of the measuring instrument and take appropriate actions if any signal drift is identified. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain efficient communication with customers. • Ensure appropriate measures are implemented to minimise the health and safety risks associated with measuring instruments and test methods.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select and justify appropriate test method by critically evaluating the test request from the customer and interpreting relevant test standard, • select appropriate physical / mechanical measuring instrument for a particular test by evaluating the requirements of relevant test method/standard and sample characteristics, • evaluate the performance and stability of the measuring instrument to ensure it is ready and safe for use in physical and mechanical testing activities.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Record and present data
Code	105873L3
Range	This unit of competency (UoC) covers the abilities to record and store data, perform simple calculations of scientific quantities, present information in appropriate format, and identify atypical data and rectify mistakes in a testing / calibration laboratory.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of recording and presenting data <ul style="list-style-type: none"> • Apply basic concepts of metrology, the international system of units and data traceability. • Master relevant scientific and technical terminology of data and observations to be recorded. • Describe conversion of units, significant figures, estimation, approximation and rounding policy. • State mathematical formulae for data manipulation. • Describe different formats of presenting data, e.g. graphs, charts, tables. 2. Record and present data <ul style="list-style-type: none"> • Enter original measurement data and observation into laboratory information system or record sheets as required. • Record identities of equipment used, reference standards, method, standard solutions, operator and necessary information to ensure the traceability of measurement. • Check data to identify transcription errors or atypical entries and rectify errors in compliance with documented procedures. • Calculate simple scientific quantities using given formulae and data. • Present data accurately in tables and charts using given formats and scales. • Submit all data records for checking by appropriate personnel. • File and store data securely in accordance with documented procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure data and relevant information are accurately recorded and presented. • Maintain the confidentiality of data in accordance with documented procedures and code of conduct of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • record and present data in the required format accurately, • compute simple scientific quantities, identify atypical entries and rectify mistakes timely, • store and keep records securely to maintain the confidentiality of data.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Apply statistical calculations to measurement data
Code	105871L4
Range	This unit of competency (UoC) covers the abilities to apply appropriate statistical technique for analysing measurement data and determine the performance of quality assurance activities and method performance characteristics in a testing / calibration laboratory.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of various statistical techniques for analysing measurement data <ul style="list-style-type: none"> • Master relevant scientific and technical terminology, e.g. variables, dispersion, central tendency, process control, process stability, normal distribution, confidence level, pooled precision and replication. • Describe principles, application and mathematical equations of statistical calculations such as t-test, Q-test, F-test, analysis of variance (ANOVA). • Specify requirements of statistical treatment defined in international standards and guidelines for relevant method performance characteristics and quality assurance activities. • Identify definitions and calculations of method performance characteristics such as repeatability, reproducibility, intermediate precision, pooled standard deviation, method bias, recovery, limit of detection and quantitation. 2. Apply statistical calculations to measurement data <ul style="list-style-type: none"> • Verify validity and adequacy of measurement data and information. • Reject invalid data using data acceptability tests. • Apply appropriate statistical technique to analyse valid measurement data based on intended purpose, e.g.: <ul style="list-style-type: none"> • regression and correlation coefficients for calibration curve, • pooled standard deviation for method precision, • significance tests, such as t-test, paired t-test, F-test, analysis of variance (ANOVA) for within or between laboratory comparison, method bias, recovery and measurement uncertainty, • data acceptability tests, such as Q, T and Youden test, • mean, standard deviation, probability for construction of control chart and frequency distribution plots, and evaluation of limit of detection and quantitation. • Establish criteria for quality control checks based on results of the statistical treatment. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure statistical treatments of valid measurement data comply with industry practices.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • determine appropriate statistical technique for analysing valid measurement data in compliance with international standards and intended purpose, • apply statistical calculations to analyse measurement data accurately, • establish method performance characteristics and criteria of quality assurance activities.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Process data
Code	105872L4
Range	This unit of competency (UoC) covers the abilities to manipulate measurement data and verify the accuracy of processed data in a testing / calibration laboratory.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of data processing and verification requirements <ul style="list-style-type: none"> • Describe the requirements of recording and presenting data and observations. • Define the acceptance criteria of data after manipulation • Employ the commercial software and/or self-developed programmes for processing measurement data. • Determine the processing conditions, e.g. time window, ion ratio, threshold peak area for chromatographic processing. • Command the mathematical concepts, e.g. algebraic, power, exponential and/or logarithmic functions. 2. Process measurement data <ul style="list-style-type: none"> • Retrieve measurement data using appropriate files and/or application software. • Apply appropriate software or programmes and the acceptance criteria to process measurement data, e.g.: <ul style="list-style-type: none"> • integration and quantification of the chromatographic measurement data, • confirmation of presence / absence of identity of target analytes, • present graphical data, chromatograph, and spectrum using appropriate scales to span the range of data or display trends, • computation of average, standard deviation, maximum difference, maximum and minimum of continuous data logging system. • Apply appropriate mathematical concepts, e.g. decibel usage, linear scale, log scale exponential function to convert data to the specified scale. • Present setup and observations diagrammatically, e.g. force and connection diagram. • Verify the accuracy of transcription of measurement data and processed results. • File and store data securely in accordance with documented procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the measurement data are processed accurately and precisely. • Maintain the confidentiality of data in accordance with documented procedures and code of conduct of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply appropriate software, programmes or tool to process the measurement data to obtain valid final results, • verify accuracy of processed data in compliance with specifications of test methods/standards or documented procedures.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Review test results
Code	105867L5
Range	This unit of competency (UoC) covers the abilities to review and analyse test results generated from the laboratory / on-site testing activities. Practitioners should be capable to verify scientific calculations and evaluate invalid test results.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Establish the requirements of reviewing test results <ul style="list-style-type: none"> • Command the concepts of metrology, measurement traceability and uncertainty. • Command the principles of data integrity and specify the requirements of recording and presenting data/observations. • Employ the international system of units, significant figures reporting and rounding policy. • Describe the checking procedures for calculation of test data. • Specify the requirements of quality control check parameters of test methods/standards and documented procedures. 2. Review test results <ul style="list-style-type: none"> • Verify test results by checking the scientific calculations. • Identify transcription errors or atypical entries and rectify errors in compliance with documented procedures. • Effectively examine completeness of information to ensure unbroken chain of data traceability. • Examine anomalies in data and identify possible invalid test results. • Exercise appropriate judgement to decide for re-analysis of sample with doubtful test results. • Evaluate the results of quality control check parameters against the established criteria. • Determine for acceptance of test results by evaluating the compliance of method quality control criteria. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure test results are reviewed and checked thoroughly within the agreed time frame.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • review test results critically against the completeness of information and expectation to identify any invalid test results, • determine for acceptance of test results by critically evaluating the compliance of measurement uncertainty and acceptance criteria.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Interpret test results
Code	105868L5
Range	This unit of competency (UoC) covers the abilities to interpret measurement data and observations obtained from laboratory / on-site testing activities and critically justify the conclusion and evaluate the compliance of test samples against specifications and/or requirements.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of test result interpretation <ul style="list-style-type: none"> • Specify requirements of recording and presenting data and observations. • Explain the principles and requirements of measurement techniques and methods. • Describe relevant scientific and technical terminology of data and observations to be interpreted. • Interpret the requirements and limitations of test methods/standards or documented procedures. • Document the rationales upon which the interpretations are made, e.g.: <ul style="list-style-type: none"> • chemical and biochemical reactions involved for colour change of tests and indicators, • scope, limitations and reporting limit of test methods, • pass / fail evaluation criteria for abuse tests, flammability tests, physical and mechanical tests, and electrical tests, • confirmation criteria of identity of target analytes. 2. Interpret test results <ul style="list-style-type: none"> • Apply the basis for interpretation of observations and test results. • Observe results of expectations and normal range. • Evaluate samples that are out of scope and determine possible invalid test results. • Conclude valid test results by exercising appropriate judgement and evaluate the compliance of results against international test standards, test methods or specifications. • Assess test results exceeding expectations and reasonable ranges. • Interpret the trends of test results by examining the control charts or other appropriate means. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the interpretation of test results complies with industrial practices and relevant categories of standards. • Ensure the rationales upon which interpretations are made are documented and controlled.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • interpret test results and observations independently according to appropriate criteria, • interpret the trends of test results by examining the control charts, • conclude test results by exercising appropriate judgement and evaluate the compliance of test results against relevant specifications of test standards, test methods or specifications.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Validate laboratory information management system
Code	105869L6
Range	This unit of competency (UoC) covers the abilities to validate laboratory information management system (LIMS) for laboratory / on-site testing activities to meet operational requirements. This UoC also includes the abilities to perform the validation tasks individually or in a team context by exercising appropriate judgement on resource requirements and to monitor, critically evaluate and determine measures to control potential operational variations and discrepancies.
Level	6
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Determine the validation plan and resources availability <ul style="list-style-type: none"> • Use a wide range of computer hardware and software concepts, relevant numbering systems (binary, decimal and hexadecimal) and technical terminology to communicate effectively with relevant personnel. • Explain the workflow and operation of different sectors within the laboratory and integration of laboratory processes with computer information systems. • Apply a broad range of data types and information in laboratory / on-site testing activities. • Consolidate information from manuals, specification sheets, diagnostic equipment and software and verify compatibility of existing workstation with system to be developed. • Determine communication hardware, hardware configuration, digitisation requirements, operational considerations and constraints, administrator, level of accessibility and protection mechanism. • Determine the personnel, information and equipment required to deliver the validation work. 2. Perform validation of LIMS in consultation with relevant personnel <ul style="list-style-type: none"> • Validate the applications of the LIMS, e.g.: <ul style="list-style-type: none"> • transforming information to electronic data, • acquiring experimental data, • transforming electronic data stream to digital domain, • programming, interrogating and capturing data from stand alone monitoring equipment and non-automated laboratory processes, • routing interconnections and communication of data to and between computerised systems, • tracking amendments of data entry, • rejection of data exceeding acceptable conditions. • Develop standard operating procedures (SOPs) for interfaced systems stating constraints and authorisation. • Manage the implementation of automated laboratory and/or field system and ensure the competence of personnel in using the system. • Monitor the implementation and resolve troubles identified with consultation with relevant personnel. • Critically evaluate the applicability of the LIMS and establish measures to control and rectify potential operational variations and discrepancies. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the LIMS is properly debugged and validated to meet the operational requirements. • Maintain the integrity and confidentiality of laboratory information and data.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate validation plan and determine resource availability, • validate the LIMS to ensure its compliance with operational specifications, • monitor the applicability of LIMS, critically evaluate potential variations and implement measures efficiently in response to potential discrepancies.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Validate laboratory self-developed software
Code	105870L6
Range	This unit of competency (UoC) covers the abilities to validate self-developed software and programme for data manipulation of laboratory / on-site testing activities. This UoC also includes the abilities to establish procedures to validate self-developed software and develop mechanism to prevent unintentional disruption or amendment of the software.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Formulate validation procedures and protection mechanism for self-developed software <ul style="list-style-type: none"> • Develop and establish validation procedures to validate the software for ensuring validity of test results. • Develop, establish and implement mechanism for protecting integrity and confidentiality of data entry or collection, data storage, data transmission and data processing, e.g.: <ul style="list-style-type: none"> • access control by use of password, • read only file for authorised user, • track log of amendments of data entry, • rejection of data exceeding acceptable conditions, • permanent record of all cell formulas, logistics, • lock all cells of a spreadsheet except those input by the user. • Compose user procedures of the software to facilitate daily operation. 2. Validate laboratory self-developed software <ul style="list-style-type: none"> • Apply the user procedures to get access to the software. • Verify the self-developed software and programme, e.g.: <ul style="list-style-type: none"> • check output manually, • comparison with known results from known data, • input non-numerical data, nonsensical data or extreme values. • Distribute the validated software and programme to team or relevant personnel and confirm their competencies in using the software. • Monitor the usage and collect feedback from relevant personnel and consolidate any variations or potential disruptions. • Critically evaluate possible causes for the disruptions and modify the software to fit intended use with consultation of relevant personnel. • Document all changes made to software and control in accordance with document control system. • Re-validate laboratory self developed software regularly. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the self-developed software and programme are thoroughly validated before release for use. • Maintain the integrity and confidentiality of data in accordance with documented procedures and code of conduct.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate and establish procedures for validation of software and for protecting integrity and confidentiality of data entry or collection, data storage, data transmission and data processing, • validate laboratory self-developed software efficiently and accurately, • monitor and evaluate potential disruptions, modify and re-validate the software regularly.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Implement laboratory quality control procedures
Code	105878L4
Range	This unit of competency (UoC) covers the abilities to implement quality control procedures in a testing laboratory by continuously monitoring the reliability and validity of test results in compliance with the formulated quality control protocol.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of quality control protocol and validity of test results <ul style="list-style-type: none"> • Describe the implementation plan of the formulated quality control protocol. • Employ the concepts of continuous improvement processes. • Describe the meaning of reliability and validity of test. • Identify the acceptance criteria for determining the validity of test results. • Outline statistical techniques for analysing quality control data. 2. Implement laboratory quality control procedures <ul style="list-style-type: none"> • Select monitoring methods appropriate for the type and volume of the work undertaken. • Record all results in such a way that the trends in testing activities are detectable by use of quality control procedures, e.g.: <ul style="list-style-type: none"> • use of analytical control charts for the monitoring of the ongoing level of precision by analysing certified reference materials, • ongoing estimate of the repeatability from replicate tests, • ongoing estimate of the recovery from fortification of test samples with certified reference materials or other reference materials, • estimation of between-operator precision from testing of the same sample by two or more operators. • Verify the accuracy of test data and technical records. • Apply statistical techniques to review and evaluate the results. • Report findings to relevant personnel concerning the quality control data outside pre-defined acceptance criteria. • Identify potential causes for unacceptable results and nonconformities. • Take necessary actions to correct the problem and prevent incorrect results from being reported. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality control data are recorded in such a way that trends are detectable and, where practicable, statistical techniques shall be applied to review the results.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement quality control procedures by selecting monitoring methods appropriate for the type and volume of the work undertaken, • collect and analyse all necessary data / documentation / records in quality control to identify unacceptable results and nonconformities, • implement and monitor corrective actions for correcting the problem and preventing incorrect results from being reported.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Control reference materials and working standards
Code	105879L4
Range	This unit of competency (UoC) covers the abilities to control and maintain reference materials and working standards by applying established procedures to prevent their contamination or deterioration in the testing laboratory.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of using and handling reference materials and working standards <ul style="list-style-type: none"> • Categorise different classes of reference materials in compliance with the requirements specified in the test methods. • Describe the application of different classes of reference materials used for measurements. • Apply the concepts of metrology and SI units of measurement to testing activities. • Describe the procedures for safe handling, transport, storage and use of reference materials and working standards. 2. Control reference materials and working standards <ul style="list-style-type: none"> • Select suitable class of reference materials to verify a range of measuring instruments and test methods. • Use reference materials and working standards in a safe and metrologically sound manner. • Store and transport reference materials and working standards to prevent contamination and/or deterioration in accordance with standard operating procedures. • Undertake regular maintenance of reference materials and working standards in accordance with the maintenance register. • Examine defective reference materials and working standards and report for replacement or re-verification. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain reference materials and working standards to protect their integrity in the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select suitable class of reference materials and working standards for laboratory use in a safe and metrologically sound manner, • handle, store, transport and maintain reference materials and working standards to prevent contamination and/or deterioration.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Verify critical consumables
Code	105880L4
Range	This unit of competency (UoC) covers the abilities to verify critical consumables used in the testing laboratory in compliance with standard specifications or requirements defined in test methods.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of verifying critical consumables <ul style="list-style-type: none"> • Identify different consumable materials or perishable items that bear a critical influence on test results, e.g.: <ul style="list-style-type: none"> • media used for selective, qualitative or quantitative microbiological tests, • chemical reagents such as acid / base solutions, • apparatus such as cartridge used for solid-phase extraction, • glassware. • Identify possible factor(s) affecting the quality of critical consumables. • Describe procedures and acceptance criteria for verification of critical consumables in compliance with standard specifications or test method requirements. • Describe the statistical technique applied, e.g. student t-test for the evaluation. • Employ the concepts of uncertainty of the verification procedures. 2. Verify critical consumables <ul style="list-style-type: none"> • Select appropriate method for verification of critical consumables. • Perform the verification of critical consumables in accordance with the documented procedures, e.g. compare the response to unit mass / concentration of both materials using statistical technique or evaluate the calculated purity of the materials with the claimed one. • Determine the acceptance of consumable materials or perishable items for use in routine operation of the laboratory against pre-established criteria. • Maintain verification records of critical consumables for retrieval. • Label the verified consumable materials and store them in appropriate locations such as dry cabinet, freezer or refrigerator. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure critical consumables are verified and stored properly in the laboratory. • Differentiate the degradation of critical consumables.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • verify critical consumables and/or perishable items that bear influence on test results in compliance with standard specifications or test method requirements, • judge the acceptance of consumable materials or perishable items for use in routine operation of the laboratory against pre-established criteria.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Formulate quality control protocol for monitoring the validity of tests
Code	105874L5
Range	This unit of competency (UoC) covers the abilities to critically review the operation of the laboratory and formulate the quality control protocol for monitoring the reliability and validity of test results in the testing laboratory.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of techniques and procedures for quality control of test results <ul style="list-style-type: none"> • Interpret the requirements of assuring the quality of test results in relevant international standard. • Explain the meaning of reliability and validity of test. • Command statistical techniques or trend analysis for reviewing the quality control data. • Critically review the operation of the laboratory and select monitoring methods appropriate for the type and volume of the work undertaken. 2. Formulate quality control protocol for monitoring the validity of tests <ul style="list-style-type: none"> • Establish the policy and procedures for monitoring the validity of tests undertaken and implementing the quality control protocol. • Designate the responsibilities and authorities for monitoring the validity of tests undertaken. • Incorporate the requirements for assuring the quality of test results in the quality control protocol. • Plan and review the monitoring protocol including, but not limited to, the following: <ul style="list-style-type: none"> • regular use of certified reference materials and/or internal quality control using secondary reference materials, • participation in interlaboratory comparison or proficiency-testing programmes, • replicate tests using the same or different methods, • retesting of retained items, • correlation of results for different characteristics of an item. • Establish criteria for determining the validity of a test. • Suggest statistical techniques to review and evaluate the results obtained from a particular test. • Plan and recommend appropriate actions for handling incorrect results. • Conduct continual assessment on the defined criteria and adjust the criteria to suit the laboratory conditions. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the defined criteria laid down in the quality control protocol are implemented and monitored effectively for continuous improvement.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically review the operation of the laboratory and formulate the quality control protocol for monitoring the validity of tests, • define criteria for evaluating the validity of test results and make recommendations based on incorrect results reported, • establish procedures to implement the quality control protocol in the laboratory.
Remark	<p>The relevant international standard involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

Unit of Competency

Functional Area: Testing Operations

Title	Evaluate subcontractor laboratory
Code	105875L5
Range	This unit of competency (UoC) covers the ability to critically evaluate subcontractor laboratory for subcontracting of tests according to relevant international standard and/or accreditation regulation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of subcontracting of tests <ul style="list-style-type: none"> • Explain conditions and circumstances when the laboratory subcontracts testing work, e.g. workload, need for further expertise, temporary incapacity, permanent subcontracting, franchise arrangements. • Interpret the requirements for subcontracting of tests in relevant international standard and/or laboratory accreditation scheme. • Formulate criteria for selection of competent subcontractor laboratory. • Command interpersonal and communications skills with customers. 2. Evaluate subcontractor laboratory <ul style="list-style-type: none"> • Evaluate whether the subcontractor is competent to perform testing work, e.g. testing activities of the subcontractor laboratory comply with relevant international standard and/or laboratory accreditation scheme. • Critically evaluate non-accredited laboratory to perform subcontracting testing activities. • Advise the customer of the subcontracting arrangement in writing and, when appropriate, gain the approval of the customer. • Take the responsibility for the subcontractor's work. • Maintain a register of all subcontractors for tests and a record of the evidence of compliance with relevant international standard. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the evaluation of subcontractor is effective and efficient.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • critically evaluate the competence of subcontractor laboratory in compliance with relevant international standard and/or laboratory accreditation scheme.
Remark	<p>The relevant international standard and laboratory accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories • HOKLAS 003 Technical Criteria for Laboratory Accreditation

Unit of Competency**Functional Area: Testing Operations**

Title	Control purchasing of services and supplies
Code	105876L5
Range	This unit of competency (UoC) covers the abilities to select and critically evaluate purchasing of services and supplies that affect the quality of tests in the laboratory according to relevant international standard and/or accreditation regulation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of purchasing of services and supplies <ul style="list-style-type: none"> • Critically review the test methods and operation of the laboratory to determine reagents, consumables and equipment needed to be purchased. • Establish the stock control requirements of reagents and consumables. • Interpret the requirements for purchasing of services and supplies in relevant international standard and/or laboratory accreditation scheme. • Identify suppliers of critical consumables, supplies and services. • Formulate criteria for selection of suppliers of consumables and services. 2. Control purchasing of services and supplies <ul style="list-style-type: none"> • Select suitable suppliers according to the selection criteria and purchase consumables and services that affect the quality of tests according to the standard operating procedures. • Check the compliance of purchased services and supplies with standard specifications or requirements defined in the test methods and maintain the record of actions taken. • Review and approve for technical content in purchasing documents for items affecting the quality of laboratory output prior to release. • Critically evaluate a broad range of suppliers of consumables, supplies and services which affect the quality of testing and maintain the record of evaluations and list of approved suppliers. • Maintain stock levels of reagents and consumables to ensure smooth operation of the laboratory. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the control of purchasing of services and supplies complies with standard specifications or test method requirements.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select suitable suppliers for the purchase of services and supplies that affect the quality of tests, • critically evaluate suppliers of consumables, supplies and services and generate the list of approved suppliers.
Remark	<p>The relevant international standard and laboratory accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories • HOKLAS 003 Technical Criteria for Laboratory Accreditation

Unit of Competency

Functional Area: Testing Operations

Title	Organise and implement proficiency testing activities
Code	105877L5
Range	This unit of competency (UoC) covers the abilities to devise a plan to participate in proficiency testing programmes or other forms of interlaboratory comparisons for the testing laboratory. This UoC also includes the abilities to organise and implement proficiency testing and/or interlaboratory comparisons for other testing laboratories.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of proficiency testing programmes or interlaboratory comparisons <ul style="list-style-type: none"> • Interpret the requirements of participating and/or organising proficiency testing programmes or interlaboratory comparisons in relevant international standard and laboratory accreditation scheme. • Determine the scope of laboratory testing activities which require the participation in proficiency testing programmes or interlaboratory comparisons. • Employ statistical techniques for evaluation of test results from proficiency testing programmes or interlaboratory comparisons. • Command the concepts and principles of tests seeking for laboratory accreditation. 2. Organise and implement proficiency testing activities <ul style="list-style-type: none"> • Devise an implementation plan for participation in proficiency testing programmes or interlaboratory comparisons to demonstrate the competence of the laboratory in performing tests under its scope of accreditation. • Investigate the root causes for unsatisfactory results and identify the problem. • Implement corrective actions to eliminate the problem and to prevent recurrence. • Monitor the effectiveness of corrective actions taken. • Review, update and justify the plan for participation in proficiency testing programmes or interlaboratory comparisons in response to, e.g.: <ul style="list-style-type: none"> • changes of the scope of accreditation, staffing, methodology, instrumentation and capability, • effectiveness of corrective action taken, • other factors that may affect the quality of laboratory's tests. • Maintain records of participation in proficiency testing activities representative of the accredited testing activities under each test area of the scope of accreditation. • Organise proficiency testing programmes and/or interlaboratory comparisons in compliance with the requirements of relevant international standard. • Use appropriate statistical techniques to evaluate the results of laboratories participating in the proficiency testing programmes or interlaboratory comparisons. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the laboratory participates in proficiency testing programmes or interlaboratory comparisons regularly in accordance with the implementation plan.

Unit of Competency

Functional Area: Testing Operations

<p>Assessment Criteria</p>	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • devise an implementation plan for the laboratory to participate in proficiency testing programmes or interlaboratory comparisons, • organise proficiency testing programmes or interlaboratory comparisons for other laboratories, • critically evaluate the results of proficiency testing programmes or interlaboratory comparisons to justify the competence of the laboratory in performing tests and maintain records of proficiency testing activities.
<p>Remark</p>	<p>The relevant international standard and laboratory accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17043 Conformity Assessment – General Requirements for Proficiency Testing • HOKLAS 003 Technical Criteria for Laboratory Accreditation • HOKLAS Supplementary Criteria No. 33 Accreditation Regulations Specific for HOKLAS – Laboratory • HOKLAS 017 Technical Criteria for Accrediting Proficiency Testing Providers • HOKLAS Supplementary Criteria No. 34 Accreditation Regulations Specific for HOKLAS – Proficiency Testing Provider

Unit of Competency**Functional Area: Testing Operations**

Title	Control laboratory documents and records
Code	105994L5
Range	This unit of competency (UoC) covers the abilities to control and maintain a range of laboratory documents and quality and technical records to be readily retrievable in the laboratory according to relevant international standard and/or accreditation regulation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of laboratory document control system <ul style="list-style-type: none"> • Interpret the requirements of document control and control of records in relevant international standard and/or laboratory accreditation scheme. • Describe the procedures to control all documents that form part of the management system of the laboratory. • Determine a range of documents to be controlled in the laboratory, e.g. regulations, standards, other normative documents, test and/or calibration methods, drawings, software, specifications, instructions, manuals. • Describe the procedures for identification, collection, indexing, access, filing, storage within defined period, maintenance and disposal of quality records (including internal audit reports, management review reports, records of corrective and preventive actions) and technical records. • Describe the procedures to protect and back-up records stored electronically and to prevent unauthorised access to or amendment of these records. 2. Control laboratory documents and records <ul style="list-style-type: none"> • Authorise editions of appropriate documents and make available at all locations where essential laboratory operations are performed. • Review and, where necessary, revise documents periodically to ensure continuing suitability and compliance with applicable requirements and identify the altered or new text in the document or the appropriate attachments. • Remove invalid or obsolete documents from all points of issue or use. • Identify management system documents generated by the laboratory uniquely, including the date of issue and/or revision identification, page numbering, the total number of pages, the issuing authority(ies). • Store and retain records in a way that they are readily retrievable in the laboratory. • Maintain records of original observations and raw data and provide a traceable link between the test sample or calibration item as received and the report or certificate which is eventually issued. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the controlled documents are reviewed and managed effectively in the laboratory. • Ensure controlled quality and technical records are retained securely and confidentially.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • authorise, review and revise documents to ensure continuing suitability and compliance with applicable requirements, • control and maintain records to provide a traceable link between the test sample or calibration item as received and the report or certificate to be issued.
Remark	<p>The relevant international standard and laboratory accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories • HOKLAS 003 Technical Criteria for Laboratory Accreditation

Unit of Competency**Functional Area: Testing Operations**

Title	Calibrate and maintain reference standards
Code	105889L4
Range	This unit of competency (UoC) covers the abilities to calibrate reference standards against established acceptance criteria and determine the storage conditions in a testing / calibration laboratory.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of calibrating and storing reference standards <ul style="list-style-type: none"> • Describe the characteristic properties of reference standards. • Select an appropriate calibration technique that the response is stable and sensitivity is large enough for calibration of reference standards. • Select an appropriate control of another reference standard for calibration. • Employ appropriate statistical technique, e.g. student t-test for the evaluation of calibration results. • Apply the concepts of uncertainty to the calibration procedure. 2. Calibrate and maintain reference standards <ul style="list-style-type: none"> • Determine the optimal range of the selected technique. • Perform the calibration of reference standards in accordance with the documented procedures. • Apply appropriate statistical technique to evaluate the calibration results against the pre-established tolerance. • Determine the acceptance of reference standards fit for intended use in the laboratory. • Evaluate the uncertainty of calibration results. • Label reference standards indicating the date of calibration and next calibration date. • Store reference standards in appropriate locations such as dry cabinet, freezer or refrigerator and take measures to maintain their integrity and conditions. 3. Exhibit professionalism <ul style="list-style-type: none"> • Document calibration results and maintain records of calibration of reference standards that meet the requirements of intended application. • Ensure reference standards are calibrated and stored properly.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • calibrate reference standards that meet the requirements of intended use in the laboratory, • evaluate the suitability for use of reference standards against the acceptance criteria.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Verify and maintain reference materials
Code	105890L4
Range	This unit of competency (UoC) covers the abilities to verify the purity of reference materials against established acceptance criteria and determine the storage conditions for maintaining reference materials in a testing / calibration laboratory.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of verification techniques and storage requirements for reference materials <ul style="list-style-type: none"> • Describe the structure of reference materials and their characteristic properties such as UV absorptivity and volatility. • Identify possible impurities in materials under test. • Select an appropriate technique that the response is stable and sensitivity is large in differentiation of minor difference in concentration. • Select a selective detection system, if applicable, to eliminate possible interferences and impurities in the materials under test. • Select an appropriate control material according to the following priority: <ul style="list-style-type: none"> • certified reference material, if available, • reference materials of another brand if certified reference material is not available, • reference materials of another lot only if no other brand is available. • Employ appropriate statistical technique, e.g. student t-test for the evaluation. • Apply the concepts of uncertainty of the verification procedure and uncertainty of purity of materials under test. 2. Verify and maintain in-house reference materials <ul style="list-style-type: none"> • Apply the developed verification method and determine the optimal range of the selected technique. • Prepare the concentration for which verification is performed for both the materials under verification and the control materials. • Perform the verification in accordance with the established procedures. • Compare the response to unit mass / concentration of both materials using statistical technique or evaluate the calculated purity of the materials with the claimed one against pre-established tolerance. • Determine the acceptance and suitability of the materials for use as in-house reference materials for routine operation. • Evaluate the uncertainty of purity of the materials under test. • Label in-house reference materials indicating the verification date, next verification date, verified purity and related uncertainty in purity. • Store in-house reference materials in appropriate locations such as dry cabinet, freezer or refrigerator and take measures to prevent cross-contamination with samples and degradation of reference materials. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain records of verification of in-house reference materials that meet the requirements of intended application. • Ensure in-house reference materials are verified and stored properly. • Differentiate the degradation of reference materials.

Unit of Competency

Functional Area: Testing Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• select appropriate technique and method for verification of in-house reference materials that best differentiate small difference in concentration and possible impurities,• verify in-house reference materials according to the established verification procedures,• evaluate the suitability for use of in-house reference materials.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Verify and maintain reference and working cultures
Code	105891L4
Range	This unit of competency (UoC) covers the abilities to verify reference and working cultures, specify the criteria of acceptance and storage conditions, and maintain reference and working cultures in a testing laboratory.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess the knowledge of verification procedures and maintenance techniques for reference and working cultures <ul style="list-style-type: none"> • Identify reference cultures of microorganisms not obtained directly from a national collection. • Describe the characteristics of the strains of reference and working cultures to be verified. • Describe various verification techniques for reference and working cultures, e.g.: <ul style="list-style-type: none"> • serological tests, • biochemical tests, • morphological examination. • Select appropriate reference cultures that are traceable to a national culture collection. 2. Verify and maintain reference and working cultures <ul style="list-style-type: none"> • Apply appropriate verification technique according to the characteristics of the strains of reference cultures and the number of sub-culturing passages. • Perform the verification in accordance with the established procedures. • Determine the acceptance criteria of the cultures / sub-cultures for use as reference stocks and working stocks for routine operation in the laboratory. • Record the characteristics of reference and working cultures and compare against the determined acceptance criteria, e.g. microorganisms in reference cultures. • Count the number of passages that a culture stock has gone through. • Label the verified reference and working cultures and sub-cultures indicating the verification date and next verification date. • Maintain desired characteristics of the strains of reference and working cultures by using appropriate storage environment and preservation technique such as freeze-drying, liquid nitrogen storage, beads. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain verification records of reference and working cultures and sub-cultures that meet the requirements of intended application. • Ensure reference and working cultures and sub-cultures are verified and maintained properly to avoid any loss of viability, changes of biochemical activity and/or change in morphology.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • apply appropriate verification technique and procedure to verify reference and working cultures within the determined acceptance criteria, • maintain desired characteristics of the strains of reference and working cultures by applying appropriate storage environment and preservation technique.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Handle and perform equipment calibration
Code	105892L4
Range	This unit of competency (UoC) covers the abilities to carry out calibration of equipment used in the laboratory / on-site testing activities impartially by applying appropriate methods/standards and techniques, and maintain the calibrated equipment by conducting intermediate checks.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of equipment calibration techniques <ul style="list-style-type: none"> • Explain the operating principles of major equipment used in the laboratory. • Employ the principles of equipment calibration. • Apply the concepts of traceability, S.I. unit essentials, fundamentals of reference standards and certified reference materials. • Describe the calibration methods for major equipment. • Identify the requirements of calibration for major laboratory equipment in relevant national and international standards, including but not limited to ISO, AS/NZS, OIML, ASTM, BS, EN and JIG. • Describe the principles and operation of setting up equipment used for calibration. • Apply the principle and mathematical concepts for evaluation of uncertainty for the equipment calibration. • Apply the procedures for conducting intermediate checks of calibrated equipment. 2. Perform equipment calibration <ul style="list-style-type: none"> • Apply appropriate calibration methods or standards and set up proper conditions and accessories for calibration of equipment. • Use appropriate equipment, test chamber and test control site, whichever applicable for equipment calibration. • Set up appropriate test conditions for the equipment under calibration. • Carry out equipment calibration impartially using appropriate certified reference materials or reference standards according to relevant methods/standards. • Estimate the uncertainty of calibration. • Record and document equipment calibration results properly. • Carry out intermediate checks, if needed, to maintain confidence in the calibration status of the equipment according to a defined procedure. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all calibrations are carried out in accordance with good laboratory practices and in compliance with the required standard.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out the calibration on equipment impartially according to the requirements of the relevant methods/standards, • analyse calibration results and estimate the uncertainty in calibration, • carry out intermediate checks to maintain confidence in the calibration status of the equipment.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Formulate calibration programme for reference standards
Code	105881L5
Range	This unit of competency (UoC) covers the abilities to formulate a programme for the calibration of reference standards by critically evaluating the requirements of reference standards for intended used in a testing / calibration laboratory.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of reference standards and their calibration requirements <ul style="list-style-type: none"> • Explain the importance of using reference standards for traceability purpose in a testing / calibration laboratory. • Evaluate calibration requirements for reference standards. • Interpret requirements of measurement traceability in relevant international standards. 2. Formulate calibration programme and procedures for reference standards <ul style="list-style-type: none"> • Critically evaluate the scope and requirements of the calibration programme. • Determine reference standards to be calibrated and prepare the inventory list. • Develop detailed calibration programme including calibration schedules, calibration methods and procedures, interpreting and reporting calibration results, procedures and schedules for conducting intermediate checks. • Establish the acceptance criteria for the calibration of reference standards fit for intended use in the measurement process. • Explain the importance of calibration of reference standards and allocate roles and responsibilities of the personnel. • Establish the re-calibration interval for reference standards. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the calibration programme is implemented and monitored effectively. • Ensure the measurement traceability is effectively maintained.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate calibration programme for reference standards by critically evaluating the scope and requirements of reference standards, • establish procedures to implement the calibration programme for reference standards to be used in the laboratory.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Formulate verification programme for reference materials
Code	105882L5
Range	This unit of competency (UoC) covers the abilities to formulate a programme for verification of reference materials by critically evaluating the requirements of reference materials to be used in a testing / calibration laboratory.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of reference materials and their verification requirements <ul style="list-style-type: none"> • Explain the importance of using reference materials for traceability purpose in a testing / calibration laboratory. • Evaluate requirements for verifying the purity of reference materials. • Interpret requirements of measurement traceability in relevant international standards. 2. Formulate verification programme and procedures for reference materials <ul style="list-style-type: none"> • Critically evaluate the scope and requirements of the verification programme. • Determine reference materials to be verified and prepare the inventory list. • Specify SI units of measurement or select appropriate certified reference materials to which reference materials shall be traceable. • Develop detailed verification programme including verification schedules, verification methods and procedures, interpreting verification data, procedures and schedules for conducting intermediate checks. • Establish the acceptance criteria for verification of reference materials fit for intended use in the measurement. • Explain the importance of verification of reference materials and allocate roles and responsibilities of the personnel. • Establish the re-verification interval for reference materials. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the verification programme is implemented and monitored effectively. • Ensure the measurement traceability is effectively maintained.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate verification programme for reference materials by critically evaluating the scope and requirements of reference materials, • establish procedures to implement the verification programme for reference materials to be used in the laboratory.
Remark	<p>This UoC will be used together with the following UoC:</p> <ul style="list-style-type: none"> • Select and handle certified reference materials (TCTETO541A)

Unit of Competency**Functional Area: Testing Operations**

Title	Formulate verification programme for reference and working cultures and sub-cultures
Code	105883L5
Range	This unit of competency (UoC) covers the abilities to formulate a planned programme for verification of reference and working cultures and sub-cultures of microorganisms used in a microbiological testing laboratory.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of reference and working cultures and sub-cultures of microorganisms and their verification techniques <ul style="list-style-type: none"> • Explain the importance of using reference and working cultures for traceability purpose in a testing laboratory. • Identify recognised national collection of reference cultures, e.g.: <ul style="list-style-type: none"> • American Type Culture Collection (ATCC), • Type Culture Collection of Chinese Academy of Sciences (CGMCC), • National Collection of Type Cultures (NCTC), • European Collection of Animal Cell Cultures (ECACC). • Explain various verification techniques for desired characteristics of the strains in reference and working cultures, e.g.: <ul style="list-style-type: none"> • serological tests, • biochemical tests, • morphological examination. 2. Formulate verification programme for reference and working cultures and sub-cultures <ul style="list-style-type: none"> • Critically evaluate the scope and requirements of the verification programme for reference and working cultures and sub-cultures. • Determine reference cultures of microorganisms claimed to be traceable to a national collection. • Identify reference stocks and working stocks of cultures to be verified. • Prepare the inventory list and history of sub-culture from reference cultures. • Develop detailed verification programme including verification schedules, verification procedures, interpreting verification data. • Determine the number of passages for which the purchased reference culture can be sub-cultured and the validity period of culture stocks. • Allocate roles and responsibilities of laboratory personnel. • Establish the re-verification interval for reference and working cultures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the verification programmes of reference and working cultures and sub-cultures are implemented and monitored effectively.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate verification programme for reference and working cultures and sub-cultures by critically evaluating the scope and requirements, • establish procedures to implement verification programme of reference and working cultures and sub-cultures in the microbiology testing laboratory.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Formulate equipment calibration plan
Code	105884L5
Range	This unit of competency (UoC) covers the abilities to formulate equipment calibration plan for laboratory / on-site / testing / inspection activities to meet requirements of intended use of the equipment for the correct performance of tests and/or calibrations.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Determine equipment calibration requirements and resources availability <ul style="list-style-type: none"> • Develop an alert system in reminding assigned personnel of the equipment calibration schedule. • Evaluate the latest information on manufacturers' specifications, recommendations and international guidelines for performing equipment calibration. • Determine the level of quality of the personnel, material, reference standards, equipment, traceability and procedures required to deliver the work according to the specifications on equipment calibration. 2. Formulate equipment calibration plan <ul style="list-style-type: none"> • Devise equipment calibration plans which satisfy international guidelines and the relevant accreditation guidelines, balance the best use of available resources with skill development opportunities, and achieve the reliability of equipment and level of traceability required. • Distribute the plans to team or appropriate personnel, explain and confirm contents with them. • Establish the interval between calibrations, acceptance criteria of equipment calibration against intended use and specifications of test standards. • Monitor the workflow and outputs against plans and investigate any variations. • Revise the calibration plans according to the trend analysis of calibration results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure a system for alerting responsible personnel of the due date of work plan is implemented effectively and efficiently. • Ensure the calibration status is updated and the plan is revised according to the trend analysis of calibration checks.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate the equipment calibration plan that fits the intended use and satisfies international guidelines and the relevant accreditation criteria without compromising quality, accuracy and traceability, • monitor the progress of planned equipment calibration work, • revise the equipment calibration plan according to the trend analysis of calibration results for continuous improvement.
Remark	<p>The relevant accreditation document involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • HOKLAS Supplementary Criteria No. 2 All Test Categories – Equipment Calibration and Verification

Unit of Competency**Functional Area: Testing Operations**

Title	Develop equipment calibration methods
Code	105885L5
Range	This unit of competency (UoC) covers the abilities to develop equipment calibration methods for laboratory / on-site testing activities to meet the requirement of intended use of the calibrated equipment.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess knowledge of equipment calibration methods <ul style="list-style-type: none"> Comprehend the principles and importance of equipment calibration. Describe the measurement traceability concept and essentials of the International System of Units (S.I.). Comprehend the fundamentals and functions of reference standards and certified reference materials. Identify major equipment that require calibration in the laboratory. Specify the requirements of equipment calibration in relevant national and international standards, including but not limited to ISO, AS/NZS, OIML, ASTM, BS, EN and JIG. Explain the operating principle of selected equipment which requires the calibration. Employ the operating principle of equipment used for calibration. Apply the principle and mathematical concepts for evaluation of uncertainty in the calibration. Evaluate the factors and elements contributing the effect to the design of calibration methods. Employ the metrology principle and statistical concepts for taking and evaluating measurement data. Develop and document calibration methods for equipment <ul style="list-style-type: none"> Develop equipment calibration methods based on manufacturer's specifications and recommendations, international guidelines and procedures. Determine the certified reference materials, reference standards, environmental conditions, techniques and equipment required to deliver the calibration work. Determine the parameters that are critical to the equipment calibration. Compile calibration methods and performance checks with details including step by step instructions to ensure that the operation can be properly performed on a routine basis. Establish the interval between calibration and acceptance criteria of parameters taking into consideration of intended use, applicable range and specifications of test standards. Critically monitor and evaluate the applicability of methods and the competence of assigned personnel in achieving the accuracy of the work. Maintain documentation control and distribution of calibration methods/procedures. Exhibit professionalism <ul style="list-style-type: none"> Ensure all developed methods comply with good laboratory practices and relevant categories of standards. Ensure all developed methods can address the performance and traceability of equipment. Ensure all developed methods are well documented with procedure details including calibration intervals and criteria.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> develop and compile equipment calibration methods that are fit for the intended use and satisfy international guidelines and relevant accreditation criteria without compromising quality, accuracy and traceability, establish the calibration interval and determine the relevant acceptance criteria of the equipment under calibration, monitor and critically evaluate the applicability of calibration methods and skills of assigned personnel in performing the calibration work.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Select competent laboratories for calibration of equipment and reference standards
Code	105886L5
Range	This unit of competency (UoC) covers the abilities to establish and apply the criteria in selection of competent laboratories for calibration of equipment and reference standards in a testing / calibration laboratory by critically analysing the quality, price, demonstration of traceability and competence of laboratories in performing the calibration.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Formulate the criteria for selection of competent laboratories for calibration of equipment and reference standards <ul style="list-style-type: none"> • Determine the range and accuracy of equipment parameters to be calibrated. • Establish the criteria for selection including: <ul style="list-style-type: none"> • proof of traceability in relevant calibration either demonstrated by accreditation or being a member of national metrological institution, • measurement capability, • past experience in relevant services, • price and turnaround time of services, • availability of pickup services and means of handling and transportation and on-site service, • calibration certificates in compliance with requirements as stipulated in relevant international standards, • reputation. 2. Select competent laboratories for calibration of equipment and reference standards <ul style="list-style-type: none"> • Apply the criteria of selection and eliminate unqualified laboratories. • Select the most competent calibration laboratory by critically analysing its performance against the established criteria. • Arrange the calibration work in consultation with relevant personnel. • Critically evaluate the performance of the selected calibration laboratory annually and take necessary actions for suppliers of unsatisfactory calibration services. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the most competent calibration laboratory is selected to the best benefits of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate criteria for selection of competent calibration laboratories that fit the intended use and satisfy international guidelines without compromising quality, accuracy, capability and traceability, • select the most competent laboratory for calibration of equipment and reference standards by critically analysing its performance against the established criteria.
Remark	<p>The relevant international standard involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

Unit of Competency

Functional Area: Testing Operations

Title	Evaluate calibration results of equipment and reference standards
Code	105887L5
Range	This unit of competency (UoC) covers the abilities to critically evaluate calibration results of equipment and/or reference standards to justify whether the equipment and/or reference standards are fit for the intended use in the laboratory.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of intended use of equipment and reference standards and requirements of calibration certificates <ul style="list-style-type: none"> • Determine the intended use of equipment and reference standards in the laboratory. • Establish acceptance criteria for the performance of equipment and reference standards after calibration. • Interpret the compliance requirements of calibration certificates in relevant international standards. • Comprehend the principle and mathematical concepts for evaluation of uncertainty for the calibration. 2. Evaluate calibration results of equipment and reference standards <ul style="list-style-type: none"> • Critically evaluate calibration certificates by interpreting: <ul style="list-style-type: none"> • calibration results with units of measurement where appropriate, • calibration methods used, • conditions (e.g. environmental) under which the calibrations are made that have an influence on the measurement results, • uncertainty of measurement and/or a statement of compliance with an identified metrological specification or clauses, • evidence that the measurements are traceable. • Justify the suitability of equipment for intended use based on the interpretation of calibration results against established acceptance criteria and its tendency of performance. • Formulate measures in case calibration exceeds the specified tolerance. • Comprehend and document necessary information in the calibration certificates or results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the calibration certificate complies with requirements of relevant international standards. • Ensure the necessary information in the calibration certificates or results is updated and the personnel in use of the equipment / reference standards are aware of the information.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate calibration results and justify the suitability of equipment and reference standards for intended use, • comprehend and apply necessary information in the calibration certificates or results.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories • ISO Guide 31 Reference Materials – Contents of Certificates and Labels • ISO Guide 32 Calibration in Analytical Chemistry and Use of Certified Reference Materials

Unit of Competency**Functional Area: Testing Operations**

Title	Select and handle certified reference materials
Code	105888L5
Range	This unit of competency (UoC) covers the abilities to formulate and apply the criteria in the selection and handling of certified reference materials by critically analysing the quality, price, traceability, matrix, concentration range and intended use in a testing / calibration laboratory.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> Possess knowledge of selecting and handling certified reference materials <ul style="list-style-type: none"> Determine the intended use of certified reference materials such as verification of trueness of method, construction of calibration curve or use as a quality control sample. Establish the criteria for selection including: <ul style="list-style-type: none"> proof of traceability of the materials either demonstrated by accreditation for their production under appropriate international standard for the competence of reference material providers or produced by member of national metrological institution, appropriate concentration range, matrix and uncertainty that meet the requirements of intended use, stability, forms (solid, liquid or gas) and package of the materials (package size, storage solvent, storage conditions), price and delivery time of materials, certificates in compliance with requirements as stipulated in relevant international standard governing the contents of certificates and labels of reference materials. Comprehend the nature, characteristics and deterioration of certified reference materials. Determine the environmental conditions required for handling and storing certified reference materials. Select and handle certified reference materials <ul style="list-style-type: none"> Select and use the correct class of certified reference materials to match with the appropriate measuring instrument or the purpose of intended use by applying the defined criteria. Select an approved supplier capable of providing the certified reference materials. Estimate the amount of certified reference materials required by critically analysing the usage, expiration date of relevant materials and package. Arrange the purchase of certified reference materials in consultation with relevant personnel. Evaluate the certificates and assign expiration date as recommended in the certificates. Handle and store certified reference materials within the work environment in accordance with organisational procedures. Report and investigate malfunction of or damage to certified reference materials. Exhibit professionalism <ul style="list-style-type: none"> Ensure proper selection of certified reference materials that meet the requirements of intended application.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> formulate criteria for selection of certified reference materials that fit the requirements of intended application in terms of matrix, concentration range and traceability, select and use the correct class of certified reference materials in testing / calibration activities, handle and store certified reference materials in a safe and metrological sound manner.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> ISO Guide 31 Reference Materials – Contents of Certificates and Labels ISO Guide 32 Calibration in Analytical Chemistry and Use of Certified Reference Materials ISO Guide 33 Uses of Certified Reference Materials ISO Guide 34 General Requirements for the Competence of Reference Material Producers ISO Guide 35 Reference Materials – General and Statistical Applications for Certification

Unit of Competency

Functional Area: Testing Operations

Title	Handle and transport equipment
Code	105895L3
Range	This unit of competency (UoC) covers the abilities to handle and transport equipment according to the standard operating procedures within laboratories and/or field sites for carrying out testing / calibration / inspection activities.
Level	3
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and skills of handling and transporting equipment <ul style="list-style-type: none"> • Describe the characteristics of different types of packing materials. • Identify the transport containers, carriers, materials and accessories required for the equipment. • Describe the procedures for handling and transporting equipment within laboratories and/or field sites. • Specify the precautions for handling and transportation of equipment. 2. Handle and transport equipment in accordance with standard operating procedures and work instructions <ul style="list-style-type: none"> • Handle equipment in accordance with standard operating procedures, work instructions, recommendation of manufacturer and intended use. • Stow equipment in specified transport containers under the required conditions and deliver the equipment to the reception point on time. • Check and complete the required documents at pickup points for chain of custody of the equipment. • Safeguard and protect the equipment from damage during the transport to field site for appropriate activities. • Store equipment in original case, box or designated location when not in use. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain the integrity of equipment during handling and transport. • Ensure appropriate and timely transport of equipment required for testing / calibration / inspection activities.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • handle and transport the equipment in a timely manner within laboratories and/or field sites without affecting the performance of equipment and the quality of results, • record details of equipment exchange in chain of custody forms, • safeguard and store the equipment to prevent unintentional damage or lost.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Perform equipment maintenance and performance checks
Code	105894L4
Range	This unit of competency (UoC) covers the abilities to carry out maintenance work and performance checks of equipment used in laboratory / on-site testing activities impartially by applying appropriate procedures and techniques.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of equipment maintenance and performance check techniques <ul style="list-style-type: none"> • Employ the operating principles of major equipment. • Apply the principles of equipment performance check. • Describe maintenance procedures for the major equipment. • Describe the performance check methods for major equipment. • Describe the principles and operation of setting up equipment used for performance checks and maintenance. 2. Perform maintenance and performance checks of equipment <ul style="list-style-type: none"> • Apply appropriate methods, set up the required conditions and accessories for performance or intermediate checks of equipment. • Use suitable equipment, test chamber and test control site, whichever applicable for equipment performance checks. • Set up appropriate environmental conditions for the equipment under check. • Carry out performance checks according to the established procedures. • Identify faulty outcomes of the equipment. • Carry out basic maintenance work for faulty equipment in accordance with standard operating procedures and equipment operating manual. • Record and document equipment performance check results and maintenance work. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all equipment performance checks and maintenance work are carried out in accordance with good laboratory practices.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • carry out performance checks on equipment impartially by applying appropriate procedures and techniques, • identify faulty equipment by analysing performance check results, • carry out equipment maintenance in accordance with standard operating procedures.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Formulate equipment maintenance plan
Code	105893L5
Range	This unit of competency (UoC) covers the abilities to formulate equipment maintenance and performance check plan for laboratory / on-site testing activities to fulfil the requirements of intended use.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Determine equipment maintenance and performance check requirements and resources availability <ul style="list-style-type: none"> • Develop an alert system in reminding assigned personnel of the equipment maintenance and performance checks schedule. • Evaluate the latest information on manufacturers' specifications, recommendations and international guidelines for performing the equipment maintenance work. • Critically evaluate the level of quality of the personnel, material, equipment and procedures required to deliver the work according to the specifications on equipment maintenance. 2. Formulate equipment maintenance and performance check plan <ul style="list-style-type: none"> • Devise equipment maintenance plans according to the manufacturer's specifications and balance the best use of available resources with skill development opportunities. • Distribute the plans to team or appropriate personnel, explain and confirm contents with them. • Establish measurement criteria of performance check against intended use in consultation with personnel in charge of the equipment. • Monitor the workflow and outputs against plans and investigate any variations. • Revise the maintenance plan appropriately based on the track record of performance checks to achieve the established criteria and balance the effort and the cost. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the system for alerting responsible personnel of the due date of maintenance plan is implemented effectively and efficiently.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate equipment maintenance and performance check plans that fit the intended use without compromising quality, accuracy and traceability, • establish an effective and efficient alerting system to alert responsible personnel in carrying out planned equipment maintenance work, • revise the equipment maintenance plans according to the trend analysis of performance checks.
Remark	

Unit of Competency**Functional Area: Testing Operations**

Title	Authorise test results and reports
Code	105896L5
Range	This unit of competency (UoC) covers the abilities to critically assess the accuracy of data and validity of test results in test reports prior to formally authorising the release of test reports to customer.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of assessing the accuracy of data and validity of test results <ul style="list-style-type: none"> • Command scientific and technical knowledge of the samples, procedures, equipment, materials and instrumentation used to generate test data and results. • Establish expected values for data and results and the uncertainty components for specified test methods. • Describe laboratory procedures for authorising test results and reports. • Specify reporting requirements in test methods, international standards and/or laboratory accreditation schemes. • Apply the concepts of using statistical tests to estimate uncertainties and determine data acceptability, e.g. t-test, F-test, analysis of variance (ANOVA), regression methods. 2. Authorise test results and reports <ul style="list-style-type: none"> • Verify the accuracy of data and technical records by: <ul style="list-style-type: none"> • comparing data with expected values and identifying any outliers, • inspecting data records to check the integrity of data entry, alterations, transfers and calculations, • confirming that technical records provide sufficient information to ensure traceability for the tests involved. • Compare test results with expected values and investigate any significant differences. • Check the reliability of results by examining data or results from repeated tests or duplicate samples. • Assess the significance of any documented observations or typical test conditions or environment and/or sample appearance. • Check that all calculations are free from mistakes and estimates of uncertainty are reasonable and consistent with test method or specification requirements. • Authorise test results and reports in compliance with laboratory procedures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure that the test reports are verified and checked free from errors prior to issuance. • Maintain the integrity and confidentiality of information in the test reports in compliance with the code of conduct of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically verify the accuracy and completeness of data, results and technical records for specified tests, • authorise and issue test results and reports in compliance with laboratory procedures.
Remark	

Unit of Competency

Functional Area: Testing Operations

Title	Investigate complaints and appeals on testing services
Code	105897L5
Range	This unit of competency (UoC) covers the abilities to investigate complaints and appeals on test reports or results by critically analysing suspicious test results and rectifying test reports in a testing laboratory.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and skills of handling complaints and appeals <ul style="list-style-type: none"> • Explain technical details of sampling, test methods and test results. • Establish expected values for data and results. • Command effective problem solving techniques and cause analysis skills appropriate to test methods. • Describe procedures relating to customer service and communication protocols. 2. Investigate complaints and appeals on testing services <ul style="list-style-type: none"> • Determine the validity of complaints and appeals. • Examine records of performance checks and calibration critically to ensure that the equipment used meet test specifications and requirements. • Examine whether human and/or environmental factors could have effects on the reliability of results. • Evaluate sources of interferences that may have occurred during measurements. • Retrieve stored samples and examine whether they are contaminated or deteriorated. • Verify whether sampling procedures could contribute to unexpected results. • Perform control tests using the new or same samples to check unexpected results. • Investigate possible root causes of unexpected results and the preventive/corrective actions undertaken. • Report investigation outcomes and recommendations for improvements in accordance with laboratory procedures. • Explain investigation outcomes and confidence level for unexpected test results to the complainant / appellant clearly by appropriate communication means. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate a professional approach and positive organisation image by maintaining independence and an ability to resist improper influences. • Maintain the confidentiality of complainant's information in compliance with the code of conduct of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • investigate complaints and appeals by critically analysing unexpected test results in a logical and efficient manner, • explain investigation outcomes to the complainant / appellant clearly using appropriate communication means.
Remark	

**Units of Competency for Laboratory /
On-site Testing - Testing Quality
Management**

Unit of Competency

Functional Area: Testing Quality Management

Title	Formulate laboratory quality management system
Code	105898L6
Range	This unit of competency (UoC) covers the abilities to formulate and design a quality management system in a testing / calibration laboratory according to its operational needs by interpreting the requirements in relevant international standards and laboratory accreditation scheme.
Level	6
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of laboratory quality management system <ul style="list-style-type: none"> • Determine the scope of activities of the laboratory. • Analyse a broad range of resources requirements and their availabilities in the laboratory. • Interpret the requirements of laboratory quality management system in relevant international standards for testing / calibration laboratories. • Interpret the requirements of laboratory quality management system in relevant laboratory accreditation scheme. 2. Formulate laboratory quality management system <ul style="list-style-type: none"> • Plan and design a quality management system to match with the scope of activities carried out by the laboratory in the following aspects: <ul style="list-style-type: none"> • document control, • review of requests, tenders and contracts, • subcontracting of tests and calibrations, • purchasing services and supplies, • service to customer and complaints handling, • control of nonconforming work, • improvement, • corrective action and preventive action, • control of records, • internal audits, • management reviews, • personnel, • accommodation and environmental conditions, • test and calibration methods and method validation, • equipment, • measurement traceability, • sampling, • handling of test / calibration items, • assuring the quality of test / calibration results, • reporting the results. • Develop the plan and procedures for implementing quality management system in the laboratory, including the following components: <ul style="list-style-type: none"> • objectives and tasks, • responsibilities of personnel, • timeline, • budget and resource needs, • benchmarks or performance indicators. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality management system is fit for the purpose and complies with the size and scope of the laboratory. • Ensure the quality management system plan should be made available to all laboratory staff for its implementation.

Unit of Competency

Functional Area: Testing Quality Management

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• formulate the quality management system for a laboratory by critically interpreting the requirements in relevant international standards and laboratory accreditation scheme,• develop the plan and procedures for implementing the quality management system by determining the scope of activities of the laboratory in compliance with the organisation policy on quality management.
Remark	The relevant international standards and laboratory accreditation scheme involved in this UoC are as follows: <ul style="list-style-type: none">• ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories• HOKLAS 003 Technical Criteria for Laboratory Accreditation

Unit of Competency

Functional Area: Testing Quality Management

Title	Implement laboratory quality management system
Code	105899L5
Range	This unit of competency (UoC) covers the abilities to implement quality management system in a testing / calibration laboratory in compliance with the formulated quality management system and procedures.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of quality management system and its implementation requirements <ul style="list-style-type: none"> • Employ the concepts of continuous improvement processes. • Explain the formulated implementation plan of laboratory quality management system. • Identify the objectives of laboratory quality management system. • Determine resource requirements in the implementation process. • Examine the training needs of laboratory personnel responsible for the implementation of quality management system. 2. Implement laboratory quality management system <ul style="list-style-type: none"> • Establish and follow the timeline for tasks to be performed with projected completion dates. • Secure necessary resources which are in place and available for implementation of laboratory quality management system, e.g.: <ul style="list-style-type: none"> • all financial requirements, • personnel needs such as number of staff required, training need of staff, • facilities, equipment, supplies of materials, reference standards. • Adjust the implementation plan according to resource implications and communicate effectively with laboratory personnel involved in the implementation processes. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the laboratory quality management system is implemented in compliance with the established plan and defined objectives.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement quality management system in the laboratory by establishing the timeline for tasks to be performed in compliance with the defined objectives, • adjust the implementation plan by exercising appropriate judgement on resource implications.
Remark	

Unit of Competency**Functional Area: Testing Quality Management**

Title	Monitor and review implementation of laboratory quality management system
Code	105900L6
Range	This unit of competency (UoC) covers the abilities to continuously monitor and critically review the implementation of quality management system in a testing / calibration laboratory and recommend appropriate improvement measures for the quality management system by evaluating the performance outcomes of the laboratory.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of the objectives of laboratory quality management system and key performance indicators of the management system <ul style="list-style-type: none"> • Define the objectives of laboratory quality management system. • Establish the key performance indicators of implementing the laboratory quality management system. • Examine a broad range of quality documentation, including records of improvement plans and initiatives. • Analyse roles, duties and current competencies of relevant personnel involved in laboratory operations. 2. Monitor and review implementation of laboratory quality management system <ul style="list-style-type: none"> • Review and revise, where necessary, quality manuals and work instructions for the workplace. • Critically review performance outcomes and evaluate the implementation of quality management system and its operations. • Recommend improvement measures for the quality management system in accordance with own level of responsibility and workplace procedures. • Initiate and monitor training and skill development programmes for personnel in relation to quality system and continuous improvement. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality management system is monitored and reviewed regularly and effectively for continuous improvement of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • monitor and critically review the implementation of quality management system for testing/ calibration activities within the work area, • recommend improvement measures and initiate quality processes to enhance the performance of individuals and teams in the work area.
Remark	

Unit of Competency**Functional Area: Testing Quality Management**

Title	Manage and handle nonconforming testing work
Code	105901L6
Range	This unit of competency (UoC) covers the abilities to investigate nonconforming testing work or departures from the policies and procedures in the laboratory management system and/or technical operations by evaluating the evidence collected in a testing laboratory, and recommend improvement measures to manage the nonconformities.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of technical aspects of testing procedures and documents of management system</p> <ul style="list-style-type: none"> • Command the concepts of test methods and apply testing and quality control procedures. • Comprehend the quality manual and a broad range of documents relevant to laboratory management system. • Devise suitable approach and procedures to identify and investigate nonconforming testing work and test reports. • Interpret the requirements for control of nonconforming testing work and test reports in relevant international standard and laboratory accreditation requirements. <p>2. Manage and handle nonconforming testing work</p> <ul style="list-style-type: none"> • Identify and investigate nonconforming testing work or departures from the policies and procedures in the laboratory management system and/or technical operations through a variety of activities, e.g.: <ul style="list-style-type: none"> • internal or external audits, • management reviews, • feedback / complaints from customers, • staff observations / suggestions. • Critically evaluate the significance of nonconforming testing work and the impact of nonconforming test reports. • Recommend appropriate measures for continuous improvement of the laboratory. • Establish a mechanism to recall nonconforming test reports that have been issued. • Establish policy and procedures for implementing corrective actions to eliminate identified nonconformities. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Collect sufficient evidence and analyse all necessary data / documents / records to identify and investigate nonconforming testing work and test reports.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • investigate nonconformities in laboratory management system and/or technical operations by applying suitable approach and procedures, • critically evaluate the significance of nonconformities and impact of nonconforming test reports, • recommend improvement measures and corrective actions to eliminate identified nonconformities in the laboratory.
Remark	<p>The relevant international standard and laboratory accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories • HOKLAS 003 Technical Criteria for Laboratory Accreditation

Unit of Competency

Functional Area: Testing Quality Management

Title	Conduct management review of laboratory
Code	105902L5
Range	This unit of competency (UoC) covers the abilities to establish the schedule and procedures for the laboratory's top management to conduct a review of the laboratory management system to ensure its continuing suitability and effectiveness and to induce any necessary changes or improvements.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of reviewing management system of a laboratory <ul style="list-style-type: none"> • Determine the scope and detailed requirements of reviewing management system of a laboratory. • Explain the details in all aspects of quality management system of a laboratory. • Interpret the requirements of management system in relevant international standard and define the performance indicators of the management system. 2. Conduct management review of a testing / calibration laboratory <ul style="list-style-type: none"> • Establish procedures to review the management system of a testing / calibration laboratory at planned regular intervals by taking into account of the following: <ul style="list-style-type: none"> • the suitability of policies and procedures, • reports from managerial and supervisory personnel, • the outcome of recent internal audit, • corrective and preventive actions, • assessments by external bodies, • the results of inter-laboratory comparisons or proficiency tests, • customer feedback, • appeals and complaints, • recommendations for improvement, • other relevant factors, such as quality control activities, resources and staff training. • Critically evaluate findings from the review of: <ul style="list-style-type: none"> • measurable quality objectives such as customer survey and outside services and supplies, • accommodation, • capacities and workload, • personnel, • future development. • Maintain accurate records of management review. • Generate an action plan to improve the laboratory management system. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the management review is conducted timely and effectively to enhance the quality management system of the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • plan and conduct management review of the laboratory according to predetermined schedule and procedures, • evaluate review findings critically to ensure the continuing suitability and effectiveness of the laboratory management system, • generate an action plan to improve the management system.
Remark	<p>The relevant international standard involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

Unit of Competency

Functional Area: Testing Quality Management

Title	Conduct internal audit of laboratory quality system
Code	105903L5
Range	This unit of competency (UoC) covers the abilities to prepare for, carry out and document an internal audit of aspects of the quality system of a testing laboratory. It also covers the abilities to critically analyse audit findings to develop an action plan for implementing the identified corrective actions for continuous improvement.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of conducting an internal audit <ul style="list-style-type: none"> • Determine the scope of internal audit and evaluate detailed requirements of the planned audit. • Identity procedures and/or the work area to be audited, and collect relevant documentation. • Allocate roles and responsibilities of personnel in internal audit team. • Explain the audit process and develop a detailed audit plan in consultation with relevant personnel. • Develop an audit checklist to identify conformance and non-conformance. • Apply the concept of horizontal, vertical and witness audits in conducting internal audit. 2. Conduct internal audit and report findings <ul style="list-style-type: none"> • Determine the components of the quality system and work area to be audited. • Collaborate with relevant personnel to maximise continuous improvement and ownership of the audit process. • Collect sufficient evidence to identify non-conforming aspects of the quality system. • Compile findings from the audit processes in the required format. • Maintain accurate records of internal audit. • Analyse nonconformities critically to investigate the root causes. • Propose corrective actions for identified nonconformities. • Suggest strategies and procedures for the implementation and monitoring of the corrective actions. • Generate an action plan for the implementation of corrective actions and monitoring of their effectiveness to improve the quality system. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the internal audit of laboratory quality system is conducted timely and effectively.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • conduct an internal audit of the laboratory quality system according to the audit plan by determining the scope and detailed requirements of the internal audit, • collect and analyse all necessary data/documentation/records to investigate nonconformities and their root causes, • generate an action plan to implement and monitor the corrective actions for continuous improvement of the laboratory quality system.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories • ISO 9001 Quality Management Systems • ISO 19011 Guidelines for Auditing Management Systems

Unit of Competency

Functional Area: Testing Quality Management

Title	Implement corrective actions for testing services
Code	105904L4
Range	This unit of competency (UoC) covers the abilities to identify root causes of detected nonconformities in a testing laboratory and implement appropriate corrective actions to eliminate the causes.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of identifying root cause of detected nonconformity in the laboratory <ul style="list-style-type: none"> • Examine the nonconformities detected in the laboratory. • Identify and investigate the root causes of nonconformities. 2. Implement corrective actions for testing services <ul style="list-style-type: none"> • Implement appropriate corrective actions to eliminate identified nonconformities. • Consult with relevant personnel regarding the necessary strategies to improve the laboratory operations and quality system. • Report the effectiveness of the corrective actions after an agreed time interval. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the corrective actions are effective to handle detected nonconformities in the laboratory.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • identify the root causes of nonconformities detected in the laboratory technical operations and quality system, • implement corrective actions to eliminate identified nonconformities.
Remark	

Unit of Competency

Functional Area: Testing Quality Management

Title	Implement preventive actions for testing services
Code	105905L4
Range	This unit of competency (UoC) covers the abilities to identify the potential sources of nonconformities in technical operations and management system of a testing laboratory and implement appropriate preventive actions for continuous improvement.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of identifying potential sources of nonconformities in the laboratory <ul style="list-style-type: none"> • Employ scientific and technical knowledge underpinning the processes, procedures, equipment and instrumentation associated with the individual's work tasks and duties. • Describe the operating procedures associated with the individual's regular technical duties. • Identify the role of laboratory services to the organisation and customers. • Identify potential sources of nonconformities in laboratory technical operations and management system by, e.g.: <ul style="list-style-type: none"> • analysis of test and quality control data, • review of standard operating procedures, • trend and risk analysis, • proficiency test results. 2. Implement preventive actions for testing services <ul style="list-style-type: none"> • Implement preventive actions according to the identified potential sources of nonconformities. • Monitor and report the effectiveness of preventive actions based on: <ul style="list-style-type: none"> • the extent of preventive actions, • the likelihood of the occurrence of nonconformities, • the consequence of the potential nonconformities. • Identify and report opportunities for continual improvements in procedures, processes and equipment in work area. • Recommend improvement actions and monitor their implementation and effectiveness to eliminate possible causes for sub-optimal performance. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the preventive actions are effective to handle potential nonconformities in the laboratory.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify potential nonconformities in laboratory technical operations and management system, • implement preventive actions to eliminate the likelihood of the occurrence of nonconformities in the laboratory.
Remark	

Units of Competency for Inspection - Inspection Operations

Unit of Competency

Functional Area: Inspection Operations

Title	Prepare work documents for conducting inspection
Code	105914L3
Range	This unit of competency (UoC) covers the abilities to prepare work documents and instructions for conducting inspection in accordance with standard operating procedures of the inspection body.
Level	3
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of work documents required for conducting inspection <ul style="list-style-type: none"> • Describe the inspection procedures such as planning, sampling, testing results recording. • Identify the specifications of product / process to be inspected and the production system such as significant factors, control points. • Identify the content or type of information to be collected during the inspection. • Collect and review the information relevant to inspection activities and work document preparation for recoding inspection results. • Describe the documentation and record system of the inspection body. 2. Prepare work documents for conducting inspection <ul style="list-style-type: none"> • Identify the scope and requirements of the work documents and instructions. • Assign unique identification of work documents. • Follow documentation format to prepare documents by taking into consideration of selected inspection method, equipment and apparatus used, qualified personnel, sampling and testing requirements, acceptance criteria of inspection and professional judgement. • Control work documents to keep them up-to-date and available to the relevant personnel. • Maintain work documents to ensure their functionality for inspection 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure work documents are appropriate and fit for intended use.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • prepare work documents fit for practical use in conducting inspection efficiently.
Remark	

Unit of Competency**Functional Area: Inspection Operations**

Title	Identify equipment and resources requirement for conducting inspection
Code	105911L4
Range	This unit of competency (UoC) covers the abilities to identify equipment and resources requirement for conducting inspection by determining a range of measuring equipment and resources required for particular inspection activities in public or private organisations.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of equipment and resources required for conducting inspection <ul style="list-style-type: none"> • Describe the design and application of basic components in trade measuring equipment. • Identify the type of inspection required for a range of measuring equipment. • Specify the requirements of resources used for inspection activities. 2. Identify equipment and resources requirement for conducting inspection <ul style="list-style-type: none"> • Study the inspection methods and plans for resources requirements • Identify the operating features of equipment. • Identify the location and uses of components in measuring equipment. • Select and use the specialised equipment in prescribed manner for the inspection. • Confirm the equipment for existing verification/certification marks. • Apply appropriate tolerances to measuring equipment used for inspection. 3. Exhibit professionalism <ul style="list-style-type: none"> • Apply the equipment in consistent with the environment and objective factors.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify the requirements of resources by studying the inspection methods and plans, • identify and select suitable equipment for inspection with consideration of environmental factors.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Identify items and samples for inspection
Code	105912L4
Range	The unit of competency (UoC) covers the abilities to identify, collect and handle items and samples at field or production sites using specified equipment and procedures for inspection purpose.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of inspection requirements on samples <ul style="list-style-type: none"> • Describe the inspection method and inspection plan. • Analyse the characteristics of items and samples for inspection. • Specify the sampling plan and equipment requirements. • Identify appropriate statistical sampling techniques. • Identify potential site hazards. • Specify the traceability requirements of inspection items and samples. • Describe different handling methods for inspection items and samples 2. Identify items and samples for inspection <ul style="list-style-type: none"> • Confirm the purpose, priority and scope of the sampling request. • Liaise with relevant personnel to arrange site access and all necessary clearances/permits. • Identify the required sample containers and labelling tools such as marking pens and adhesive labels. • Apply appropriate sampling procedures for a variety of items and samples at a range of sites. • Apply appropriate safety measures during sampling at field or production sites. • Apply appropriate methods for handling inspection items and samples. • Record all sample information such as sample number, sampling location, sample descriptions, sample appearance, environmental conditions and any other factors that may have impact on sample integrity in accordance with traceability requirements. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain the integrity of items and samples during handling and transportation. • Collect right samples at right sampling points upon customer requests.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify, collect and label inspection items and samples accurately using specified equipment and procedures, • handle inspection items and samples by appropriate methods to meet the traceability requirements.
Remark	

Unit of Competency**Functional Area: Inspection Operations**

Title	Define defect classification and acceptance criteria
Code	105913L4
Range	This unit of competency (UoC) covers the abilities to define agreed defect classification and acceptance criteria for a particular product and/or process for inspection.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of defect classification and requirements of acceptance criteria <ul style="list-style-type: none"> • Exercise professional judgement on inspection activities. • Identify the product and/or process to be inspected. • Describe different types of defect for inspection activities. • Identify relevant international standards and industrial specifications for a particular product and/or process. 2. Define defect classification and acceptance criteria <ul style="list-style-type: none"> • Search defect classifications such as the grade (e.g. critical, major or minor), type and physical attributes and acceptance criteria according to international standards, industrial norms and specifications. • Interview customer and industrial parties to determine the acceptance criteria. • Define defect classification and associated deliverables in measurable terms by taking into account of constraints. • Establish acceptance criteria to evaluate each deliverable. • Confirm the definitions with relevant personnel. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure defect classification and acceptable criteria are well defined. • Document the process for analysing variances and their impact on the inspection.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • define defect classification and acceptance criteria for a particular product and/or process to be inspected according to international standards, industrial norms and specifications.
Remark	

Unit of Competency**Functional Area: Inspection Operations**

Title	Develop inspection methods from international standards
Code	105906L5
Range	This unit of competency (UoC) covers the ability to develop technical inspection methods by interpreting the requirements from international standards in inspection bodies.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of developing inspection methods <ul style="list-style-type: none"> • Define purposes and uses of inspection method. • Specify the requirements of developing inspection methods. • Interpret the requirements in international standards for proposed inspection methods to be developed. • Explain technical terms used in inspection. • Determine inspection planning, sampling and inspection techniques, testing and personnel required in the inspection field. • Employ the validation and statistical techniques of the inspection methods. 2. Develop inspection methods from international standards <ul style="list-style-type: none"> • Examine the inspection method from relevant international standards of same inspection field. • Consult with users or relevant parties about the suitability of inspection method for the scope of work from the review and evaluation by users and industrial associations. • Generate the structure of the inspection method by focusing on the flow of information, style, tone and content format. • Assess a range of information requirements with reference to layout and document structure. • Design document templates and style guides in consistent with international standards. • Apply content format and style according to inspection method templates. • Assign unique identification of inspection method and construct the inspection procedures based on the template, type of inspection bodies, industrial norms, user needs and scope of work using the information gathered. • Submit the inspection method to relevant parties for review, approval and publishing. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the developed inspection method is fit for intended use.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • develop technical inspection methods by interpreting the requirements in international standards and meeting the scope of work of the inspection body.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Develop non-standard inspection methods
Code	105907L5
Range	This unit of competency (UoC) covers the abilities to develop non-standard inspection methods that can meet organisational requirements, regulatory requirements and/or customer's needs for inspection services provided by inspection bodies.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of developing non-standard inspection methods <ul style="list-style-type: none"> • Specify the organisational requirements for developing non-standard inspection methods. • Interpret the regulatory requirements for the inspection of product and/or process. • Review the customer's need on the inspection service. • Explain technical terms used in inspection. • Determine inspection planning, sampling and inspection techniques, testing and personnel required in the inspection field. • Employ the validation and statistical techniques of non-standard inspection methods. 2. Develop non-standard test methods to meet requirements <ul style="list-style-type: none"> • Identify and evaluate the need for non-standard inspection methods in consultation with management, production, development and maintenance staff, and in accordance with organisational requirements and customer's needs. • Establish specifications and justification for non-standard inspection methods. • Develop suitable documentation and associated procedures in accordance with the approved specification for proposed arrangements. • Prepare draft non-standard inspection methods. • Trial-run and validate non-standard methods to a range of situations with the intended users according to the defined requirements. • Modify the draft non-standard inspection methods according to the feedback provided by intended users to meet work quality goals. • Document the outcomes of the trial run and validation of draft non-standard inspections methods. • Seek approval of non-standard inspection methods from appropriate personnel for implementation. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the developed non-standard inspection methods are effective and their validation procedures and outcomes are documented.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • develop non-standard inspection methods fit for intended use to meet organisation and regulatory requirements, • validate non-standard inspection methods and seek approval of non-standard inspection methods according to organisational procedures.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Manage inspection methods
Code	105908L5
Range	This unit of competency (UoC) covers the abilities to manage inspection methods by reviewing and evaluating the inspection methods for continuous improvement in compliance with the scope and requirements of the inspection body.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of managing inspection methods <ul style="list-style-type: none"> • Explain technical requirements of inspection methods. • Command inspection procedures including planning, sampling, testing required. • Determine the scope of work of the inspection body and analyse the requirements for continuous improvement in the inspection body. 2. Manage inspection methods <ul style="list-style-type: none"> • Review the suitability and feasibility of the inspection methods for use. • Collect and analyse the feedback from various parties on reviewing the inspection methods. • Consult with relevant parties to validate and confirm the scope of work. • Interpret and evaluate the inspection methods and confirm details with relevant parties. • Validate and review the method structure and functionality with the user. • Evaluate the inspection methods periodically for change and improvements. • Assess evaluation results and revise the inspection methods where necessary. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the inspection methods are fit for purpose and reviewed periodically.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • review and evaluate the inspection methods periodically by consulting with relevant parties concerned, • assess the results of evaluation and revise the inspection methods for continuous improvement.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Evaluate customer's requests on inspection services
Code	105909L5
Range	The unit of competency (UoC) covers the abilities to critically evaluate the requests on inspection services from customers and respond to customers with accurate and relevant information in compliance with organisation and accreditation requirements.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of evaluating customer's requests on inspection services <ul style="list-style-type: none"> • Describe procedures relating to customer service and communication methods. • Explain technical details of inspection methods and procedures, inspection planning, sampling, recording of inspection observations and the key features of inspection reports and inspection certificates. • Analyse customer information about inspection services. • Employ the procedures for reviewing the contract terms and conditions. 2. Evaluate customer's requests on inspection services and provide appropriate response to customer <ul style="list-style-type: none"> • Clarify and confirm the source, nature and priority of the request. • Critically evaluate the request to generate the required information given the priority and costs involved. • Compile a range of information to customer by using appropriate technical terminology through the most appropriate communication method. • Check that the response has met the customer's needs and take appropriate actions if required, e.g. check if the activities of customer's organisation fall within the scope of the inspection body being accredited. • Review and liaise the contract terms and conditions with the customer. • Record and document all information and responses accurately in accordance with operating procedures set out by the inspection body. 3. Exhibit professionalism <ul style="list-style-type: none"> • Deal with the customer politely, efficiently and appropriately in accordance with operating procedures of the inspection body. • Maintain security and confidentiality of customer's information according to the code of conduct of the inspection body.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate customer's requests on inspection services to generate and synthesise the required information, • compile a range of response information that is accurate and relevant and communicate the response with the customer in an efficient and polite manner, taking into account of the customer's needs.
Remark	

Unit of Competency**Functional Area: Inspection Operations**

Title	Formulate inspection plans
Code	105910L5
Range	This unit of competency (UoC) covers the abilities to formulate inspection plans by analysing the scope of inspection activities, equipment used and technical information.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of planning inspection activities <ul style="list-style-type: none"> • Explain the need of inspection in accordance with organisational priorities. • Analyse the technology used for the manufacture of products to be inspected. • Determine the operation of the processes and the delivery of inspection services. • Differentiate the objectives and technique requirements of different timing of inspection, including: <ul style="list-style-type: none"> • pre-shipment inspection, • during production inspection, • raw materials inspection. • Explain characteristics of operations for different timing of inspection, e.g. quantitative (measuring) and qualitative (descriptive) characteristics and define specifications for these inspection characteristics. • Investigate factors affecting inspection results. 2. Formulate inspection plans <ul style="list-style-type: none"> • Justify the need and specifications of inspection plan, e.g. inspect several products and processes with one inspection plan, or one product or process with several inspection plans. • Select with justifications the manufacturing products and processes for inspection. • Establish the criteria of selecting appropriate testing equipment for inspection. • Determine the sequence of inspection operations and identify relevant personnel or department involved in the inspection processes. • Establish the compliance requirements (e.g. defects and acceptance criteria) of products and/or processes to be inspected. • Exercise professional judgement on the inspection results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the inspection plans can be used to justify the compliance of product / process against the inspection requirements.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • formulate the inspection plan by setting the sequence of inspection operations and selecting the testing equipment and operation characteristics for inspection.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Record inspection observations and findings
Code	105919L3
Range	This unit of competency (UoC) covers the abilities to record inspection observations and findings accurately by applying appropriate technologies and store the inspection records safely.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of conducting inspection and technologies for recording inspection observations and findings</p> <ul style="list-style-type: none"> • Describe the inspection plan and procedures. • Describe the types of observations and findings to be recorded during the inspection process. • Identify the technologies for recording inspection observations and findings and select appropriate digital, analogue or computerised means according to the types of observations and inspection plan. <p>2. Record inspection observations and findings</p> <ul style="list-style-type: none"> • Observe facilities and equipment to record all materials related to inspection observations and findings, e.g. photo-taking equipment, videotape recorder. • Input original inspection observations into inspection records at the time of inspection or sampling following the procedures and guidelines of inspection body. • Record all original inspection data pertinent to inspection reports, e.g.: <ul style="list-style-type: none"> • details of the client and the work order, including identification of the client, record of contract negotiation and telephone conversation, • full description of each product design, product, service, process or plant inspected, • identification of inspection method, • unique identifications of the inspected items, • identification and specification of equipment used for measuring and testing, • original inspection and/or test observations, checklist and calculations, • names of persons performing the inspection, sampling and calculation check, • date and time of inspection and sampling, • environmental conditions during the inspection and sampling, • results of any laboratory tests on the samples. • Store the inspection records safely according to operation procedures of the inspection body to protect confidential information. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Record observations and findings clearly and sign for corrections or alterations made in the records. • Record observations or data in the course of inspection in a timely manner so as to prevent loss of relevant information. • Maintain the integrity and confidentiality of inspection records.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • record inspection observations and findings accurately and clearly by applying appropriate recording technologies, • store the inspection records safely to maintain the confidentiality of information and traceability of records.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Perform on-site inspection of production processes / delivery of services
Code	105916L4
Range	This unit of competency (UoC) covers the abilities to perform on-site inspection of production process / delivery of services by examining the information gathered during the inspection of manufacturing premises and identify nonconformities against legislative and accreditation requirements.
Level	4
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of on-site inspection <ul style="list-style-type: none"> • Explain the legislative and accreditation requirements for the inspection and the purpose of inspection. • Identify the steps of production processes of various products, e.g.: <ul style="list-style-type: none"> • injection moulding, painting, electroplating, stamping, annealing for hardgoods, • soldering, painting, electroplating, assembly, packing for electrical and electronic products, • organising into frame, cutting, steaming and pressing to surface processing for building materials. • Describe the types of delivery of services to be inspected. • Prepare interview questions in a logical manner to cover all elements of an offence. 2. Perform on-site inspection of production processes / delivery of services <ul style="list-style-type: none"> • Develop a range of contingencies that facilitate minimal disruption to the manufacturer and compromise the inspection effectiveness and operational efficiency. • Apply appropriate inspection tools and measurement methods, e.g.: <ul style="list-style-type: none"> • size measurement for garment, • measurement chart, • metal detection check, • hi-pot check, • non-destructive testing for building materials. • Interview the manufacturer and witnesses for gathering the supporting evidence. • Identify nonconformities (e.g. failures in processes or deficiencies in the delivery of services) against legislative and accreditation requirements for the inspection related to the production processes and the products. • Examine the action taken when nonconforming work is identified. 3. Exhibit professionalism <ul style="list-style-type: none"> • Seek the advice from the manufacturer concerning the method of product return/disposal. • Strike for a balance between the operational efficiency of the manufacturer and the inspection effectiveness.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • perform on-site inspection of production processes by examining the gathered information and evidence during the surveillance and interview with the manufacturer and witnesses, • identify nonconformities against legislative and accreditation requirements.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Inspect items and samples
Code	105917L4
Range	This unit of competency (UoC) covers the abilities to inspect items and samples by applying appropriate statistical techniques for sampling and sample inspection skills during the inspection procedure and identify any defects on the items and samples.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of statistical sampling techniques and sample inspection skills <ul style="list-style-type: none"> • Describe the Acceptable Quality Level (AQL) sampling plan and its application. • Identify relevant random statistical techniques and differentiate (-risk and (-risk. • Describe general inspection skills set, e.g.: <ul style="list-style-type: none"> • quantity check, • sampling methods and procedures, • selection process. • Examine defect classification and acceptance criteria according to the inspection plan. 2. Inspect items and samples <ul style="list-style-type: none"> • Apply appropriate skills and processes to inspect items and samples, e.g.: <ul style="list-style-type: none"> • interpretation of requirements, • product description, • checking on style, colour, packaging, shipping mark, barcode, • carton drop check. • Apply appropriate statistical techniques for sampling of inspection items and samples. • Identify potential defects on the items and samples. • Record the defects by appropriate techniques, e.g. photo taking technique. • Record apparent abnormalities and inform the client where there is any doubt as to the item's suitability for the inspection to be carried out or where the item does not conform to the description provided. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate impartiality and confidentiality during the inspection.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • inspect items and samples by applying appropriate statistical sampling techniques and sample inspection skills and processes, • identify and record defects on the inspected items and samples.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Perform compliance inspection on materials
Code	105918L4
Range	The unit of competency (UoC) covers the abilities to detect non-compliance on goods and materials by taking accurate on-site measurements and recording on-site observations.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of compliance inspection <ul style="list-style-type: none"> • Identify the scope of inspection to be performed. • Identify the criteria of compliance checks on goods and materials to be inspected. • Determine the potential defects which may occur during the use of the goods and materials. • Describe the policies and procedures of the inspection body relating to conducting routine and non-routine inspections. 2. Perform compliance inspection on materials <ul style="list-style-type: none"> • Conduct compliance inspection in accordance with the policies and procedures of the inspection body. • Identify and define the designated area to be inspected. • Conduct accurate on-site measurements with appropriate measuring equipment and record on-site observations to identify defects and nonconformities. • Record non-compliance / possible breaches in accordance with legislative and/or the requirements of the inspection body. 3. Exhibit professionalism <ul style="list-style-type: none"> • Complete records of inspection work accurately in accordance with inspection and management system requirements.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • perform compliance inspection on goods and materials by taking accurate on-site measurements and recording on-site observations, • detect and record non-compliance / possible breaches in accordance with the requirements of the inspection body.
Remark	

Unit of Competency**Functional Area: Inspection Operations**

Title	Supervise on-site inspection
Code	105915L5
Range	This unit of competency (UoC) covers the abilities to supervise on-site inspection activities effectively and smoothly in the organisation under inspection.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of inspection requirements, practices and techniques <ul style="list-style-type: none"> • Examine the scope of inspection to be performed • Specify the requirements of the inspection to be carried out. • Employ a range of technologies used for the manufacture of products under inspection and assess their potential defects. • Describe the operation of processes and delivery of services. • Determine a range of factors affecting inspection results. 2. Supervise on-site inspection <ul style="list-style-type: none"> • Select and apply appropriate inspection method, work documents and inspection plan. • Select a team of inspectors having appropriate technical competence to perform different types, range and volume of inspection activities according to the inspection plan. • Assign duties and responsibilities of the team on inspection functions. • Monitor all inspectors and other personnel involved in inspection activities for satisfactory performance. • Provide clear instructions for sampling, testing and inspection field. • Supervise the team for selecting and using measuring equipment for inspection. • Exercise professional judgement to examine the inspection results and identify the potential failures in the operation or deficiencies in the delivery of services. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate effective and efficient leadership and communications skills.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • supervise and monitor a team of inspectors to undertake on-site inspection activities effectively and smoothly, • exercise professional judgement to examine the inspection results and identify defects of products and/or failures in operations.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Implement inspection quality control procedures
Code	105921L4
Range	This unit of competency (UoC) covers the abilities to implement quality control procedures in an inspection body by continuously monitoring the validity of inspection results in compliance with the formulated quality control protocol.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of quality control protocol and validity of inspection results <ul style="list-style-type: none"> • Describe the implementation plan of the formulated quality control protocol. • Apply the concepts of continuous improvement processes. • Describe the contract or work order control system. • Outline statistical techniques for checking inspection results. 2. Implement quality control procedures for inspection activities <ul style="list-style-type: none"> • Select monitoring methods appropriate for the type and volume of the inspection work undertaken. • Review inspection work undertaken regularly. • Check calculations and data transfer accurately to ensure error-free in inspection results. • Verify the integrity of information supplied by other party as a part of the inspection process. • Apply appropriate statistical techniques to check the validity of inspection results. • Take necessary actions to correct the problems and review the corrective actions undertaken. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the inspection results shall be internally traceable to the inspector(s) who performed the inspection.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement quality control procedures to review the inspection work undertaken regularly, • check the validity of inspection results by applying appropriate statistical techniques and verify the integrity of information supplied by other party, • implement and review corrective actions for tackling the identified problems.
Remark	

Unit of Competency

Functional Area: Inspection Operations

Title	Formulate quality control protocol for monitoring inspection results
Code	105920L5
Range	This unit of competency (UoC) covers the abilities to formulate the quality control protocol for monitoring the reliability and validity of inspection results in compliance with relevant international standard.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of quality control tools for monitoring inspection results <ul style="list-style-type: none"> • Interpret the quality control requirements of inspection results in relevant international standard. • Employ a range of statistical techniques for sampling, processing and interpretation of results. • Explain the requirements of contract or work order control system. 2. Formulate quality control protocol for monitoring inspection results <ul style="list-style-type: none"> • Establish the policy and procedures for monitoring inspection results and implementing the quality control protocol. • Establish a contract or work order control system: <ul style="list-style-type: none"> • work to be undertaken is within the expertise of the inspection body, • adequate resources are available to meet the requirements of the inspection plan, • the requirements are adequately defined and special conditions are understood, • work being undertaken is controlled by regular review and corrective action, • the requirements of the contract or work order have been met. • Establish a mechanism for checking calculations and data transfer from one location to another where errors could be introduced. • Establish procedures to verify the integrity of information supplied by other party as part of the inspection process. • Suggest appropriate statistical techniques to check the inspection results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality control protocol is implemented and monitored effectively for continuous improvement.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • establish the policy and procedures for monitoring inspection results, • establish a contract or work order control system, • establish a mechanism for checking inspection results by appropriate statistical techniques, • establish procedures to verify the integrity of information supplied by other party.
Remark	<p>The relevant international standard involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection

Unit of Competency

Functional Area: Inspection Operations

Title	Control inspection documents and records
Code	105991L5
Range	This unit of competency (UoC) covers the abilities to control and maintain a range of inspection documents and records to be readily retrievable in the inspection body according to relevant international standard and/or accreditation regulation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of document control system in an inspection body <ul style="list-style-type: none"> • Interpret the requirements of control of documents and control of records in relevant international standard and/or accreditation scheme. • Describe the procedures to control both internal and external documents in the inspection body. • Determine a range of documents to be controlled in the inspection body. • Describe the procedures for identification, storage, protection, retrieval, retention time and disposition of records. • Describe the procedures to retain inspection records with consideration of contractual and legal obligations as well as confidentiality arrangements. 2. Control inspection documents and records <ul style="list-style-type: none"> • Approve documents for adequacy before issuing for use. • Review and, where necessary, revise and re-approve documents periodically to ensure continuing suitability and compliance with applicable requirements and identify the changes and the current revision status of documents. • Identify documents of external origin and control their distribution. • Remove invalid or obsolete documents from all points of issue or use. • Store and retain records in a way that they are readily retrievable in the inspection body. • Retain records for a period consistent with the contractual and legal obligations of the inspection body. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure controlled documents are reviewed and managed effectively in the inspection body. • Ensure controlled records are retained securely and confidentially.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • approve, review and revise inspection documents to ensure continuing suitability and compliance with applicable requirements, • control and retain records according to the established procedures and confidentiality arrangements.
Remark	<p>The relevant international standard and laboratory accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection • HKIAS 003 Technical Criteria for Accreditation of Inspection Bodies

Unit of Competency

Functional Area: Inspection Operations

Title	Authorise inspection results and reports
Code	105922L5
Range	This unit of competency (UoC) covers the abilities to critically assess the accuracy of inspection data and validity of results in inspection reports prior to formally authorising the release of inspection reports and certificates to the customer.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of assessing the accuracy of data and validity of inspection results <ul style="list-style-type: none"> • Command technical knowledge of sampling, inspection methods and procedures, equipment and facilities for conducting inspection. • Describe the procedures of the inspection body for authorising inspection results and reports. • Interpret reporting requirements in relevant international standards and/or accreditation schemes. • Employ the concepts of using statistical techniques to determine data acceptability. 2. Authorise inspection results and reports <ul style="list-style-type: none"> • Verify the accuracy of data and validity of inspection results by: <ul style="list-style-type: none"> • inspecting data records to check the integrity of data entry, alterations, transfers and calculations, • confirming that technical records provide sufficient information to ensure traceability for the inspection involved. • Critically assess the significance of any documented observations or typical inspection conditions or environment and/or sample appearance. • Check and confirm that all calculations and data transfer are free from errors. • Authorise inspection reports and issue inspection certificates in compliance with the standard operating procedures of the inspection body. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure that all information in the inspection reports / certificates is verified correctly prior to issuance. • Maintain the integrity and confidentiality of information in the inspection reports / certificates in compliance with the code of conduct of the inspection body.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically assess the accuracy and integrity of data and inspection results and conform the correctness and sufficiency of information in technical records, • authorise inspection reports and issue inspection certificates to the customer in compliance with the standard operating procedures of the inspection body.
Remark	

Unit of Competency**Functional Area: Inspection Operations**

Title	Investigate complaints and appeals on inspection services
Code	105923L5
Range	This unit of competency (UoC) covers the abilities to investigate complaints and appeals on inspection reports / certificates by critically analysing suspicious inspection results and rectifying inspection reports.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and skills of handling complaints and appeals <ul style="list-style-type: none"> • Explain technical details of sampling, inspection methods and procedures, and inspection results. • Command effective problem solving techniques and cause analysis skills appropriate to inspection methods. • Describe procedures relating to customer service and communication protocols. 2. Investigate complaints and appeals on inspection services <ul style="list-style-type: none"> • Validate complaints and appeals relating to inspection activities by gathering and verifying all necessary information. • Analyse records of inspection observations, findings, calculations and data transfer. • Examine whether human and/or environmental factors could have effects on the reliability of inspection results. • Evaluate sources of interferences that may have occurred during measurements. • Verify whether sampling procedures could contribute to unexpected results. • Investigate possible root causes of unexpected results and appropriate preventive/corrective actions undertaken. • Record, notify and explain investigation decisions and actions undertaken to complainant or appellant clearly by appropriate communication means in accordance with standard operating procedures of the inspection body. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate a professional approach and positive organisation image by maintaining independence and an ability to resist improper influences. • Maintain the confidentiality of complainant's information in compliance with the code of conduct of the inspection body.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • investigate complaints and appeals by critically analysing records of inspection results and data in a logical and efficient manner, • explain investigation decisions and actions undertaken to the complainant / appellant clearly using appropriate communication means.
Remark	

Units of Competency for Inspection - Inspection Quality Management

Unit of Competency

Functional Area: Inspection Quality Management

Title	Formulate quality management system for inspection services
Code	105924L6
Range	This unit of competency (UoC) covers the abilities to formulate a quality management system in an inspection body according to its operational needs by critically evaluating requirements in relevant international standards and interpreting accreditation requirements.
Level	6
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of quality management system for body providing inspection services <ul style="list-style-type: none"> • Determine the scope of activities of the inspection body. • Analyse resources requirements and availability in the inspection body. • Critically evaluate the requirements of quality management system in relevant international standards for inspection body. • Interpret the requirements of quality management system in relevant accreditation scheme for inspection body. 2. Formulate quality management system in accordance with the requirements of relevant international standards <ul style="list-style-type: none"> • Establish the framework for the management system that is capable of supporting and demonstrating the consistent achievement of the requirements of relevant international standards. • Develop policies and objectives for quality management system. • Evaluate a broad range of resources and manpower required for establishing, implementing and maintaining the management system. • Develop procedures for identifying, assessing and treating quality issues related to inspection functions. • Develop plan and procedures for implementing the quality management system in the inspection body, including the following components: <ul style="list-style-type: none"> • management system documentation, • control of documents and records, • internal audits, • management reviews, • corrective actions and preventive actions, • handling complaints and appeals. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality management system is fit for the purpose and complies with the scope of activities of the inspection body.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • formulate the quality management system and its implementation procedures for an inspection body by critically evaluating the requirements in relevant international standards and accreditation scheme.
Remark	<p>The relevant international standard and accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection • HKIAS 003 Technical Criteria for Accreditation of Inspection Bodies

Unit of Competency

Functional Area: Inspection Quality Management

Title	Implement inspection quality management system
Code	105925L5
Range	This unit of competency (UoC) covers the abilities to implement quality management system in the inspection body in compliance with the formulated quality management system and procedures.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of quality management system and its implementation requirements for an inspection body <ul style="list-style-type: none"> • Apply the concepts of continuous improvement processes. • Explain the implementation plan of quality management system. • Identify the objectives of quality management system for inspection body. • Determine resource requirements in the implementation process. • Identify the training needs of personnel responsible for the implementation of quality management system. 2. Implement quality management system in the inspection body <ul style="list-style-type: none"> • Establish and follow the timeline for tasks to be performed with projected completion dates. • Secure necessary resources which are in place and available for implementation, e.g.: <ul style="list-style-type: none"> • all financial requirements, • personnel needs such as number of staff required, training need of staff, • facilities, equipment, supplies of materials. • Implement procedures for controlling internal and external documents and records relating to the inspection activities and management system. • Establish a system for monitoring the implementation of the quality management system in the inspection body. • Adjust the implementation plan and communicate effectively with personnel involved in the implementation of quality management system. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality management system is implemented in compliance with the established plan and defined objectives.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement quality management system in the inspection body by establishing the timeline for tasks to be performed in compliance with the defined objectives, • establish a system for monitoring the quality management system and adjust the implementation plan by exercising appropriate judgement.
Remark	

Unit of Competency**Functional Area: Inspection Quality Management**

Title	Evaluate subcontractor of inspection activities
Code	105926L5
Range	This unit of competency (UoC) covers the abilities to critically evaluate subcontractor of inspection activities to ensure the inspection quality conforming to relevant international standards and/or accreditation regulations.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of outsourcing and subcontracting strategy of the inspection body <ul style="list-style-type: none"> • Interpret the outsourcing strategy by considering all related factors and its follow up activities for subsequent implementation / operation of the strategy. • Review the purpose, priority and specific requirements of subcontracting work with the customer request. • Define the scope of work provided by / subcontracting to the outsourcing entity. • Formulate criteria for the selection, qualification and monitoring of the outsourcing entity including documentation procedure of maintaining all related records to demonstrate the competency and impartiality, e.g. training records and resume demonstrating working experience, evaluation records. 2. Evaluate subcontractor of inspection activities <ul style="list-style-type: none"> • Analyse the conditions under which outsourcing may take place, e.g. workload, need for further expertise, temporary incapacity, beyond the capability or resources of the inspection body. • Evaluate the competence, impartiality and confidentiality of the outsourcing entity to perform the outsourced inspection services. • Follow closely the policy and procedure for subcontracting of inspection service, including those procedures appropriate to site operations for management of contracts. • Advise subcontracting arrangement and gain approval of the customer for accepting the selected subcontractor. • Monitor the quality of subcontractor's services for inspection activities in conformance with relevant international standard. • Evaluate the subcontractor after the completion of work and update the register of subcontractors for inspection services. • Investigate dispute cases to identify causes and validity for dispute resolution and seek appropriate technical/legal advice to clarify dispute issues. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the subcontractor conforms to requirements of the inspection body and also to relevant international standards.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate the competence, impartiality and confidentiality of the subcontractor to perform the outsourced inspection activities in accordance with the strategy of the inspection body, • take responsibility for all activities outsourced to subcontractor by monitoring and evaluating the quality of its work and outputs.
Remark	<p>The relevant international standard and accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection • HKIAS 003 Technical Criteria for Accreditation of Inspection Bodies

Unit of Competency

Functional Area: Inspection Quality Management

Title	Conduct management review on inspection services
Code	105927L5
Range	This unit of competency (UoC) covers the abilities to review the management system of the inspection body at planned intervals to ensure its continuing suitability, adequacy and effectiveness in accordance with relevant international standards and the quality management system of the inspection body.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of management system of the inspection body and its review requirements</p> <ul style="list-style-type: none"> • Determine the scope and detailed requirements of reviewing management system of the inspection body. • Determine scheme(s) / product(s) to be covered in the periodical management review. • Interpret the requirements of quality management system in relevant international standards. • Propose the agenda and review interval of the management review. <p>2. Conduct management review of the inspection body</p> <ul style="list-style-type: none"> • Gather related information for input to the management review, e.g.: <ul style="list-style-type: none"> • results of internal and external audits, • feedback from clients and interested parties, • the status of preventive and corrective actions, • follow-up actions from previous management reviews, • the fulfilment of objectives, • changes that could affect the management system, • appeals and complaints. • Establish performance indicators in accordance with relevant international standards. • Analyse a range of collected information and recommend decisions and actions related to: <ul style="list-style-type: none"> • improvement of the effectiveness of the management system and its processes, • improvement of the inspection body related to the fulfilment of relevant international standards, • resource needs. • Retain all records of the management review inputs and outputs, including the follow up actions. • Allocate required resources for improvement plan / action proposed in the management review. • Monitor and report progress of the follow up actions. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure all aspects of the management review have been covered and evaluated. • Exercise good analytical power to review the performance of the management system. • Strive for continual improvement by identifying improvement opportunities.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • conduct management review in a timely and regular manner in accordance with the quality management system of the inspection body, • monitor and evaluate the progress of review outputs to ensure the continuing suitability, adequacy and effectiveness of the inspection body.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection • ISO 9001 Quality Management Systems

Unit of Competency

Functional Area: Inspection Quality Management

Title	Conduct internal audit of inspection services
Code	105928L5
Range	This unit of competency (UoC) covers the abilities to prepare for, carry out and document an internal audit of the quality system of an inspection body. It also covers the abilities to objectively and critically analyse audit findings to develop improvement action plan.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of preparation for conducting an internal audit in the inspection body <ul style="list-style-type: none"> • Determine the scope and detailed requirements of the internal audit. • Describe procedures for conducting internal audit to verify the fulfilment of relevant international standards and accreditation requirements, as well as the internal guideline and specifications for internal audit. • Devise audit programme and audit plan by taking into consideration of the importance of the process and areas to be audited, as well as the results of previous audits. • Allocate audit resources with knowledge of inspection and requirements of the applied international standards. • Develop an audit checklist and auditing documents for collection of objective evidence within the scope. • Demonstrate inspection and auditing skills. • Apply the concept of horizontal, vertical and witness audits in conducting internal audit. 2. Conduct internal audit in the inspection body <ul style="list-style-type: none"> • Apply and document appropriate sample methodology, including the sampling method to be deployed in the internal audit. • Collect sufficient objective evidence to identify and evaluate non-conforming aspects of the quality system in the inspection body. • Analyse the evidence critically to identify suitable corrective actions. • Collaborate with relevant personnel to maximise continuous improvement and ownership of improvement. • Propose corrective actions for identified nonconformities. • Suggest strategies and procedures for the implementation and monitoring of the corrective actions. • Maintain audit documents and accurate records. • Document and report audit findings in the required format. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the internal audit is conducted timely and effectively. • Demonstrate unbiased judgement and impartiality with good communication skill and strong analytical power.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • conduct an internal audit to collect and analyse the evidence critically to identify nonconformities in the inspection body, • document and report audit results, • generate an action plan to implement and monitor the corrective actions for continuous improvement of inspection services.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection • ISO 9001 Quality Management Systems • ISO 19011 Guidelines for Auditing Management Systems

Unit of Competency**Functional Area: Inspection Quality Management**

Title	Manage and handle nonconforming inspection work
Code	105929L5
Range	This unit of competency (UoC) covers the abilities to examine nonconforming inspection work or departures from the policies and procedures in the management system and/or technical operations by evaluating the evidence collected in the inspection body, and recommend improvement measures to manage the nonconformities.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of technical aspects of inspection procedures and documents of management system <ul style="list-style-type: none"> • Employ the concepts of inspection methods and describe inspection quality control procedures. • Describe the quality manual and documents relevant to the management system of the inspection body. • Devise suitable approach and procedures to identify nonconforming inspection work and inspection reports. • Interpret the requirements for control of nonconforming inspection work in relevant international standards and accreditation requirements. 2. Manage and handle nonconforming inspection work <ul style="list-style-type: none"> • Identify nonconforming inspection work or departures from the policies and procedures in the management system and/or technical operations through a variety of activities, e.g.: <ul style="list-style-type: none"> • internal or external audits, • management reviews, • feedback from customers or complaints, • staff observations / suggestions. • Analyse the problems and evaluate the significance of nonconforming inspection work and impact of nonconforming inspection reports. • Take appropriate action immediately together with the decision about the acceptability of the nonconforming work. • Establish a mechanism to recall nonconforming inspection reports that have been issued. • Identify root causes of the nonconforming work and establish procedures for implementing corrective actions timely and effectively. • Recommend appropriate measures for continuous improvement of the inspection body. 3. Exhibit professionalism <ul style="list-style-type: none"> • Collect sufficient evidence and analyse all necessary data/ documents/ records to identify nonconforming inspection work.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify nonconformities in the management system and/or technical operations of the inspection body by applying suitable approach and procedures, • evaluate the significance of nonconformities and impact of nonconforming inspection reports, • recommend improvement measures and corrective actions to eliminate identified nonconformities in the inspection body.
Remark	<p>The relevant international standard and accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17020 Conformity Assessment – Requirements for the Operation of Various Types of Bodies Performing Inspection • HKIAS 003 Technical Criteria for Accreditation of Inspection Bodies

Unit of Competency

Functional Area: Inspection Quality Management

Title	Implement corrective actions and preventive actions for inspection services
Code	105930L4
Range	This unit of competency (UoC) covers the abilities to identify operational and potential nonconformities in the inspection body and implement appropriate corrective actions and preventive actions to eliminate the causes of nonconformities.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of operational and potential nonconformities in the inspection body <ul style="list-style-type: none"> • Determine the causes of operational nonconformities, e.g. <ul style="list-style-type: none"> • violation of accreditation requirements, • complaints and appeals, • management reviews and internal audits. • Anticipate the causes of potential nonconformities in the technical operations and/or management system of the inspection body. • Define the method applied in the evaluation of the need for corrective action and preventive action, e.g. risk analysis approach. • Describe the handling process of the corrective and preventive actions, including root cause analysis, correction and corrective action applied, result of the action taken, review of effectiveness, preventive action applied. • Allocate roles and responsibilities for the identification, evaluation, implementation and review of corrective actions and preventive actions. 2. Implement corrective actions and preventive actions for inspection services <ul style="list-style-type: none"> • Implement corrective actions needed to prevent recurrence of identified nonconformities in a timely manner according to the established action plan. • Implement preventive actions needed to prevent the occurrence of potential nonconformities in the inspection body. • Examine the results of actions taken. • Review the effectiveness of the corrective actions and preventive actions taken. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the performance of the actions deployed in all relevant parts of the inspection body is evaluated in a timely manner.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • identify the causes of operational and potential nonconformities in the operation of the inspection body, • implement corrective actions and preventive actions according to the established action plans, • review the effectiveness of actions taken to eliminate the recurrence of operational nonconformities and occurrence of potential nonconformities.
Remark	

Units of Competency for Certification - Certification Operations

Unit of Competency**Functional Area: Certification Operations**

Title	Identify and select competent audit team
Code	105936L4
Range	This unit of competency (UoC) covers the abilities to identify and select the audit team, including the audit team leader, according to the pre-determined competence criteria with regard to the requirements of management system standard.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of specific management system standards and certification body's processes <ul style="list-style-type: none"> • Describe procedures of certification body to obtain the information of client's products, processes and organisation. • Identify the client business sector. • Describe the specific management system standard that the client is to be certified. • Describe the pre-determined competence criteria of required knowledge and skills necessary to effectively perform audit and certification tasks. 2. Identify and select competent audit team <ul style="list-style-type: none"> • Analyse the requirements of management system standard or specification for each technical area and for each function in the certification process. • Identify competent audit team members with the following consideration: <ul style="list-style-type: none"> • audit objectives, scope, and competence criteria, • requirements of management system standard or specification, • certification requirements, e.g. statutory, regulatory or contractual aspects. • Select competent audit team members according to the client's management system / operation, objectives of the audit and physical location. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the audit team members are competent in conducting certification audits. • Demonstrate effective communication and planning skills.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • identify and select audit team including auditors and audit team leaders, taking into account of the competence needed to achieve the objectives of the audit.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Prepare work documents for conducting audit
Code	105938L4
Range	This unit of competency (UoC) covers the abilities to prepare work documents such as audit guidelines and boundaries for conducting audit to ensure sufficient audit depth is achieved in a timely manner.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of work documents required for certification audit <ul style="list-style-type: none"> • Identify the content / type of information to be collected during the audit. • Collect and review the information relevant to audit assignments and work document preparation for recoding audit evidence. • Describe the audit trail to support the audit process and address the requirements as defined by the scope of the audit in compliance with the audit requirements. 2. Prepare work documents <ul style="list-style-type: none"> • Prepare audit work documents such as checklists, audit sampling plans, forms for recording information. • State the details and the quantities of information to be collected as audit evidence to support audit results. • Provide an outline for recording both positive findings and nonconformities. • Provide an outline of audit documents for driving post-audit action, e.g. cause analysis, correction and corrective action by the organisation being audited, responsible parties for improvement processes. • Provide a guideline for documenting the audit evidence of potential nonconformities. 3. Exhibit professionalism <ul style="list-style-type: none"> • Exercise effective time management to prepare work documents for conducting audit.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • prepare work documents for conducting audit efficiently.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Review client's application for certification
Code	105932L5
Range	The unit of competency (UoC) covers the abilities to critically review the application for certification from the client and respond to it with accurate and relevant information in compliance with accreditation requirements.
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of reviewing client's application for certification <ul style="list-style-type: none"> • Describe the process of the certification body on reviewing client's application for certification. • Describe the procedures of the certification body relating to customer service and communication protocols. • Obtain client information on its business sector, products, processes and organisation, and its management system. • Examine the requirements of specific management system standards / normative documents for certification. 2. Review client's application for certification and provide appropriate response to the client <ul style="list-style-type: none"> • Establish and evaluate the scope and boundaries of the certification sought, with reference to client's critical activities, processes / workflow and physical boundaries. • Justify the presentation and wording of the scope statement to reflect the actual operation and underlying processes. • Determine the competence required by the audit team including the audit team leader for certification activities according to the established competence criteria. • Determine the audit time needed, including planning and accomplishing a complete and effective audit of the client's management system, with consideration of the multi-site sampling (where applicable). • Verify that the client is a legal entity by checking its Business Registration or other relevant documents. • Verify the regulatory conformity of the legal entity for the established management system, e.g. fire certification for Occupational Health and Safety Assessment. • Confirm the certification validity in terms of authenticity, duration and scope of activities covered by the management system certification for certification transfer application. • Check previous audit reports within the review cycle to confirm if there is no outstanding issue. • Provide decision of accepting or rejecting the application of certification to the client by using appropriate technical terminology through the most appropriate communication method. • Record and file all responses and justification for the decision accurately in accordance with operating procedures set out by the certification body. • Record reasons for declining the client's application for certification / certification transfer. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the response provided to the client is accurate, relevant and complies with organisation / accreditation requirements. • Maintain security and confidentiality of client's information.

Unit of Competency

Functional Area: Certification Operations

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• critically review client's application for certification by establishing the scope of certification and determining the required competence of audit team and the audit time,• generate and communicate the decision of application and other information that are accurate and relevant with the client in an efficient and effective manner.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Develop audit programme
Code	105933L5
Range	This unit of competency (UoC) covers the abilities to develop audit programme for the full certification cycle and justify the audit activities required to demonstrate that the client's management system fulfils the requirements for certification to the selected standard(s).
Level	5
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of developing audit programme <ul style="list-style-type: none"> • Describe the process of the certification body on developing audit programme. • Analyse client information on its business sector, products, processes and organisation, and its management system. • Specify the requirements of specific management system standards / normative documents for certification. • Interpret the scope, technical and management requirements of relevant certification scheme. 2. Develop audit programme <ul style="list-style-type: none"> • Assess the following information required for developing audit programme: <ul style="list-style-type: none"> • size and nature of the client organisation with consideration of the multi-site sampling (where applicable), • scope, functionality, complexity and level of maturity of the management system(s) applied, • results of any previous audits. • Establish the full certification cycle including: <ul style="list-style-type: none"> • two-stage initial certification audit, • surveillance audits, • a recertification audit prior to expiration of certification. • Formulate the audit activities required to demonstrate that the client's management system fulfils the requirements for certification to the selected standard(s) or other normative document(s). • Establish procedures and criteria for reviewing and revising the audit programme. • Review and adjust the audit programme with justification by collecting sufficient and verifiable information on the client's certification status. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the developed audit programme is implemented and reviewed effectively.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • develop the audit programme for the full certification cycle of the client's management system, • formulate the audit activities required to demonstrate that the client's management system fulfils the requirements for certification to the selected standard(s) or other normative document(s).
Remark	<p>The relevant accreditation requirements involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • International Accreditation Forum (IAF) <ul style="list-style-type: none"> • IAF MD 5: Mandatory Document for Duration of QMS and EMS Audits • IAF MD 1: Mandatory Document for Certification of Multiple Sites Based on Sampling

Unit of Competency

Functional Area: Certification Operations

Title	Formulate certification / surveillance audit plan
Code	105934L5
Range	This unit of competency (UoC) covers the abilities to formulate certification / surveillance audit plan to achieve the audit objectives. This UoC also contributes to plan the audit processes within the specified timeframes so as to facilitate time management and confirm audit results.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of planning certification / surveillance audit <ul style="list-style-type: none"> • Review the management system requirements of the organisation to be audited. • Analyse the applicable legal and other requirements relevant to the activities and products of the organisation to be audited. • Determine audit objectives and establish audit scope and criteria for each audit identified in the audit programme. • Identify responsibilities, competencies and qualifications of audit team personnel required according to the scope of audit. • Review previous audit results and the current status of management system of the certified organisation for surveillance audit. 2. Formulate certification / surveillance audit plan <ul style="list-style-type: none"> • Justify the criteria for selecting audit team members and technical expert (including translator) if required. • Schedule the activities to be conducted in the audit plan. • Arrange the dates and sites where the on-site audit activities are to be conducted, including visits to temporary sites, as appropriate. • Assign the responsibility of each audit team member for conducting the individual audit. • Assess the audit procedures where audit methods, means and resources, including logistics like travelling are adequately stated. • State the proposed client meeting arrangement, including opening and closing meetings. • Establish procedures for monitoring the progress of the audit plan execution. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the audit rundown is appropriate and reasonable where confidentiality, information security and health and safety are addressed.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate the certification / surveillance audit plan in a timely manner before the commencement of audit, • evaluate and justify the duration, competencies of audit team, scope and criteria to achieve the objectives of the audit, • manage the audit plan by considering the needs of client and audit team members.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Identify requirements of management system in international standards
Code	105935L5
Range	The unit of competency (UoC) covers the abilities to critically evaluate the requirements of management systems in international standards and apply relevant standards to conduct the audit and achieve the audit objectives.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of international standards relevant to management systems <ul style="list-style-type: none"> • Specify the type and context of the management system of the organisation to be audited. • Determine the scope of the organisation reflecting the business characteristics without ambiguity. • Command the concepts of 'Plan-Do-Check-Act' methodology for improving the effectiveness of management systems. 2. Identify requirements of management systems in international standards <ul style="list-style-type: none"> • Examine the purpose of the requirements of management systems in international standards. • Explain the interrelationship of other supporting documents / guidelines, e.g. ISO 9004 supporting ISO9001 and definition of many other standards of management systems. • Evaluate the common requirements of integrated management systems. • Apply relevant contexts of management system requirements in international standards to conduct audit effectively. 3. Exhibit professionalism <ul style="list-style-type: none"> • Keep abreast of the latest version of international standards.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • evaluate critically the requirements of management system in the international standards, • apply contexts of management system requirements to conduct audit effectively.
Remark	<p>The international standard relevant to this UoC is:</p> <ul style="list-style-type: none"> • ISO 9000 Series Quality Management System

Unit of Competency

Functional Area: Certification Operations

Title	Manage certification services
Code	105931L6
Range	This unit of competency (UoC) covers the abilities to manage the certification services by executing the deployment plan and monitor the performance of the delivery in compliance with the related requirements.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of certification services and accreditation requirements <ul style="list-style-type: none"> • Explain technical requirements of the unique feature of the certification scheme, e.g. audit duration, audit visit cycle, assessor qualifications. • Evaluate respective roles in the certification audit, e.g. compliance manager, certification decision makers, auditors, technical experts (if needed). • Examine the resource and competency requirements of respective roles. • Interpret the following aspects in the certification auditing services: <ul style="list-style-type: none"> • certification methodology and procedures, • equipment / tools required in conducting audit, • management system to be audited and its audit criteria, • requirements of environmental conditions. 2. Manage certification services <ul style="list-style-type: none"> • Execute the deployment plan according to the scheme related to various derivatives which are under the scheme owners' rule and / or accreditation requirements. • Manage all requests for support of respective services within that business unit. • Design and formulate certification service plan, including facilitating the development of personnel and auditors' qualifying requirements, to meet particular national requirements, resource limitations, and perceived business risk. • Monitor the quality of performance of the certification services and manage the change of the certification service plan when required. 3. Exhibit professionalism <ul style="list-style-type: none"> • Keep abreast of the latest version of international standards. • Demonstrate strong risk management skill and communication skill to coordinate with respective parties.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • manage the certification services by executing the deployment plan, • monitor quality control processes and the quality of performance of the certification services.
Remark	<p>The relevant international standards and accreditation requirements involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • International Accreditation Forum (IAF)

Unit of Competency

Functional Area: Certification Operations

Title	Qualify competent personnel for conducting certification activities
Code	105990L6
Range	This unit of competency (UoC) covers the abilities to critically evaluate the competence of personnel for each technical area and for each function of the certification activity and exercise professional judgement to qualify the personnel for conducting audits and certification activities.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of competence criteria with regard to the requirements of management system standard or specification and evaluation methods as per the certification service requirements</p> <ul style="list-style-type: none"> • Identify competence criteria of required knowledge and skills for personnel involved in conducting certification audits with regard to certification functions, e.g.: <ul style="list-style-type: none"> • conducting the auditors' application review including the qualification, training and working experience evidence, • Interpret the requirements of management system certification in relevant international standards. • Interpret a broad range of evaluation methods for assessing the competence of audit and certification personnel, e.g.: <ul style="list-style-type: none"> • auditing skills including interview and presentation skills, • audit reporting skill, • review of records, • feedback from past employers, by peers, from the client / market. <p>2. Qualify competent personnel for conducting certification activities</p> <ul style="list-style-type: none"> • Select appropriate evaluation methods for initial competence evaluation of personnel. • Apply relevant competence criteria according to the technical area and the function in the certification activity. • Organise the qualifying audit and assess the performance of auditor trainees by: <ul style="list-style-type: none"> • critically evaluating the competence of personnel for conducting certification activities according to the requirements of management system / product standard or specification, • critically evaluating the audit coverage, depth and judgement of the auditors-in-training, including time management and handling of auditees. • Review the evaluation results to qualify competent personnel to be involved in certification activities. • Document the evaluation processes and results according to the standard operating procedures of the certification body. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure that the objective evaluation methods are effective.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate the competence of personnel to be involved in the audit and certification activities by applying relevant competence criteria, • review the evaluation results to qualify competent personnel for conducting certification activities.
Remark	

Unit of Competency**Functional Area: Certification Operations**

Title	Select samples of record / evidence for characteristics determination
Code	105941L4
Range	The unit of competency (UoC) covers the abilities to select representative samples of record / evidence during the on-site audit of the organisation to conclude if the audit criteria are fulfilled.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of sampling techniques for characteristics determination <ul style="list-style-type: none"> • Identify audit objectives, scope and criteria and other information relating to interface between functions, activities and processes of the organisation, as well as distribution of physical location. • Identify the population of the sampling pool with reference to the objective of the sampling plan and characteristics of the organisation to be audited. • Define the period to be reviewed with reference to the audit sampling programme and certification scheme. 2. Select and collect information by appropriate sampling <ul style="list-style-type: none"> • Determine the sources of samples. • Select representative and verifiable samples. • Confirm the confidence level of sampling and the impact to the audit findings in accordance with the sampling methodology. • Consider if the sample size should be extended when the audit conclusion cannot be determined. • Record the sample selected including the population (e.g. size / period under review), source of the sample and unique identifier of the sample. 3. Exhibit professionalism <ul style="list-style-type: none"> • Observe the confidentiality and privacy in the course of sampling.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify and select representative and verifiable samples as audit evidence by appropriate sampling, • document records / evidence selected to ensure traceability and to support the audit findings based on the established fact.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Perform documentation review for initial certification of management system
Code	105937L5
Range	This unit of competency (UoC) covers the abilities to perform documentation review for initial certification of management system of the client organisation by critically examining the management system and documents/information provided by the client.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of initial certification audit of management system <ul style="list-style-type: none"> • Command audit principles, practices and techniques. • Describe the specific management system standard(s) or normative document(s) that the client is to be certified. • Describe the process of the certification body for performing documentation review for stage one audit of initial certification. • Gather a range of client information on its business sector, products, processes and organisation, and its management system. 2. Perform documentation review for initial certification of management system <ul style="list-style-type: none"> • Review the client's management system documentation. • Assess the location and site-specific conditions of the client to determine the preparedness for the multi-stage audit of initial certification, including stage two audit. • Review the status of client and extent of understanding requirements of the standard. • Analyse necessary information about the scope of the management system, processes and location of the client, and related statutory and regulatory aspects and compliance. • Review the allocation of resources for stage two audit. • Plan for the stage two audit by reviewing the management system and site operations of the client. • Verify the internal audits and management review of the client are planned and performed regularly. • Communicate audit findings to the client and confirm if the audit team can proceed to the stage two of the on-site audit for initial certification. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate competent audit skills and effective communication skills.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • perform documentation review for initial certification audit of client's management system in a smooth and effective manner by critically examining documents/information of client's management system.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Lead and supervise on-site certification audit activities
Code	105939L5
Range	This unit of competency (UoC) covers the abilities to lead and supervise an audit team to perform on-site audit activities effectively and smoothly in the organisation under audit.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of audit principles, practices and techniques <ul style="list-style-type: none"> • Examine the certification scheme and management system requirements of the organisation under audit (or client) with reference to the audit objectives, criteria, scope and resource requirements according to the audit plan. • Review previous audit results and the current status of management system of the certified organisation for surveillance audit. 2. Lead and supervise on-site audit activities <ul style="list-style-type: none"> • Conduct and record the opening meeting with the client's management to confirm the agreement of the audit plan and activities and record the attendance. • Assign roles and tasks of team members, including observers (if any), according to the audit plan and request for guides. • Keep the client updated of the audit progress. • Resolve any conflicts and dispute. • Conclude the audit findings by confirming if the audit criteria are met and agreeing all audit findings with the audit team. • Conduct closing meeting with the client by presenting the audit findings made by the audit team. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate effective and efficient leadership and communications skills.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • lead and coordinate the audit within the audit team and with the client, • supervise and manage the audit team to conduct the on-site certification audit by considering the needs and requests of client and audit team members.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Perform on-site audit for initial certification of management system
Code	105940L5
Range	This unit of competency (UoC) covers the abilities to perform the on-site audit for initial certification of the client to critically evaluate the implementation of the client's management system and justify its effectiveness against the requirements of relevant standard.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of on-site audit of management system <ul style="list-style-type: none"> • Examine the certification scheme and management system requirements of the client organisation. • Determine the key performance / significant aspects, processes, objectives and operation of the applied management system(s). • Apply audit principles, practices and techniques. • Describe the process of the certification body on performing the on-site audit. 2. Perform on-site audit for initial certification of management system <ul style="list-style-type: none"> • Collect and analyse information and evidence to confirm the conformity to all requirements of the applicable management system standard. • Evaluate the client's performance monitoring, measuring, reporting and reviewing critically against key performance objectives or legal compliance. • Review the operational control of the client's processes. • Record all audit findings accurately. • Analyse findings and conclusions of internal audits and management reviews and examine any corrective actions taken. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate competent auditing skills and effective communication skills • Exercise effective time management and professional judgement during the on-site audit.
Assessment Criteria	<p>The integrated outcome requirements of this UoC is the ability to:</p> <ul style="list-style-type: none"> • perform on-site audit for initial certification to critically evaluate the implementation of the client's management system and justify its effectiveness against the requirements of relevant management system standard.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Verify the effectiveness of corrections and corrective actions for nonconformities
Code	105943L5
Range	This unit of competency (UoC) covers the abilities to critically review and verify the effectiveness of corrections and corrective actions for nonconformities found in the audited organisation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of collecting evidence for the proposed corrections and corrective actions <ul style="list-style-type: none"> • Analyse the root cause(s) being identified and evaluate whether the proposed corrections and corrective actions have addressed the root cause(s). • Examine the proposed actions and determine the completion of proposed actions in a timely manner. 2. Verify the effectiveness of corrections and corrective actions <ul style="list-style-type: none"> • Evaluate the performance of the actions deployed in all relevant parts and in a timely manner. • Verify the existence of effective monitoring process in the audited organisation. • Determine the sufficiency of the monitoring period for effective implementation of proposed actions. • Check if repeated nonconformities in similar nature still exist. • Verify the approval of proposed actions by authorised personnel to confirm its closure. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the nonconformities identified and actions taken can be clearly traceable.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically review the evidence of the corrections and corrective actions and their implementation, • verify if the actions deployed can eliminate the nonconformities with similar nature and potential issues.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Control certification documents and records
Code	105989L5
Range	This unit of competency (UoC) covers the abilities to control and maintain a range of auditing documents and records to be readily retrievable in the certification body according to relevant international standard and/or accreditation regulation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of document control system in a certification body <ul style="list-style-type: none"> • Interpret the requirements of control of certification documents and control of audit records in relevant international standard and/or accreditation scheme. • Describe the procedures to control both internal and external documents in the certification body. • Determine a range of documents to be controlled in the certification body. • Describe the procedures for identification, storage, protection, retrieval, retention time and disposition of records. • Describe the procedures to retain audit records with consideration of contractual and legal obligations as well as confidentiality arrangements. 2. Control certification documents and records <ul style="list-style-type: none"> • Review and, where necessary, revise documents periodically to ensure continuing suitability and compliance with applicable requirements and identify the changes and the current revision status of documents. • Identify documents of external origin and control their distribution. • Remove invalid or obsolete documents from all points of issue or use. • Store and retain audit records in a way that they are readily retrievable in the certification body. • Prepare guidelines to provide a mechanism / channel to confirm the validity of a given certification, on request from interested parties, including: <ul style="list-style-type: none"> • an updated publicly accessible client directory of valid certification, • explanation of handling security information which should be made available upon request, • justification if there is any security reason, information disclosed is limited. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure controlled documents are managed effectively in the certification body. • Ensure controlled audit records are retained securely and confidentially.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • control certification documents to ensure continuing suitability and compliance with applicable requirements, • control and retain audit records according to the established procedures and confidentiality arrangements.
Remark	<p>The relevant international standard and laboratory accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • ISO/IEC 17065 Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services • HKCAS 003 Technical Criteria for Accreditation of Management System Certification Bodies • HKCAS 023 Technical Criteria for Accreditation of Product Certification Bodies

Unit of Competency

Functional Area: Certification Operations

Title	Review attestation of audit reports and conclusions
Code	105942L6
Range	This unit of competency (UoC) covers the abilities to exercise appropriate judgement to review attestation of audit reports and conclusions to enable an informed certification decision to be made
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of certification scheme and critical evaluation of audit report <ul style="list-style-type: none"> • Interpret the scope and type of certification scheme and relevant requirements for certification, e.g. certification objectives, criteria. • Examine the requirements of relevant accreditation scheme for the certification body. 2. Review attestation of audit report and conclusions <ul style="list-style-type: none"> • Critically evaluate and verify the information provided by the audit team with respect to the certification scheme and scope for certification, including the audit programme for the entire certification cycle, audit reports, comments on the nonconformities, and new application review. • Evaluate a broad range of relevant information, e.g. public information, comments on the audit report from the client organisation. • Justify the certification recommendations and any other conditions or observations in audit reports and conclusions to enable an informed certification decision to be made. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate good analytical power to review the attestation of audit reports and conclusions.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • review attestation of audit reports and conclusions critically based on the evaluation of audit findings and conclusion and any other relevant information to enable an informed certification decision to be made.
Remark	<p>The relevant international standard and accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • HKCAS 003 Technical Criteria for Accreditation of Management System Certification Bodies

Unit of Competency

Functional Area: Certification Operations

Title	Make certification decision
Code	105944L6
Range	This unit of competency (UoC) covers the abilities to exercise professional judgement to make certification decision by critically evaluating the audit conclusions and reviewing the correction and corrective actions taken or proposed by the client.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of making certification decision <ul style="list-style-type: none"> • Describe the process of the certification body on making certification decision. • Command knowledge of client business sector. • Interpret the requirements of specific management system standards / normative documents for certification. • Examine the audit objectives against the scope of the audit. 2. Make certification decision <ul style="list-style-type: none"> • Examine a broad range of audit findings and conclusions including conformities and nonconformities with gradings. • Evaluate the recommendations made by the audit team with respect to the certification requirements and the scope for certification. • Critically review and evaluate the cause analysis, correction and corrective action taken by the client for identified nonconformities. • Review the planned correction and corrective action proposed by the client for any other nonconformities. • Make and inform the certification decision (whether or not to grant certification) to the client together with any conditions or observations. 3. Exhibit professionalism <ul style="list-style-type: none"> • Exercise determinative power in making certification decision.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • make certification decision by critically evaluating audit conclusions and reviewing correction and corrective actions taken / proposed by the client for any identified nonconformities.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Generate audit reports
Code	105945L5
Range	This unit of competency (UoC) covers the abilities to generate a written report for each audit by critically evaluating the audit findings and conclusions.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of generating audit reports <ul style="list-style-type: none"> • Examine the audit objectives against the scope of the audit. • Evaluate audit findings and other appropriate information collected during the audit against the audit objectives. • Interpret the content of audit reports. 2. Generate audit reports <ul style="list-style-type: none"> • Confirm audit conclusions and grading of audit findings with identification of audit criteria. • Conclude the extent of conformities with the audit criteria and robustness of the applied management system(s). • Identify any necessary follow-up actions. • Formulate a timeframe for the client to present a plan for correction and corrective action for any identified nonconformities. • Generate an audit report to be issued to the client. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain impartiality with the client organisation and independence to generate a fair and unbiased audit report.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate and confirm audit findings and their grading with supporting evidence collected during the audit, • generate an accurate, precise and clear audit report by compiling audit findings and conclusions.
Remark	

Unit of Competency

Functional Area: Certification Operations

Title	Investigate complaints and appeals on certification services
Code	105946L5
Range	This unit of competency (UoC) covers the abilities to investigate complaints and appeals on certification results by critically analysing audit activities and findings and taking appropriate actions in a timely manner.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge and skills of handling complaints and appeals on certification services <ul style="list-style-type: none"> • Explain technical details of an audit programme including the audit objectives, criteria, scope, certification plan and activities, sampling programme, collection of evidence. • Establish the processes to receive, evaluate, investigate and make decisions in response to complaint / appeal case. • Command effective problem solving techniques and cause analysis skills appropriate to audit programmes. • Describe the procedures relating to customer service and communication protocols. 2. Investigate complaints and appeals on certification services <ul style="list-style-type: none"> • Acknowledge the receipt of the complaint / appeal case. • Employ the complaint and appeal handling processes with effective communication, tracking of audit outcomes, acknowledgement, initial assessment, investigation and closure process. • Analyse the information / data obtained objectively and verify the record with reference to previous cases and applied requirements. • Evaluate complaints related to the certified client and inform the certified client in question at an appropriate time. • Initiate review of the certified management system to confirm effectiveness. • Carry out any appropriate corrections and corrective actions in a timely manner and take into account the results of previous similar appeals. • Report investigation outcomes and recommendations for improvement. • Explain investigation outcomes to the complainant / appellant clearly by appropriate communication means. • Record all complaints and related evidence as well as actions taken in compliance with the traceability requirements. 3. Exhibit professionalism <ul style="list-style-type: none"> • Maintain confidentiality and handle the complaints and appeals in an unbiased and objective manner. • Identify improvement opportunities when handling complaints and appeals.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • investigate complaints and appeals by critically analysing unexpected certification results in a logical and efficient manner, • explain investigation outcomes and actions taken to the complainant / appellant clearly using appropriate communication means.
Remark	

Units of Competency for Certification - Certification Quality Management

Unit of Competency**Functional Area: Certification Quality Management**

Title	Formulate quality management system for certification services
Code	105947L6
Range	This unit of competency (UoC) covers the abilities to formulate and design a quality management system in a certification body according to its operational needs by critically evaluating relevant international standards and interpreting accreditation requirements.
Level	6
Credit	6 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of quality management system for bodies providing audit and certification services</p> <ul style="list-style-type: none"> • Determine the scope of activities of the certification bodies. • Analyse resource requirements and availability in the organisation. • Critically evaluate the requirements of quality management system in relevant international standards for certification bodies. • Interpret the requirements of quality management system in relevant accreditation scheme for certification bodies. <p>2. Formulate quality management system in accordance with the requirements of relevant international standards</p> <ul style="list-style-type: none"> • Establish and maintain a management system that is capable of supporting and demonstrating the consistent achievement of the requirements of relevant international standards. • Illustrate the management framework with defined roles and responsibilities, as well as the personnel involved. • Distribute and explain the importance and information about quality management system to personnel involved, including relevant external parties. • Provide direction and resource support to ensure effective enforcement of the management system, including policy, objectives and training needs. • Develop plan and procedures for implementing the quality management system in the certification body, including the following components: <ul style="list-style-type: none"> • policy and objective for its activities, • internal audits, • management reviews, • customer satisfaction on certification services. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure the quality management system is fit for the purpose and complies with the scope of activities of the certification body.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate the quality management system for a certification body by critically evaluating the requirements in relevant international standards and accreditation scheme, • develop the plan and procedures for implementing the quality management system by determining the scope of activities of the certification body in compliance with the organisation policy on quality management.
Remark	<p>The relevant international standards and accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • ISO/IEC 17065 Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services • HKCAS 003 Technical Criteria for Accreditation of Management System Certification Bodies • HKCAS 023 Technical Criteria for Accreditation of Product Certification Bodies • International Accreditation Forum (IAF) Mandatory Documents (MDs)

Unit of Competency

Functional Area: Certification Quality Management

Title	Evaluate performance of personnel involved in audits and certification activities
Code	105948L6
Range	This unit of competency (UoC) covers the abilities to critically evaluate the performance of personnel conducting audits and certification by applying the performance criteria with regard to the requirements of each type of management system / product standard or specification, for each technical area, and for each function in the certification process.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of performance criteria with regard to the requirements of management system standard or specification and evaluation methods</p> <ul style="list-style-type: none"> • Define performance criteria for personnel involved in the audits and certification with regard to certification functions, e.g.: <ul style="list-style-type: none"> • conducting the application review, • reviewing audit reports and making certification decisions, • auditing, • leading the audit team. • Interpret the requirements of management system / product certification in relevant international standards. • Explain evaluation methods for assessing the performance of audit and certification personnel, e.g.: <ul style="list-style-type: none"> • review of records, • feedback from past employers, by peers, from the client / market, • interviews, • observations, • examinations, • post-audit review. <p>2. Evaluate performance of personnel involved in certification audits</p> <ul style="list-style-type: none"> • Select appropriate evaluation methods for on-going monitoring of the performance of auditing personnel. • Apply relevant performance criteria according to the technical area and the function in the certification activity. • Critically evaluate the performance of personnel involved in the audits and certification according to the requirements of management system / product standard or specification. • Review the evaluation results to identify training needs of the personnel in the light of their performance. • Document the evaluation processes and findings according to the standard operating procedures of the certification body. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure that the evaluation methods are effective.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • critically evaluate the performance of personnel involved in the audit and certification activities by applying relevant performance criteria with regard to the requirements of the management system / product standards or specification to be certified.
Remark	

Unit of Competency

Functional Area: Certification Quality Management

Title	Implement actions taken against misuse of marks and hazardous certified products
Code	105951L4
Range	This unit of competency (UoC) covers the abilities to implement procedures for checking use of accreditation and certification logo / marks and hazardous certified products and to take actions against misuse of marks and hazardous certified products.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of policy governing any mark that the certification body authorises certified clients to use <ul style="list-style-type: none"> • Specify the traceability requirements of the certification body in relevant international standards. • Describe the proper use of certification marks / logo and identify the conditions for misuse of marks, e.g.: <ul style="list-style-type: none"> • ambiguity in the mark or accompanying text as to what has been certified and which certification body has granted the certification, • logo / mark on the product or product packaging seen by the consumer or in any other way that may be interpreted as denoting product conformity, • marks applied to laboratory test, calibration or inspection reports. 2. Implement actions taken against misuse of marks and hazardous certified products <ul style="list-style-type: none"> • Explain the use of logo and prohibited display / practice. • Undertake periodical monitoring for picking up misuse of marks in a reasonable basis. • Analyse general public's report on misuse of marks / logo picked up in the marketplace. • Consider further action if incorrect reference / representation made, including legal action. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the actions are taken effectively to maintain the reputе and public trust of the certification body.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement procedures for checking use of accreditation and certification logo / marks; • take appropriate actions to deal with incorrect references to or display of certification status or misleading use of certification documents, marks or audit reports.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • ISO/IEC 17030 Conformity Assessment – General Requirements for Third-Party Marks of Conformity

Unit of Competency**Functional Area: Certification Quality Management**

Title	Implement procedures for evaluation of authenticity of certified products
Code	105952L4
Range	This unit of competency (UoC) covers the abilities to implement procedures to assess the authenticity of certified products in accordance with product specifications or standards and product certification scheme.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of authenticity of certified products <ul style="list-style-type: none"> • Specify the requirements of authenticity of certified products according to the product specifications or standards and certification scheme. • Identify and describe evaluation methods for authenticity of certified products. • Describe the quality management system of the certification body. 2. Implement procedures for evaluation of authenticity of certified products <ul style="list-style-type: none"> • Select appropriate evaluation methods according to the nature / type of certified products. • Examine the authenticity of certified products by applying the selected evaluation methods. • Judge the authenticity of certified products by comparing against product specifications or standards and certification scheme. • Document evaluation results and report any abnormalities of certified products. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the evaluation is effective and objective to maintain the reputation and public trust of the certification body.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • evaluate the authenticity of certified products by applying appropriate evaluation methods and comparing against product specifications and certification scheme.
Remark	

Unit of Competency

Functional Area: Certification Quality Management

Title	Implement certification quality management system
Code	105949L5
Range	This unit of competency (UoC) covers the abilities to implement quality management system in a certification body in compliance with the formulated quality management system and procedures.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of quality management system and its implementation requirements for certification body <ul style="list-style-type: none"> • Apply the concepts of continuous improvement processes. • Explain the formulated implementation plan of quality management system. • Examine the objectives of quality management system for certification body. • Determine resource requirements in the implementation process. • Investigate the training needs of personnel responsible for the implementation of quality management system. 2. Implement quality management system in a certification body <ul style="list-style-type: none"> • Establish and follow the timeline for tasks to be performed with projected completion dates. • Secure necessary resources which are in place and available for implementation, e.g.: <ul style="list-style-type: none"> • financial requirements, • personnel needs such as number of staff required, training need of staff, • facilities, equipment, supplies of materials. • Establish a system for monitoring the quality management system of the certification body. • Adjust the implementation plan and communicate effectively with personnel involved in the implementation of quality management system. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the quality management system is implemented in compliance with the established plan and defined objectives.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement quality management system in the certification body by establishing the timeline for tasks to be performed in compliance with the defined objectives, • establish a system for monitoring the quality management system and adjust the implementation plan by exercising appropriate judgement.
Remark	

Unit of Competency

Functional Area: Certification Quality Management

Title	Evaluate subcontractor of certification activities
Code	105950L5
Range	This unit of competency (UoC) covers the abilities to critically evaluate subcontractor of certification activities to ensure the audit quality and conformity to the relevant standards.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of outsourcing and subcontracting strategy of the certification body <ul style="list-style-type: none"> • Interpret the outsourcing strategy by considering all related factors and its follow up activities for subsequent implementation / operation of the strategy. • Define the work of scope provided by / subcontracting to the outsourcing entity. • Formulate guidelines for the selection, qualification and monitoring of the outsourcing entity including documentation procedure of maintaining all related records to demonstrate the competency and impartiality, e.g. training records and resume demonstrating working experience, evaluation records. 2. Evaluate subcontractor of certification activities <ul style="list-style-type: none"> • Analyse the conditions under which outsourcing may take place. • Critically evaluate the competence, impartiality and confidentiality of the outsourcing entity to perform the outsourced services. • Provide appropriate training tools and means to the outsourcing entity and information related to their services provided, including the accreditation and standard requirements. • Monitor the quality of all entities that provided outsourced services used for certification activities in conformance with relevant standard. • Maintain records of competence of outsourcing entities, including auditors and technical experts. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the outsourced entities conform to the requirements of the certification body and also to relevant international standards.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate the competence, impartiality and confidentiality of the outsourcing entity to perform the outsourced certification services in accordance with the strategy of the certification body, • take responsibility for all activities outsourced to subcontractor by monitoring the quality of its work and outputs.
Remark	<p>The relevant international standards and accreditation scheme involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • ISO/IEC 17065 Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services • HKCAS 003 Technical Criteria for Accreditation of Management System Certification Bodies • HKCAS 023 Technical Criteria for Accreditation of Product Certification Bodies

Unit of Competency

Functional Area: Certification Quality Management

Title	Conduct management review on certification services
Code	105953L5
Range	This unit of competency (UoC) covers the abilities to review the management system of the certification body at planned intervals to ensure its continuing suitability, adequacy and effectiveness in accordance with relevant international standards and the quality management system of the certification body.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of management system of the certification body and its review requirements <ul style="list-style-type: none"> • Determine the scope and detailed requirements of reviewing management system of the certification body. • Determine scheme(s) / product(s) to be covered in the periodical management review. • Specify the requirements of management system in relevant international standards. • Propose the agenda and review interval of the management review. 2. Conduct management review of the certification body <ul style="list-style-type: none"> • Collect a range of related information for the management review, e.g.: <ul style="list-style-type: none"> • results of internal and external audits, • feedback from clients and interested parties, • feedback from the committee for safeguarding impartiality, • the status of preventive and corrective actions, • follow-up actions from previous management reviews, • the fulfilment of objectives, • changes that could affect the management system, • appeals and complaints. • Critically analyse collected information and recommend decisions and actions related to: <ul style="list-style-type: none"> • improvement of the effectiveness of the management system and its processes, • improvement of the certification services related to the fulfilment of relevant international standards, • resource needs. • Retain all records of the management review inputs and outputs, including the follow up actions. • Allocate required resources for improvement plan / action proposed in the management review. • Monitor and report progress of the follow up actions. 3. Exhibit professionalism <ul style="list-style-type: none"> • Demonstrate good analytical power to review the performance of the management system. • Strive for continual improvement by identifying improvement opportunities.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • conduct management review in a timely and regular manner in accordance with the quality management system, • monitor and evaluate progress of review outputs to ensure the continuing suitability, adequacy and effectiveness of the certification body.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • ISO 9001 Quality Management Systems • International Accreditation Forum (IAF) Mandatory Documents (MDs)

Unit of Competency

Functional Area: Certification Quality Management

Title	Conduct internal audit of certification services
Code	105954L5
Range	This unit of competency (UoC) covers the abilities to conduct an internal audit of the quality system of a certification body and generate audit findings.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of conducting an internal audit in the certification body <ul style="list-style-type: none"> • Determine the scope and detailed requirements of the internal audit. • Establish procedures for conducting internal audit to verify the fulfilment of relevant international standards and accreditation requirements, as well as the internal guideline and scheme specification. • Devise audit programme and audit plan which takes into consideration of the importance of the process and areas to be audited, as well as the results of previous audits. • Allocate audit resources with knowledge of certification, auditing and requirements of the applied international standards. • Develop audit checklist and auditing documents for collection of objective evidence within scope. • Apply the concept of horizontal, vertical and witness audits in conducting internal audit. 2. Conduct internal audit in the certification body <ul style="list-style-type: none"> • Examine product(s) / scheme(s) to be included in the audit programme and apply the sample methodology, including the sampling method to be deployed. • Collect and evaluate objective and supporting evidence to generate audit findings summarising conformities and detailing nonconformities. • Collaborate with relevant personnel to maximise continuous improvement and ownership of improvement. • Maintain audit documents and accurate records as per the defined retention policy. • Document findings from the audit process in the required format. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the internal audit is conducted timely and effectively. • Demonstrate unbiased judgement and impartiality with good communication skill and strong analytical power.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • conduct the internal audit to collect objective and supporting evidence, • generate, present and document audit findings summarising conformities and detailing nonconformities.
Remark	<p>The relevant international standards involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • ISO/IEC 17021 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems • ISO 9001 Quality Management Systems • ISO 19011 Guidelines for Auditing Management Systems • International Accreditation Forum (IAF) Mandatory Documents (MDs)

Unit of Competency

Functional Area: Certification Quality Management

Title	Implement corrective actions and preventive actions for certification services
Code	105955L4
Range	This unit of competency (UoC) covers the abilities to identify operational and potential nonconformities in the operation of the certification body and implement appropriate corrective actions and preventive actions to eliminate the causes of nonconformities.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of operational and potential nonconformities in the certification body <ul style="list-style-type: none"> • Determine the causes of operational nonconformities, e.g. <ul style="list-style-type: none"> • violation of accreditation requirements, • customer complaints, • identified from internal audits, • trend analysis on quality performance indicators. • Define the method applied in evaluation of the need for corrective action and preventive action, e.g. risk analysis approach or failure mode and effect analysis. • Describe the handling process of the corrective and preventive actions, including root cause analysis, correction and corrective action applied, result of the action taken, review of effectiveness, preventive action applied. • Describe roles and responsibilities for the identification, evaluation, implementation and review of corrective actions and preventive actions. 2. Implement corrective actions and preventive actions for certification services <ul style="list-style-type: none"> • Implement corrective actions needed to prevent recurrence of identified nonconformities in a timely manner according to the established action plan. • Implement preventive actions needed to prevent the occurrence of potential nonconformities. • Record the results of actions taken. • Review the effectiveness of the corrective actions and preventive actions taken. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the performance of the actions deployed in all relevant parts of the certification body is evaluated in a timely manner.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • identify the causes of operational and potential nonconformities in the operation of the certification body, • implement corrective actions and preventive actions according to the established action plans, • review the effectiveness of actions taken to eliminate the recurrence of operational nonconformities and occurrence of potential nonconformities.
Remark	

Units of Competency for Common Operations Management

Unit of Competency**Functional Area: Operations Management**

Title	Implement ethical practices
Code	105961L4
Range	This unit of competency (UoC) covers the abilities to implement ethical practices by considering a range of ethical issues and applying current and relevant standards of professional and ethical behaviour in general settings in the organisation.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of professional code of conduct and its application to practice <ul style="list-style-type: none"> • Apply the ethical management policy of the organisation. • Describe the guidelines for implementing ethical management policy. • Describe the professional code of conduct for relevant services. • Command professional techniques, strategies and responsibilities in handling a range of ethical issues. • Identify types and sources of resources for handling ethical issues. 2. Implement ethical practices <ul style="list-style-type: none"> • Implement appropriate procedures and measures to handle ethical and professional issues. • Use reliable sources of information to ensure that knowledge of ethical practice is current, comprehensive and relevant. • Maintain productive professional relationships and networks to facilitate awareness of current ethical issues. • Apply applicable codes of ethics and conduct to work practices. 3. Exhibit professionalism <ul style="list-style-type: none"> • Seek advice and feedback on performance to improve ethical practices. • Participate in professional development activities and networks to address identified needs in current ethical practices.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement appropriate procedures to handle ethical issues by applying ethical standards to professional practices in the organisation, • reflect on and improve ethical practices in work assignments by analysing applicable code of ethics and conduct to work practices.
Remark	

Unit of Competency**Functional Area: Operations Management**

Title	Monitor the implementation of ethical practices
Code	105960L5
Range	This unit of competency (UoC) covers the abilities to monitor the implementation of ethical practices within the TIC organisation to maintain the organisation's policies on impartiality, confidentiality, professionalism and integrity, and its commitment to comply with relevant statutory and accreditation requirements.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of ethical practice implementation <ul style="list-style-type: none"> • Examine statutory requirements on ethical practices and legal responsibilities in organisation's activities and interactions with customers. • Interpret the established code of conduct and the associated ethical practices within the organisation. • Describe procedures for dealing with breaches of professional ethics. • Employ a range of methods for assessing / reviewing personal performance and planning as well as implementing effective personal improvement strategies. 2. Monitor the implementation of ethical practices <ul style="list-style-type: none"> • Monitor the compliance of work with legal obligations and requirements by using appropriate means, e.g.: <ul style="list-style-type: none"> • formal and informal performance feedback, • self-assessment and reflection in practice to monitor performance against established standards and to accurately identify personal strengths and weaknesses, • commitment to laws and organisational policies, procedures and objectives, • customers' feedback and opinions on services provided by the organisation. • Periodically remind all personnel of the code of conduct established for the organisation. • Investigate and report any impropriety or unlawful act of the organisation or any iniquitous staff to senior management. • Provide training on code of conduct to all staff as a part of the orientation programme. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure all personnel act lawfully, ethically, professionally and honestly, and protect the impartiality, independence and integrity of the organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • monitor the implementation of ethical practices in the organisation in compliance with legal obligations and accreditation requirements, • investigate and report non-compliance of work to senior management and provide appropriate training on code of conduct to staff.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Formulate ethical management policy
Code	105956L6
Range	This unit of competency (UoC) covers the abilities to formulate ethical management policy by critically examining industry standards and requirements on the quality assurance and integrity of services provided by the TIC organisation. This UoC also includes the abilities to develop guidelines for ethical management policy implementation, monitoring and evaluation in the organisation.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of ethical management and policy development <ul style="list-style-type: none"> • Critically examine industry standards and requirements on quality assurance and integrity of services provided by the TIC organisation, e.g.: <ul style="list-style-type: none"> • Hong Kong accreditation schemes and their requirements for seeking or maintaining accreditation status, • international standards and ethical schemes such as ISO/IEC, Good Manufacturing Practice (GMP). • Research and analyse information from a broad range of sources for formulating corporate ethical management policy, e.g.: <ul style="list-style-type: none"> • code of ethics and code of conduct of public sector, • government policies and protocols for corruption prevention, • policy implementation processes and practices in the public sector. • Establish procedures for developing policy guidelines. 2. Formulate ethical management policy <ul style="list-style-type: none"> • Designate responsibilities and authorities for the formulation of ethical management policy. • Develop new policy guidelines for implementing and monitoring the ethical management within the organisation. • Assess and advise on ethical management policy. • Evaluate and revise the ethical management policy where necessary. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the policy and guidelines are formulated in consultation with top management, shareholders, customers and end users. • Ensure the policy is analysed and implications are interpreted and confirmed in accordance with organisational procedures. • Ensure information and advice on the relevant acts, regulations, procedures, codes of practice, standards and guidelines are provided in accordance with organisational procedures.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate ethical management policy by critically examining industry standards and requirements on the quality assurance and integrity of corporate services, • develop guidelines for ethical management policy implementation, monitoring and evaluation in the organisation.
Remark	<p>The relevant documents involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • HKAS SC-06 HKAS Supplementary Criteria No. 6 Code of Conduct • Corruption Prevention Guide for Testing and Certification Industry issued by Independent Commission Against Corruption (ICAC)

Unit of Competency

Functional Area: Operations Management

Title	Establish code of conduct for testing services
Code	105957L6
Range	This unit of competency (UoC) covers the abilities to establish code of conduct for implementing ethical work practices in testing services within the laboratory in compliance with the statutory and accreditation requirements.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of establishing code of conduct for testing services <ul style="list-style-type: none"> • Interpret statutory requirements on ethical practices and legal responsibilities in all testing activities and interactions with customers. • Examine the governance structure of the laboratory. • Command the concept of ethics and its role in professional practice. • Evaluate any potential ethical issues if and as they arise. • Maintain an awareness of contemporary ethical issues that may impact on own professional practice. 2. Establish code of conduct for testing services <ul style="list-style-type: none"> • Generate code of conduct for testing services, e.g.: <ul style="list-style-type: none"> • commitment to ethical practices, • solicitation and acceptance of advantage and entertainment, • conflict of interest, • protection of company information, • outside work, • compliance monitoring, • promulgation of the code, • handling of testing samples. • Establish procedures to interact with customers in compliance with ethical practices of the laboratory. • Develop and implement strategies to resolve ethical issues within the laboratory. • Take responsibility for addressing ethical issues and legal requirements in testing services. • Periodically review the suitability and adequacy of the code of conduct. 3. Exhibit professionalism <ul style="list-style-type: none"> • Document the code of conduct of testing laboratory within the management system for stating the policies on impartiality, confidentiality, professionalism, integrity, conflict of interest, and the organisation's commitment to complying with relevant legislations.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • establish code of conduct for testing services by interpreting the statutory requirements on bribery prevention and ethical practices in the testing activities, • review periodically the code of conduct to maintain impartiality, confidentiality and integrity of the personnel working in the laboratory.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Establish code of conduct for inspection services
Code	105958L6
Range	This unit of competency (UoC) covers the abilities to establish code of conduct for implementing ethical work practices in inspection services within the inspection body in compliance with the statutory and accreditation requirements.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of establishing code of conduct for inspection services <ul style="list-style-type: none"> • Interpret statutory requirements on ethical practices and legal responsibilities in all inspection activities and interactions with customers and manufacturers. • Examine the governance structure of the inspection body. • Command the concept of ethics and its role in professional practice. • Evaluate any potential ethical issues if and as they arise. • Maintain an awareness of contemporary ethical issues that may impact on own professional practice. 2. Establish code of conduct for inspection services <ul style="list-style-type: none"> • Generate code of conduct for inspection services, e.g.: <ul style="list-style-type: none"> • commitment to ethical practices, • solicitation and acceptance of advantage and entertainment, • conflict of interest, • protection of company information, • outside work, • compliance monitoring, • promulgation of the code, • allocation of inspection duties and monitoring of inspections. • Establish procedures to interact with customers in compliance with ethical practices of the inspection body. • Develop and implement strategies to resolve ethical issues within the inspection body. • Take responsibility for addressing ethical issues and legal requirements in inspection services. • Periodically review the suitability and adequacy of the code of conduct. 3. Exhibit professionalism <ul style="list-style-type: none"> • Document the code of conduct of inspection body within the management system for stating the policies on impartiality, confidentiality, professionalism, integrity, conflict of interest, and the organisation's commitment to complying with relevant legislations.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • establish code of conduct for inspection services by interpreting the statutory requirements on bribery prevention and ethical practices in the inspection activities, • review periodically the code of conduct to maintain impartiality, confidentiality and integrity of inspectors and other personnel working in the inspection body.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Establish code of conduct for certification services
Code	105959L6
Range	This unit of competency (UoC) covers the abilities to establish code of conduct for implementing ethical work practices in certification services within the certification body in compliance with the statutory and accreditation requirements.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of establishing code of conduct for certification services <ul style="list-style-type: none"> • Interpret statutory requirements on ethical practices and legal responsibilities in all certification activities and interactions with customers. • Examine the governance structure of the certification body. • Command the concept of ethics and its role in professional practice. • Evaluate any potential ethical issues if and as they arise. • Maintain an awareness of contemporary ethical issues that may impact on own professional practice. 2. Establish code of conduct for certification services <ul style="list-style-type: none"> • Generate code of conduct for certification services, e.g.: <ul style="list-style-type: none"> • commitment to ethical practices, • solicitation and acceptance of advantage and entertainment, • conflict of interest, • protection of company information, • outside work, • compliance monitoring, • promulgation of the code, • control, security and issuance of certificates. • Establish procedures to interact with customers in compliance with ethical practices of the certification body. • Develop and implement strategies to resolve ethical issues within the certification body. • Take responsibility for addressing ethical issues and legal requirements in certification services. • Periodically review the suitability and adequacy of the code of conduct. 3. Exhibit professionalism <ul style="list-style-type: none"> • Document the code of conduct of certification body within the management system for stating the policies on impartiality, confidentiality, professionalism, integrity, conflict of interest, and the organisation's commitment to complying with relevant legislations.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • establish code of conduct for certification services by interpreting the statutory requirements on bribery prevention and ethical practices in the certification activities, • review periodically the code of conduct to maintain impartiality, confidentiality and integrity of auditors and other personnel working in the certification body.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Monitor environmentally sustainable work practices
Code	105964L4
Range	This unit of competency (UoC) covers the abilities to effectively monitor the environmentally sustainable work practices by analysing their effectiveness and recommend improvement measures for environmental sustainability.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of work practices in relation to environmental protection and sustainability <ul style="list-style-type: none"> • Describe procedures to evaluate the compliance of work practices with the workplace environmental policy. • Collect information on environmental and resources efficiency systems and procedures, e.g.: <ul style="list-style-type: none"> • waste reduction, • determination of the most suitable waste treatment method, • efficient use of water and energy, • measures to minimise environmental risks. • Inspect current work procedures to identify areas for improvement. 2. Monitor environmentally sustainable work practices <ul style="list-style-type: none"> • Review and analyse the implementation of environmental management system. • Determine the success or otherwise of the environmental management system. • Measure and record current resources usage and environmental work practices. • Propose and apply improvement measures to the work practices. • Review the established measures and confirm the compliance with organisation's policy on environmental protection and sustainability. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the environmental performance is effectively monitored.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • review and analyse the implementation of environmental management system, • monitor the current usage of resources in the work practices in compliance with the organisation's policy on environmental protection and sustainability, • recommend improvement measures on environmental protection and sustainability.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Implement environmental management system
Code	105963L5
Range	This unit of competency (UoC) covers the abilities to implement environmental management system within the workplace of the TIC organisation by employing good environmental protection concept.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of implementing environmental management system in the organisation <ul style="list-style-type: none"> • Explain the responsibilities of employers and employees in the environmental management system and policy. • Evaluate the operation and human resources supply of each department within the organisation. • Examine the long-term and short-term objectives established by the organisation for environmental protection as well as the performance indicators. • Employ the concept of good environmental protection practice. 2. Implement environmental management system within the workplace <ul style="list-style-type: none"> • Establish performance indicators and evaluation procedures according to the requirements of comprehensive environmental protection policy, such as evaluation methods, choice of persons and frequency, etc. • Implement good environmental management rules applicable to individual workplace according to the comprehensive environmental protection policy of the organisation. • Establish respective staff training procedure according to human resources and actual operation of the organisation, such as resources arrangement, choice of persons to be trained and training proposals. • Establish verifying procedure for the details of environmental protection management according to the actual situation of the organisation. • Establish review mechanism for monitoring the implementation of environmental management system within the workplace. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the environmental management system is implemented efficiently.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • implement the environmental management system applicable to workplaces in compliance with the comprehensive organisational policy on environmental protection and sustainability, • establish review mechanism and evaluation procedures for monitoring the implementation of environmental management system.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Formulate environmental management system and workplace environmental policy
Code	105962L6
Range	This unit of competency (UoC) covers the abilities to formulate environmental management system and workplace policy and procedures for environmental protection and sustainability within the organisation in compliance with the regulatory requirements.
Level	6
Credit	4 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of environmental management system <ul style="list-style-type: none"> • Interpret the requirements of environmental management system in relevant international standard. • Define the scope of workplace environmental policy. • Interpret regulatory requirements on environmental protection, the code of practice on environmental protection and the future trend. • Command the comprehensive operation strategy, marketing position and corporate image established by the organisation. • Assess a broad range of internal and external factors of environmental protection and sustainability for meeting the actual operation of the organisation. • Examine the content of the risk assessment report. • Establish the long-term and short-term objectives of the organisation for environmental protection as well as the performance indicators. 2. Formulate environmental management system and workplace environmental policy <ul style="list-style-type: none"> • Formulate environmental management system and develop environmental policy that reflects the organisation’s commitment to environmental protection and sustainability. • Formulate operational requirements and instructions on environmental protection based on the analysis of risk assessment report. • Develop and communicate procedures for implementing the workplace environmental policy, e.g.: <ul style="list-style-type: none"> • reduce the use of toxic materials and hazardous substances, • minimise the use of resources to reduce wastes. • Identify and analyse the discrepancy between the anticipated objectives and current performance to: <ul style="list-style-type: none"> • prepare the required resources, • establish the auditing procedure, • monitor the operation of the system, • build internal communication channels, • review the effectiveness and make suggestions for continuous improvements. • Establish a monitoring system for specific issues in environmental management, e.g.: <ul style="list-style-type: none"> • chemical wastes such as organic solvents, • waste separation, collection, and disposal, • wastewater, • noise, • air pollutant such as volatile organic chemical, awful smell. • Establish a recording system for tracking continuous improvement in sustainability approaches. 3. Exhibit professionalism <ul style="list-style-type: none"> • Analyse outcomes and feedback records to identify trends that may require remedial action, and promote continuous improvement of performance. • Modify policy and/or procedures as required to ensure the environmental policy is implemented effectively.

Unit of Competency

Functional Area: Operations Management

<p>Assessment Criteria</p>	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • formulate environmental management system and workplace policy and procedures for environmental protection and sustainability that can meet the organisational operation and comply with regulatory requirements, • develop implementation strategy for environmental management and establish a monitoring system for continuous improvement.
<p>Remark</p>	<p>The relevant international standard involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO 14001 Environmental Management Systems <p>The relevant legislations involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • Noise Control Ordinance • Waste Disposal Ordinance • Water Pollution Control Ordinance • Ozone Layer Protection Ordinance • Dumping at Sea Ordinance • Air Pollution Control Ordinance

Unit of Competency

Functional Area: Operations Management

Title	Master terminology related to testing / inspection / certification
Code	105975L2
Range	This unit of competency (UoC) covers the ability to master terminology and technical terms related to testing / inspection / certification activities in order to communicate effectively and perform related duties in daily operation.
Level	2
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of terminology related to testing / inspection / certification activities <ul style="list-style-type: none"> • Grasp the terminology and technical terms of the following areas: <ul style="list-style-type: none"> • testing, • inspection, • certification. 2. Master terminology related to testing / inspection / certification activities <ul style="list-style-type: none"> • Apply terminology related to testing / inspection / certification activities • Communicate effectively and perform related duties in daily operation. 3. Exhibit professionalism <ul style="list-style-type: none"> • Keep abreast of latest technical terms related to testing / inspection / certification activities.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • apply terminology and technical terms related to testing / inspection / certification to communicate effectively and perform related duties in daily operation.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Follow hygiene procedures
Code	105976L2
Range	This unit of competency (UoC) covers the ability to follow hygiene procedures during the daily operation of the laboratory / site work according to the established guidelines of the organisation.
Level	2
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess of knowledge of hygiene at the workplace <ul style="list-style-type: none"> • State the definition and scope of hygiene, e.g.: <ul style="list-style-type: none"> • personal hygiene, • hygiene issues at the workplace, • environmental hygiene, • hygiene of equipment and materials, • relevant hygiene regulations and established guidelines of the organisation, • waste disposal. • Describe the importance of hygiene in the TIC industry. 2. Follow hygiene procedures <ul style="list-style-type: none"> • Maintain organisational standards of personal hygiene. • Clean and decontaminate work areas regularly according to relevant hygiene regulations and practices and established guidelines of the organisation. • Clean equipment and store materials and reagents as required. • Use appropriate equipment and procedures to avoid contamination. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure a clean and hygienic working environment is maintained in the workplace.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • follow hygiene procedures during the daily operation of the laboratory / site work according to the established guidelines of the organisation to maintain a clean and hygienic workplace.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Maintain laboratory / field workplace safety
Code	105973L3
Range	This unit of competency (UoC) covers the ability to maintain the occupational safety in laboratory/ field workplace of the TIC industry to prevent the occurrence of accidents.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of occupational safety in laboratory / field workplace <ul style="list-style-type: none"> • Describe the safety precautions in various TIC processes and working procedures. • Describe the importance of maintaining laboratory / field workplace safety. 2. Maintain laboratory / field workplace safety <ul style="list-style-type: none"> • Follow safe work practices when carrying out work duties. • Keep the work areas free from obstacles. • Store, transport and dispose of hazardous materials and dangerous goods according to the guidelines of the organisation. • Check the equipment and store materials and reagents as required. • Ensure hazard controls and protective clothing and equipment as well as first aid facilities are available and functional. • Use established safety guidelines and protective clothing and equipment to ensure safety of laboratory / field personnel. • Provide information on occupational safety and health policy and guidelines to laboratory/ field personnel. • Identify and report any deviation from guidelines within level of responsibility. • Maintain conditions to ensure safety standards in the laboratory / field workplace are maintained. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the safety of personnel working in the laboratory / field workplace according to the occupational safety and health guidelines of the organisation.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • maintain laboratory / field workplace safety according to the relevant regulations and the occupational safety and health guidelines of the organisation to prevent accidents.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Handle and investigate general industrial accidents
Code	105974L3
Range	This unit of competency (UoC) covers the abilities to handle and take follow-up actions in the event of accidents occurred in workplace of the TIC industry (e.g. laboratory, inspection site, auditing site).
Level	3
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of industrial accidents at work <ul style="list-style-type: none"> • Classify the categories and causes of typical accidents in the TIC industry, such as crush, injury, cut, burnt, fire accident, direct contact of chemicals by skin or eyes, electric shock, explosion, gas leakage and fall from height, and describe their severity and immediate potential risks. • Describe the organisation's emergency and contingency measures, such as fire prevention apparatus, the location of first-aid kit and emergency exit. 2. Handle and investigate general industrial accidents <ul style="list-style-type: none"> • Collect relevant information when the accident occurs and study the severity and immediate potential risks of the accident according to organisational guidelines, such as: <ul style="list-style-type: none"> • immediate in-house treatment, • send to hospital, • call the police, • emergency evacuation. • Handle the case according to organisational guidelines, such as report to supervisor as soon as possible and complete relevant record. • Study the causes of the accident to prevent its re-occurrence. 3. Exhibit professionalism <ul style="list-style-type: none"> • Handle general industrial accidents properly according to organisational guidelines
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify categories and nature of industrial accident at work, • make suitable arrangement with respect to the severity and immediate risks of the accident occurred according to organisational guidelines, emergency and contingency measures in a familiar working environment, • study the causes of the accident to prevent its re-occurrence.
Remark	

Unit of Competency**Functional Area: Operations Management**

Title	Implement occupational safety and health supervision
Code	105969L4
Range	This unit of competency (UoC) covers the abilities to employ safety management skills and knowledge of occupational safety and health and implement occupational safety and health supervision in workplaces of the TIC industry in compliance with the relevant safety legislations and requirements of services contracts.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess concept and skills of occupational safety and health supervision <ul style="list-style-type: none"> • Describe various TIC processes and procedures. • Determine the occupational safety and health responsibilities of staff at various levels. • Apply the concept and skills of safety management in carrying out safety supervision, including: <ul style="list-style-type: none"> • work safety requirements for TIC workplaces in general, • safety inspection, • accident investigation, • safety audit and check, • workplace cleanliness and hygiene, • safety promotion, • risk assessment, • safety committee, • knowledge of latest safety legislations. 2. Implement occupational safety and health supervision <ul style="list-style-type: none"> • Inspect safety equipment in TIC workplaces and conduct safety inspection. • Assess operational safety risks to identify hazards. • Assist in implementing safety policy, measures and procedures. • Observe whether the staff can perform the tasks safely according to legislations and guidelines. • Investigate work accidents or incidents. • Respond to views from other people on safety and health. • Obtain latest information of legislative amendments. • Rectify wrong operations immediately and make remedy. • Study incidents that may possibly happen for non-compliance of safety practice and their seriousness. • Record inspections conducted and observation results. • Conduct effective occupational safety and health consultation. • Submit occupational safety and health reports and accident data regularly. • Cooperate with the safety committee and working groups. • Give warnings, suggestions or training to staff who break the rules according to corporate terms of reference. • Record and reward staff who abide by the rules of occupational safety and health. 3. Exhibit professionalism <ul style="list-style-type: none"> • Employ safety management skills and knowledge of occupational safety and health, and ensure the implementation of occupational safety and health supervision according to relevant safety legislations and contract requirements.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • employ safety management skills and knowledge of occupational safety and health to implement occupational safety and health supervision according to relevant safety legislations and contract requirements.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Monitor occupational safety and health system
Code	105970L4
Range	This unit of competency (UoC) covers the abilities to monitor the daily work and working procedures of the staff in respective departments according to working instructions on occupational safety and health.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of relevant occupational safety and health ordinances as well as organisational instructions <ul style="list-style-type: none"> • Identify organisational guidelines on occupational safety and health. • Examine labour related regulations such as Occupational Safety and Health Ordinance, Factories and Industrial Undertakings Ordinance. • Describe the daily operation and detailed working procedures in one's department. 2. Monitor the daily work and safety equipment in respective departments <ul style="list-style-type: none"> • Inspect the daily work and working procedures of the staff in their department to ensure that organisational guidelines on occupational safety and health have been met, such as the authorities on use of various facilities or equipment and their operating systems, the applications of personal protective equipment, the ventilation within the premises and its potential hazards, handling of pollutants and dangerous chemicals, waste disposal, the cleanliness of workshops, methods of manual lifting, machine operation and protection, etc. • Participate in the investigation of incidents occurred within the area that one monitors and follow up the improvement proposals. • Review the incident reporting mechanism, report to supervisors when appropriate and complete relevant records. • Inspect the emergency exit to make sure that the passageway is free from obstacle and fire fighting devices are installed. • Inspect the first-aid equipment in one's department. • Review to ensure that incidents are properly reported according to statutory requirements, such as injury at work and serious incidents, etc. • Record cases not complying with respective rules / instructions and notify the people concerned. • Implement improvement mechanisms and compile comprehensive report regularly. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the daily operation and working procedures comply with the organisational instructions on occupational safety and health system.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • monitor working procedures in one's department to ensure that they can meet organisational instructions on occupational safety and health, so as to safeguard the well-being and safety of staff to avoid injury at work or occupational diseases, • implement improvement mechanisms and compile comprehensive report on non-compliance cases.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Handle and dispose of chemical wastes
Code	105971L4
Range	This unit of competency (UoC) covers the abilities to collect, store, transport and dispose of chemical wastes properly according to the relevant regulations and the organisations' established procedures for handling chemical wastes.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of the categorisation of chemical wastes and their characteristics <ul style="list-style-type: none"> • Specify the categorisation of chemical wastes that are generated from the working procedures. • Identify hazards and characteristics of chemical wastes. • Identify the regulations of chemical waste disposal. • Describe the organisations' established procedures of handling and disposal of chemical wastes. 2. Handle and dispose of chemical wastes <ul style="list-style-type: none"> • Categorise chemical wastes according to the organisations' established procedures and identify their potential risks. • Evaluate one's own capability in handling chemical wastes, such as respective knowledge, experience, protective equipment, manpower requirements, emergency and contingency measures as well as first-aid knowledge. • Select and apply appropriate personal protective equipment according to types of chemical wastes involved. • Handle chemical wastes safely including collection, storage, transportation and disposal of chemical wastes according to organisational procedures. • Apply appropriate measures in handling accidents, emergency and contingency if required. • Comply with the procedures for storage and disposal of chemical waste and handle all wastes according to environmental protection requirements. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure safe disposal of chemical wastes according to the relevant regulations and organisations' established procedures.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • categorise chemical wastes and identify their characteristics and potential hazards, • select appropriate protective equipment to collect, store, transport or dispose of chemical wastes safely according to organisational procedures.
Remark	<p>The relevant legislations involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • Occupational Safety and Health Ordinance • Waste Disposal Ordinance

Unit of Competency

Functional Area: Operations Management

Title	Identify hazards associated with testing / inspection / certification activities
Code	105972L4
Range	This unit of competency (UoC) covers the abilities to identify hazards that are associated with testing / inspection / certification activities to enhance safety awareness at the workplace.
Level	4
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of working processes and procedures in the TIC industry <ul style="list-style-type: none"> • Describe the daily operation and detailed working procedures. • Specify sources and methods for hazard identification, including review of hazard and incident reports, standards and guidelines, workplace inspections. 2. Identify hazards associated with testing / inspection / certification activities <ul style="list-style-type: none"> • Identify hazards that are commonly found in the TIC industry, such as: <ul style="list-style-type: none"> • crush, • cuts, • burnt, • flammable liquids and gases, • cryogenics, • chemicals, • electric shock, • fluids under pressure, • microbiological organisms in water, soil, air, blood and related products, and human or animal tissue and fluids, • working at heights or in confined spaces. • Check for hazards prior to commencement of work and during work routinely. • Report hazards and incidents to supervisor according to organisations' policies and procedures and recommend improvement measures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the hazards and relevant control measures are known by all staff.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify hazards that are associated with testing/ inspection/ certification activities so as to enhance safety awareness at the workplace, • report hazards and incidents according to organisation's policies and procedures and recommend improvement measures.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Establish occupational safety and health system and guidelines
Code	105966L5
Range	This unit of competency (UoC) covers the abilities to establish occupational safety and health management system for workplaces in the TIC industry by evaluating respective regulations of occupational safety and health according to the organisation's policy.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <p>1. Possess knowledge of the regulations of occupational safety and health and the respective operations at workplaces</p> <ul style="list-style-type: none"> • Examine the responsibilities of employers and employees stipulated in the following ordinances, e.g.: <ul style="list-style-type: none"> • Occupational Safety and Health Ordinance, • Factories and Industrial Undertakings Ordinance as well as its related regulations, • related issues stipulated in the Fire Services Ordinance, • issues relating to LPG vehicles stipulated in the Gas Safety Ordinance, • related issues stipulated in the Dangerous Goods Ordinance, • respective labour regulations. • Evaluate the operation and human resources supply of each department within the organisation. • Identify the long-term and short-term objectives established by the organisation for occupational safety and health and the performance indicators. • Analyse the content of the risk assessment report. <p>2. Establish occupational safety and health management system</p> <ul style="list-style-type: none"> • Formulate evaluation procedure for performance indicators according to the policy requirements of occupational safety and health, such as evaluation methods, choice of persons and frequency. • Formulate working instructions on occupational safety and health management according to the analysis of the risk assessment report and comprehensive policy, such as the authority to use equipment, the instructions on safety operation of complicated equipment, establish monitoring system, devise reporting mechanism for incidents and compile records of documents. • Establish respective staff training procedure according to the human resources supply and actual operation of the organisation, such as resources arrangement, choice of persons to be trained and training proposals. • Review and analyse the effectiveness of the occupational safety and health management system and revise it when necessary. • Establish emergency and contingency measures to ensure smooth operation or minimise loss. • Review the established measures and confirm the compliance with statutory requirements. <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure the established occupational safety and health system and guidelines comply with the statutory requirements.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • establish a management system on occupational safety and health applicable to workplaces under their supervision according to comprehensive organisational policy, • review and optimise the occupational safety and health management system.
Remark	<p>The respective legislations involved in this unit of competency are as follows:</p> <ul style="list-style-type: none"> • Occupational Safety and Health Ordinance • Factories and Industrial Undertakings Ordinance • Fire Services Ordinance • Gas Safety Ordinance • Dangerous Goods Ordinance • Waste Disposal Ordinance

Unit of Competency**Functional Area: Operations Management**

Title	Establish chemical waste handling procedures
Code	105967L5
Range	This unit of competency (UoC) covers the ability to establish chemical waste handling procedures according to relevant regulations and organisational requirements.
Level	5
Credit	1 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of definition, characteristics and relevant regulations on handling chemical wastes <ul style="list-style-type: none"> • Explain the definition, characteristics and labelling system of chemical wastes. • Identify the relevant regulations for handling chemical waste such as the Waste Disposal Ordinance. • Specify the organisational requirements on handling chemical wastes. • Examine the responsibilities of employers and employees stipulated in the Occupational Safety and Health Ordinance. 2. Establish chemical waste handling procedures <ul style="list-style-type: none"> • Establish handling procedures for proper collection, storage, transportation and disposal of chemical wastes. • Ensure all staff members are familiarised with proper chemical waste handling procedures to minimise the harm to people and the environment. • Provide training to equip staff with the knowledge of the established procedures for handling chemical wastes. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure that the established chemical waste handling procedures comply with relevant regulations and organisational requirements.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • establish handling procedures for chemical wastes according to the relevant regulations and the organisational requirements.
Remark	<p>The relevant legislations involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • Waste Disposal Ordinance • Occupational Safety and Health Ordinance

Unit of Competency

Functional Area: Operations Management

Title	Perform risk assessment for laboratory / site work
Code	105968L5
Range	This unit of competency (UoC) covers the abilities to perform risk assessment for laboratory / site work and generate appropriate recommendations for improvement according to the regulations related to occupational safety and health.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of risk assessment <ul style="list-style-type: none"> • Identify and investigate the occupational safety and health risks associated with laboratory/ site work. • Identify relevant occupational safety and health regulations and their requirements. • Specify organisational requirements on occupational safety and health. • Establish the procedures and methods of risk assessment. • Explain the importance of risk assessment to the prevention of accidents. 2. Perform risk assessment for laboratory / site work according to relevant regulations and organisational requirements <ul style="list-style-type: none"> • Classify the working procedures and collect relevant information for laboratory / site work. • Analyse the potential hazards arising from working procedures and equipment. • Assess various operating parameter variation and estimate the respective impact so as to determine the risk level, including the severity and the frequency of hazards. • Generate recommendations for improvement according to risk assessment results. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the risk assessment for laboratory / site work can meet relevant regulations of occupational safety and health.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • assess the risks associated with laboratory / site work according to relevant regulations and organisational requirements, • generate recommendations for improvement to eliminate or reduce risks.
Remark	<p>The relevant legislation involved in this UoC is as follows:</p> <ul style="list-style-type: none"> • Occupational Safety and Health Ordinance

Unit of Competency

Functional Area: Operations Management

Title	Formulate occupational safety and health policy and improvement plans
Code	105965L6
Range	This unit of competency (UoC) covers the ability to formulate comprehensive occupational safety and health policy for the TIC enterprise by critically evaluating statutory requirements and addressing the needs of the TIC organisation.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of statutory requirements on occupational safety and health and policy planning <ul style="list-style-type: none"> • Critically evaluate the statutory requirements on occupational safety and health, related knowledge and future trend. • Explain the overall operation strategy of the organisation, market positioning and corporate image. • Advocate the key of success for organisations with distinctive achievements in occupational safety and health. 2. Formulate comprehensive occupational safety and health policy for the organisation <ul style="list-style-type: none"> • Examine a broad range of internal and external factors when formulating the comprehensive occupational safety and health policy for the organisation, e.g.: <ul style="list-style-type: none"> • select the appropriate occupational safety and health system for the organisation, • establish relevant performance indicators, • establish long-term and short-term objectives. • Critically analyse the discrepancy between the expected achievement and current performance to set up relevant management system, e.g.: <ul style="list-style-type: none"> • prepare the required resources, • monitor the operation of the system, • establish internal communication channels, • review effectiveness and suggest improvement measures when appropriate. • Take appropriate actions ensuring that the occupational safety and health policy and its effectiveness can meet relevant statutory requirements and organisational needs. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the formulated occupational safety and health policy and improvement plans comply with the relevant statutory requirements.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • formulate the occupational safety and health policy to meet the actual need of the organisation by critically evaluating the statutory requirements of occupational safety and health.
Remark	<p>The relevant legislations involved in this UoC are as follows:</p> <ul style="list-style-type: none"> • Occupational Safety and Health Ordinance • Factories and Industrial Undertakings Ordinance • Factories and Industrial Undertakings (Safety Management) Regulation • Code of Practice on Safety Management

Unit of Competency

Functional Area: Operations Management

Title	Develop risk management strategies
Code	105978L5
Range	This unit of competency (UoC) covers the ability to develop risk management strategies related to TIC industry within an organisation by critically reviewing the operations of the organisation and applying risk management techniques.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of risk management techniques <ul style="list-style-type: none"> • Identify potential risks and examine their type and nature. • Analyse probability and consequences of risk factors. • Identify available options to handle risks. • Employ risk management techniques. • Relate an organisation’s risk management requirements with reference to organisation’s guidelines. 2. Develop risk management strategies <ul style="list-style-type: none"> • Establish awareness and culture of risk management with respect to the management policy and objectives of the organisation. • Develop risk management strategies that are most suitable for the organisation and in accordance with the guidelines of the organisation. • Make appropriate use of methodologies and tools in the development of risk management strategies. • Establish systemic communication mechanism for the staff to handles risks. • Identify the responsibilities of staff involved in risk management and the available techniques to manage risks. • Collect views from the staff on risk management. • Document risk management strategies. • Review the effectiveness of the risk management strategies on a regular basis. • Suggest recommendations to revise risk management strategies. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure risk management strategies are critically reviewed regularly to manage risks effectively.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • develop and critically review risk management strategies that can effectively manage the risks in the TIC organisation.
Remark	<p>The international standard relevant to this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO 31000 Risk Management – Principles and Guidelines

Unit of Competency**Functional Area: Operations Management**

Title	Implement crisis management plans
Code	105979L5
Range	This unit of competency (UoC) covers the abilities to generate and implement crisis management plans within the TIC organisation by incorporating organisational programmes such as emergency response (broken equipment, customer complaint, etc.), disaster recovery, risk management, and business continuity to maintain the reputation and brand image of the organisation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of crisis management <ul style="list-style-type: none"> • Handle crises associated with TIC industry, such as delays or deviations in the performance of the tests and/or calibrations, lack of resources or human errors. • Explain the business objectives and goals, business area and strategies, culture, practices and policies of the TIC organisation. • Anticipate potential crises within the organisation. • Critically evaluate possible risks and threats to the organisation, staff, and assets including information and intellectual issues. • Specify the regulatory and legal requirements for the TIC industry. • Describe business continuity planning of the organisation. • Explore and develop risk management and insurance programme. • Employ general management skills such as business communication, people management, change management, negotiation and business operations. 2. Generate and implement crisis management plans <ul style="list-style-type: none"> • Work with colleagues and use various crisis management techniques to identify possible crises and their effects on the organisation. • Determine the likely consequences and assess the risks of each eventuality. • Formulate risk strategy and procedures to prevent the crises from occurring and to deal with the crises. • Formulate business continuity plan that can bring the organisation / tests / calibrations / staff back to the normal operation. • Identify staff or teams which are responsible for handling each crisis. • Identify the best method to communicate the crisis handling procedures to internal and external stakeholders. • Identify resources and training required for staff to be prepared for handling the crises. • Manage the documentation of the plan for presentation to senior management for approval and adoption of the implementation of the crisis management plans. • Evaluate the effectiveness of the plans and review procedures that can modify the plans to be the most effective for the organisation. 3. Exhibit professionalism <ul style="list-style-type: none"> • Consider a proper balance among all related technological, political, social, environmental and legal factors in developing crisis management plans.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • identify possible crises and risks of the organisation, • implement mitigating procedures to handle each crisis which can minimise its effect on the organisation / customer / staff, • implement suitable training and drilling plans to prepare the staff to handle crises in the most effective manner, • evaluate the effectiveness of the plans and review procedures that can modify the plans for continuous improvements.
Remark	<p>The international standard relevant to this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO 22301 Societal Security – Business Continuity Management Systems – Requirements

Unit of Competency

Functional Area: Operations Management

Title	Formulate risk management plans
Code	105977L6
Range	This unit of competency (UoC) covers the abilities to critically evaluate a wide scope of information relating to TIC businesses and risk assessments to formulate risk management plans for the organisation in an ever-changing business environment.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of the scope and sources of risks for TIC industry <ul style="list-style-type: none"> • Examine a broad range of sources of risks such as natural disasters, fire, accidents, thefts, quality of internal management. • Explain the operating details and daily operation of the organisation. • Evaluate the scope of risks faced by the organisation, e.g.: <ul style="list-style-type: none"> • injury and death, • direct property loss, • inventory loss, e.g. equipment, chemicals, • damages on equipment, e.g. testing instruments, calibration equipment, • loss of talents, e.g. experienced technical staff and managerial staff, • business computer operation system failure, • loss of important record and information, • damage on the reputation of the organisation. 2. Formulate risk management plans <ul style="list-style-type: none"> • Analyse findings in risk assessment reports. • Formulate risk management plans for the organisation and make the most suitable preparation, e.g.: <ul style="list-style-type: none"> • select the most appropriate insurance plans for the assets and unpredictable tangible risks of loss, e.g. property loss, inventory loss, damages on equipment, • monitor and review organisational human resources policy for the risk of loss of talents, e.g. training policy, promotion, remuneration conditions, • monitor and review the daily operation and equipment management policy for the risk of operating equipment failure, e.g. instable functioning of computer operation systems, testing instruments and equipment, • monitor and review the daily operation and monitoring system for the risk of theft of inventory goods, e.g. security systems, the receipt and dispatch of inventory and relevant records, • take into account the public relation strategy and quality management system for the risk of corporate reputation, • consider thoroughly factors like occupational safety, health and environmental protection when formulating risk management plans. • Establish structural management system and relevant indicators, collect data, conduct analysis, make improvement, monitor and prepare suitable resources to implement the risk management plans as well as emergency and contingency measures. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the risk management plans are formulated according to the needs of the TIC organisation.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • integrate a broad range of information and critically evaluate the potential risks in the TIC organisation, • formulate risk management plans for the TIC organisation to minimise or transfer possible risks.
Remark	<p>The international standard relevant to this UoC is as follows:</p> <ul style="list-style-type: none"> • ISO 31000 Risk Management – Principles and Guidelines

Unit of Competency

Functional Area: Operations Management

Title	Develop and implement staff training and development programmes
Code	105982L4
Range	This unit of competency (UoC) covers the abilities to analyse the need for staff training and develop appropriate training programmes to improve the quality of the staff working in the TIC organisation.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of staff training and development <ul style="list-style-type: none"> • Describe the organisational structure and function of each department. • Specify the competency requirements of each post in the organisation. • Specify the requirements of professional accreditation for specific jobs in the TIC organisation. • Explain the essential features of staff training in the TIC organisation, e.g.: <ul style="list-style-type: none"> • purpose of training, • method of training, • appraisal method, • training system. • Identify the characteristics, functions and advantages of different training methods, e.g.: <ul style="list-style-type: none"> • in-house training, • continuous learning, • in-service training. 2. Develop and implement staff training and development programmes <ul style="list-style-type: none"> • Assess the requirements for manpower in the foreseeable future according to the development of the business. • Analyse the competency of the staff and the need for training in the department, including professional training. • Establish the necessary staff training needs for selected person with priorities. • Develop training programmes according to the internal successor / promotion plans of the organisation. • Select an appropriate training method according to the special requirements of the department, internal training capacity, characteristics of the expected requirement on skills and the supply of the training market. • Prepare a complete staff training programme proposal. • Review the effectiveness of staff training and revise staff training programmes accordingly. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the training programmes can meet the requirements of the organisation and the development trend of the TIC industry.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • develop appropriate staff training programmes according to the training needs of staff of the TIC organisation.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Recruit and retain competent personnel
Code	105981L5
Range	This unit of competency (UoC) covers the abilities to analyse the competency requirements to select and recruit competent personnel for different posts, and develop strategies to retain the competent personnel in the organisation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of personnel competency and recruitment procedures <ul style="list-style-type: none"> • Explain the duties and scope of work of different posts in the organisation. • Analyse the requirements of human resources of the organisation, including current and the estimated manpower that may require. • Describe the established recruitment procedure and selection criteria of the organisation. • Identify the government legislations which are related to recruitment of staff, e.g.: <ul style="list-style-type: none"> • Equal Opportunities Ordinance, • Race Discrimination Ordinance, • Personal Data (Privacy) Ordinance. • Employ the skills to recruit and select personnel, e.g.: <ul style="list-style-type: none"> • skills to conduct the interview, • ability to revise the form and content of the recruitment test immediately. 2. Recruit and retain competent personnel <ul style="list-style-type: none"> • Select competent personnel to fill in different posts in accordance with the established recruitment procedure of the organisation, including: <ul style="list-style-type: none"> • list the duties and entry qualifications for each post, • deliver the message of job vacancies through different media, • follow the regulations of the organisation and legislative requirement during recruitment, • review and select appropriate personnel according to the established criteria of the organisation. • Use other appraisal methods other than interview for selection of staff, e.g.: <ul style="list-style-type: none"> • observe the actual performance of the candidate in the working location, • observe the performance of the candidate through role play, • through the performance appraisal report prepared by the supervisor or third party. • Review the methods and procedures of recruitment and selection of personnel regularly to meet the change and development of the labour market, and put forward suggestion for improvement. • Keep the documents and information about the recruitment and selection of personnel according to the established procedures of the organisation. • Develop strategies to retain competent personnel and avoid the shortage of manpower which may affect the development of the business. 3. Exhibit professionalism <ul style="list-style-type: none"> • Follow the relevant legislation during recruitment and selection of personnel to avoid breaking the law.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • select competent personnel for different posts in accordance with the established criteria for the selection and recruitment procedures of the organisation, • review the method of recruitment and selection of personnel regularly and put forward suggestions for improvement in accordance with the development of the labour market, • develop strategies to retain competent personnel and avoid the shortage of manpower.
Remark	

Unit of Competency**Functional Area: Operations Management**

Title	Formulate staff training and people development plan
Code	105980L6
Range	This unit of competency (UoC) covers the ability to formulate staff training and people development plan by analysing the objective of development and critically judging the resources of the TIC organisation to improve the skills and knowledge of the staff.
Level	6
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of staff training and people development <ul style="list-style-type: none"> • Describe the organisational structure and explain the function of each department. • Interpret the skills and competency requirements of each post related to TIC operations in the organisation. • Explain the essential components of human resources management, e.g.: <ul style="list-style-type: none"> • recruitment, • training, • remuneration, • benefits, • labour legislations. • Evaluate the professional accreditation of the TIC industry from the government / professional organisations. • Examine the skill upgrading training programmes accredited by the government / training institutions. • Specify the recognised qualifications and training requirements of the TIC organisation. • Analyse the functions and characteristics of the services of the organisation. 2. Formulate staff training and people development plan <ul style="list-style-type: none"> • Evaluate the work performance of the current staff according to the job requirements of different departments. • Analyse the difference between the ability and the expected competency of the current staff to establish necessary training needs for selected staff with priorities. • Critically assess the requirements of manpower and skills in the foreseeable future according to the trend of development of the TIC industry. • Formulate staff training programmes according to the internal successor / promotion plans of the organisation. • Select appropriate training methods according to the special requirements of different departments, internal training capacity and the supply of the training market. • Provide adequate training resources to meet the development needs of staff. • Evaluate the effectiveness of staff training programmes so that the staff can obtain the expected skills and knowledge through the training. • Review the effectiveness of staff training system and policy of the organisation regularly. • Put forward suggestions for improvement of the staff training and people development plan. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the training and development plan can help to improve the quality of the staff, and meet the need of the organisation and the developmental trend of the TIC industry.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • formulate staff training and people development plan in accordance with the objective of development and resources of the organisation.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Interact and exchange information with customers
Code	105985L3
Range	This unit of competency (UoC) covers the ability to interact and exchange information with customers according to the guidelines of the TIC organisation.
Level	3
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of interacting and exchanging information with customers <ul style="list-style-type: none"> • Describe customer relationships and the importance of customer service. • Determine customers' needs and requests. • Describe the procedures of customer service of the organisation. • Master the interpersonal skills. • Describe the functions and characteristics of the services. 2. Interact and exchange information with customers <ul style="list-style-type: none"> • Identify the importance of interacting and exchanging information with customers. • Select suitable and effective communication channels, e.g.: <ul style="list-style-type: none"> • meeting, • visit, • interview, • customer hotline, • e-mail, • customer feedback form, • fax. • Provide and exchange information about the services effectively. • Interact with customers and give advice and guidance in technical matters. • Maintain communication with the customers throughout the work, especially in large assignments. • Collect and classify information from the customers in appropriate circumstances according to the guidelines of the organisation. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure accurate information is provided to the customers.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • interact and exchange information with customers by using appropriate communication and interpersonal skills to gain customers' trust and build up good relationship.
Remark	

Unit of Competency**Functional Area: Operations Management**

Title	Follow up feedback from customers
Code	105984L4
Range	This unit of competency (UoC) covers the abilities to follow up feedback from customers according to the policies and procedures of the TIC organisation, and comprehend and respond to customers' opinions properly.
Level	4
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of following up feedback from customers and providing proper response <ul style="list-style-type: none"> • Explain the importance of customers' feedback to the development of the organisation. • Describe the relationship between customers and the organisation. • Determine the types of feedback channels, e.g.: <ul style="list-style-type: none"> • customer satisfaction surveys, • review of test or calibration reports with customers. • Describe the policies and procedures to follow up customers' feedback and provide response to customers. 2. Follow up feedback from customers <ul style="list-style-type: none"> • Obtain feedback, both positive and negative, from the customers by: <ul style="list-style-type: none"> • listening to customers' concerns, queries, questions or objections attentively and respect their rights to express opposite opinions, • revising service recommendation according to the needs and concerns of the customers, • encouraging customers to give feedback. • Handle and follow up customers' feedback, e.g.: <ul style="list-style-type: none"> • adopt the policies and procedures of the organisation for dealing with customers' feedback, • describe the background and behaviour of the customers, • use appropriate methods of communication and response, • investigate and follow up the case, • maintain and strengthen customer relationship, • analyse customers' requirements for service quality • Analyse the feedback to improve the management system, testing and calibration / inspection / certification activities and customer service. • Establish the database of customer feedback. 3. Exhibit professionalism <ul style="list-style-type: none"> • Follow up feedback from customers and respond to them in a timely and efficient manner to increase customer satisfaction. • Protect customer privacy and confidentiality.
Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to:</p> <ul style="list-style-type: none"> • follow up feedback from customer and respond to customer's opinion according to the policies and procedures of the organisation in a timely and efficient manner.
Remark	

Unit of Competency

Functional Area: Operations Management

Title	Handle and resolve customer service problems
Code	105983L5
Range	This unit of competency (UoC) covers the abilities to critically evaluate the customer service problems and justify the best solution to resolve customer service problems in compliance with the customer service policies of the TIC organisation.
Level	5
Credit	2 (for reference only)
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Possess knowledge of customer service policies <ul style="list-style-type: none"> • Explain the importance of good customer relationship. • Describe the policies and procedures of the organisation for dealing with customer service problems. • Analyse the rights of the customers. • Master the skills to build up good customer relationship, e.g.: <ul style="list-style-type: none"> • good personal image, • good communication skills, • the satisfaction of the customers, • the ability to deal with difficult customers. • Evaluate common customer services problems in TIC industry, e.g.: <ul style="list-style-type: none"> • problems about the testing and/or calibration procedures, inspection procedures, or auditing processes • delays or deviations in the performance of the tests and/or calibrations, inspection or certification, • problems caused by lack of resources or human error. 2. Handle and resolve customer service problems <ul style="list-style-type: none"> • Examine and evaluate the problems of the customers. • Propose various solutions for the problems and justify the best solution for the customer and the organisation to resolve customer service problems. • Discuss the solution with the customer and implement the solution. • Inform the customer about the progress of resolving the problems. • Report the problems and resolution to senior management. • Maintain records of the problems and the actions taken. • Review the performance of customer service, avoid the same problems to occur again and improve the quality of customer service. 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure the customer service problems are resolved to the customers' satisfaction.
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • critically evaluate customer service problems, • justify and select the best solution to resolve the customer service problems to achieve the customer's satisfaction.
Remark	

Generic Level Descriptors

Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
1	<ul style="list-style-type: none"> - Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others - Exercise basic skills - Receive and pass on information - Use, under supervision or prompting, basic tools and materials. - Apply learnt responses to solve problems - Operate in familiar, personal and/or everyday contexts - Take some account, with prompting, of identified consequences of actions. 	<ul style="list-style-type: none"> - Operate mainly in closely defined and highly structured contexts - Carry out processes that are repetitive and predictable - Undertake the performance of clearly defined tasks - Assume a strictly limited range of roles. 	<ul style="list-style-type: none"> - The ability to perform tasks of routine and repetitive nature given clear direction - Carry out directed activity under close supervision - Rely entirely on external monitoring of output and quality 	<ul style="list-style-type: none"> - Use very simple skills with assistance — for example: - Take some part in discussions about straightforward subjects - Read and identify the main points and ideas from documents about straightforward subjects - Produce and respond to a limited range of simple, written and oral communications, in familiar/routine contexts - Carry out a limited range of simple tasks to process data and access information - Use a limited range of very simple and familiar numerical and pictorial data - Carry out calculations, using whole numbers and simple decimals to given levels of accuracy.

Generic Level Descriptors

Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
2	<ul style="list-style-type: none"> - Apply knowledge based on an underpinning comprehension in a selected number of areas - Make comparisons with some valuation and interpret available information - Apply basic tools and materials and use rehearsed stages for solving problems. - Operate in familiar, personal and/or everyday contexts - Take account the identified consequences of actions. 	<ul style="list-style-type: none"> - Choose from a range of procedures performed in a number of contexts, a few of which may be non-routine - Co-ordinate with others to achieve common goals. 	<ul style="list-style-type: none"> - The ability to perform a range of tasks in predictable and structured contexts - Undertake directed activity with a degree of autonomy - Achieve outcomes within time constraints - Accept defined responsibility for quantity and quality of output subject to external quality checking. 	<ul style="list-style-type: none"> - Use skills with some assistance —for example: - Take active part in discussions about identified subjects - Identify the main points and ideas from documents and reproduce them in other contexts - Produce and respond to a specified range of written and oral communications, in familiar/routine contexts - Carry out a defined range of tasks to process data and access information - Use a limited range of familiar numerical and graphical data in everyday contexts - Carry out calculations, using percentages and graphical data to given levels of accuracy.

Generic Level Descriptors

Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
3	<ul style="list-style-type: none"> - Apply knowledge and skills in arrange of activities, demonstrating comprehension of relevant theories - Access, organize and evaluate information independently and make reasoned judgements in relation to a subject or discipline - Employ a range of responses to well defined, but sometimes unfamiliar or unpredictable, problems - Make generalizations and predictions in familiar contexts. 	<ul style="list-style-type: none"> - Operate in a variety of familiar and some unfamiliar contexts, using a known range of technical or learning skills - Select from a considerable choice of predetermined procedures - Give presentations to an audience 	<ul style="list-style-type: none"> - The ability to perform tasks in a broad range of predictable and structured contexts which may also involve some non-routine activities requiring a degree of individual responsibility - Engage in self-directed activity with guidance/evaluation - Accept responsibility for quantity and quality of output - Accept well defined but limited responsibility for the quantity and quality of the output of others 	<ul style="list-style-type: none"> - Use a wide range of largely routine and well practiced skills — for example: - Produce and respond to detailed and complex written and oral communication in familiar contexts, and use a suitable structure and style when writing extended documents. - Select and use standard applications to obtain, process and combine information - Use a wide range of numerical and graphical data in routine contexts, which may have some non-routine elements.

Generic Level Descriptors

Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
4	<ul style="list-style-type: none"> - Develop a rigorous approach to the acquisition of a broad knowledge base, with some specialist knowledge in selected areas - Present and evaluate information, using it to plan and develop investigative strategies - Deal with well defined issues within largely familiar contexts, but extend this to some unfamiliar problems - Employ a range of specialised skills and approaches to generate a range of responses. 	<ul style="list-style-type: none"> - Operate in a range of varied and specific contexts involving some creative and non-routine activities - Exercise appropriate judgement in planning, selecting or presenting information, methods or resources - Carry out routine lines of enquiry, development of investigation into professional level issues and problems. 	<ul style="list-style-type: none"> - The ability to perform skilled tasks requiring some discretion and judgement, and undertake a supervisory role - Undertake self-directed and a some directive activity - Operate within broad general guidelines or functions - Take responsibility for the nature and quantity of own outputs - Meet specified quality standards - Accept some responsibility for the quantity and quality of the output of others. 	<ul style="list-style-type: none"> - Use a wide range of routine skills and some advanced skills associated with the subject/discipline — for example: - Present using a range of techniques to engage the audience in both familiar and some new contexts - Read and synthesize extended information from subject documents; organize information coherently, convey complex ideas in well-structured form - Use a range of IT applications to support and enhance work - Plan approaches to obtaining and using information, choose appropriate methods and data to justify results & choices - Carry out multi-stage calculations.

Generic Level Descriptors

Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
5	<ul style="list-style-type: none"> - Generate ideas through the analysis of abstract information and concepts - Command wide ranging, specialized technical, creative and/or conceptual skills - Identify and analyse both routine and abstract professional problems and issues, and formulate evidence-based responses - Analyse, reformat and evaluate a wide range of information - Critically analyse, evaluate and/or synthesize ideas, concepts, information and issues - Draw on a range of sources in making judgments. 	<ul style="list-style-type: none"> - Utilise diagnostic and creative skills in a range of technical, professional or management functions - Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes. 	<ul style="list-style-type: none"> - Perform tasks involving planning, design, and technical skills, and involving some management functions - Accept responsibility and accountability within broad parameters for determining and achieving personal and/or group outcomes - Work under the mentoring of senior qualified practitioners - Deal with ethical issues, seeking guidance of others where appropriate. 	<ul style="list-style-type: none"> - Use a range of routine skills and some advanced and specialized skills in support of established practices in a subject/discipline, for example: - Make formal and informal presentations on standard/mainstream topics in the subject/discipline to a range of audiences - Participate in group discussions about complex subjects; create opportunities for others to contribute - Use a range of IT applications to support and enhance work - Interpret, use and evaluate numerical and graphical data to achieve goals/targets.

Generic Level Descriptors

Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
6	<ul style="list-style-type: none"> - Critically review, consolidate, and extend a systematic, coherent body of knowledge - Utilise highly specialised technical research or scholastic skills across an area of study - Critically evaluate new information, concepts and evidence from a range of sources and develop creative responses - Critically review, consolidate and extend knowledge, skills practices and thinking in a subject/discipline - Deal with complex issues and make informed judgements in the absence of complete or consistent data/information. 	<ul style="list-style-type: none"> - Transfer and apply diagnostic and creative skills in a range of situations - Exercise appropriate judgement in complex planning, design, technical and/or management functions related to products, services operations or processes, including resourcing and evaluation - Conduct research, and/or advanced technical or professional activity - Design and apply appropriate research methodologies. 	<ul style="list-style-type: none"> - Apply knowledge and skills in a broad range of professional work activities - Practice significant autonomy in determining and achieving personal and/or group outcomes - Accept accountability in related decision making including use of supervision - Demonstrate leadership and /or make an identifiable contribution to change and development. 	<ul style="list-style-type: none"> - Communicate, using appropriate methods, to a range of audiences including peers, senior colleagues, specialists - Use a wide range of software to support and enhance work; identify refinements to existing software to increase effectiveness or specify new software - Undertake critical evaluations of a wide range of numerical and graphical data, and use calculations at various stages of the work.

Generic Level Descriptors

Level	Knowledge & Intellectual Skills	Processes	Application, Autonomy & Accountability	Communications, IT & Numeracy
7	<ul style="list-style-type: none"> - Demonstrate and work with a critical overview of a subject or discipline, including an evaluative understanding of principal theories and concepts, and of its broad relationships with other disciplines - Identify, conceptualise and offer original and creative insights into new, complex and abstract ideas and information - Deal with very complex and/or new issues and make informed judgements in the absence of complete or consistent data/information - Make a significant and original contribution to a specialised field of inquiry, or to broader interdisciplinary relationships. 	<ul style="list-style-type: none"> - Demonstrate command of research and methodological issues and engage in critical dialogue - Develop creative and original responses to problems and issues in the context of new circumstances. 	<ul style="list-style-type: none"> - Apply knowledge and skills in a broad range of complex and professional work activities, including new and unforeseen circumstances - Demonstrate leadership and originality in tackling and solving problems - Accept accountability in related decision making - High degree of autonomy, with full responsibility for own work, and significant responsibility for others - Deal with complex ethical and professional issues. 	<ul style="list-style-type: none"> - Strategically use communication skills, adapting context and purpose to a range of audiences - Communicate at the standard of published academic work and/or critical dialogue - Monitor, review and reflect on own work and skill development, and change and adapt in the light of new demands - Use a range of software and specify software requirements to enhance work, anticipating future requirements - Critically evaluate numerical and graphical data, and employ such data extensively.

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