



REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

QUANTITY SURVEYOR

LEVEL 6



TVET CDACC
P.O. BOX 15745-00100
NAIROBI

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Council Secretary/CEO

TVET Curriculum Development, Assessment and Certification Council

P.O. Box 15745–00100

Nairobi, Kenya

Email: info@tvetcdacc.go.ke

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FOREWORD

The provision of quality education and training is fundamental to the Government's overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya's development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted in the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET shall be competency based, curriculum development shall be industry led, certification shall be based on demonstration of competence and mode of delivery shall allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for the purpose of developing a competency-based curriculum for Quantity Surveyor. These Occupational Standards will also be the basis for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the Building and Construction sector's growth and sustainable development.

**PRINCIPAL SECRETARY
VOCATIONAL AND TECHNICAL TRAINING
MINISTRY OF EDUCATION**

PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, “middle-income country providing a high-quality life to all its citizens by the year 2030”. Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 and Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification in TVET. This called for shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Building and Construction Sector Skills Advisory Committee (SSAC), have developed these Occupational Standards for a Quantity Surveyor. These standards will be the basis for development of competency-based curriculum for Quantity Surveying level 6.

The occupational standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

I am grateful to the Council members, Council Secretariat, Building and Construction SSAC, expert workers and all those who participated in the development of these occupational standards.

CHAIRMAN

TVET CDACC

ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVETCDACC) for providing guidance on the development of these Standards. My gratitude goes to Building and Construction Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

I acknowledge all other institutions which in one way or another contributed to the development of these standards.

CHAIRMAN

BUILDING AND CONSTRUCTION SECTOR SKILLS ADVISORY COMMITTEE

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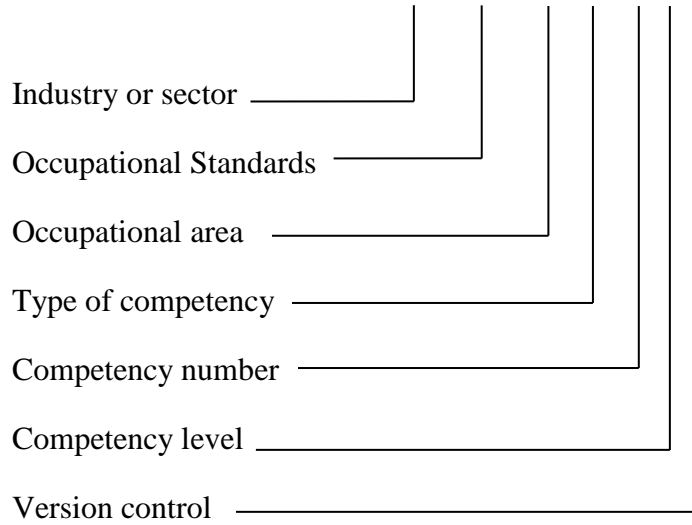
ABBREVIATIONS AND ACRONYMS

BQS	Bill of Quantities
BRC	British reinforcement concrete
CAD	Computer Aided Design
CDACC	Curriculum Development Assessment and Certification Council
EHS	Environment, health and safety
EMS	Environmental Management System
ICT	Information Computer Technology
NEMA	National Environment Management Authority
NOS	National Occupational Standards
PPE	Personal Protective Equipment
TVET	Technical and Vocational Education and Training

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KEY TO UNIT CODE

ENG / OS / QS / BC / 01 / 6 / A



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OVERVIEW

Quantity Surveying Level 6 qualification consists of competencies that a person must achieve to enable him/her to be certified as a Quantity Surveyor. The units of competency comprising Quantity Surveying certificate level 6 qualifications include the following Basic, Common and Core Units of competency:

BASIC UNITS OF COMPETENCY

Unit Code	Unit Title
ENG/OS/QS/BC/01/6/A	Demonstrate Communication Skills
ENG/OS/QS/BC/02/6/A	Demonstrate Digital Literacy
ENG/OS/QS/BC/03/6/A	Demonstrate Entrepreneurial Skills
ENG/OS/QS/BC/04/6/A	Demonstrate Employability Skills
ENG/OS/QS/BC/05/6/A	Demonstrate Environmental Literacy
ENG/OS/QS/BC/06/6/A	Demonstrate Occupational Health and Safety Practices

COMMON UNITS OF COMPETENCY

Unit Code	Unit Title
ENG/OS/QS/CC/01/6/A	Apply Engineering Mathematics
ENG/OS/QS/CC/02/6/A	Prepare and Interpret Technical Drawings
ENG/OS/QS/CC/03/6/A	Apply Building Material Science
ENG/OS/QS/CC/04/6/A	Apply Workshop Technology Practices
ENG/OS/QS/CC/05/6/A	Execute Building Temporary Works

CORE UNITS OF COMPETENCY

Unit Code	Unit Title
ENG/OS/QS/CR/01/6/A	Conduct Engineering Survey
ENG/OS/QS/CR/02/6/A	Produce Building Drawings
ENG/OS/QS/CR/03/6/A	Produce Civil Engineering Drawings
ENG/OS/QS/CR/04/6/A	Execute Construction Works
ENG/OS/QS/CR/05/6/A	Prepare Bill of Quantities

ENG/OS/QS/CR/06/6/A	Manage Project Contracts
ENG/OS/QS/CR/07/6/A	Manage Construction Project Finance
ENG/OS/QS/CR/08/6/A	Manage Construction Project

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BASIC COMPETENCIES

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COMMON COMPETENCIES

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APPLY ENGINEERING MATHEMATICS

UNIT CODE: ENG/OS/QS/CC/02/6/A

UNIT DESCRIPTION

This unit describes the competencies required by a Quantity Surveyor to apply a wide range of engineering mathematics in their work. This includes: applying algebraic functions, trigonometry and hyperbolic functions, complex numbers, coordinate geometry, carrying out binomial expansion, calculus, ordinary differential equations, Laplace transforms, power series, Statistics, Fourier series, Vector theory, Matrix, Numerical methods, probability, commercial calculations, estimations, measurements and calculations of quantities in solving problems.

ELEMENTS These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. <i>Bold and italicized terms are elaborated in the Range.</i>
1. Apply Algebra	1.1 Calculations involving Indices are performed as per the concept 1.2 Calculations involving Logarithms are performed as per the concept 1.3 Scientific calculator is used in solving mathematical problems in line with manufacturer's manual 1.4 Simultaneous equations are performed as per the rules 1.5 Quadratic equations are calculated as per the concept 1.6 Arithmetic and geometric progression problems are solved
2. Apply Trigonometry and hyperbolic functions	2.1 Calculations are performed using trigonometric rules 2.2 Calculations are performed using <i>hyperbolic functions</i>
3. Apply complex numbers	3.1 Complex numbers are represented using Argand diagrams 3.2 Operations involving complex numbers are performed 3.3 Calculations involving complex numbers are performed using De Moivre's theorem

4. Apply Coordinate Geometry	<p>4.1 Polar equations are calculated using coordinate geometry</p> <p>4.2 Graphs of given polar equations are drawn using the Cartesian plane</p> <p>4.3 Normal and tangents are determined using coordinate geometry</p> <p>4.4 Loci of points are determined for given mechanism</p>
5. Carry out Binomial Expansion	<p>5.0 Roots of numbers are determined using binomial theorem</p> <p>5.1 Errors of small changes are determined using binomial theorem</p> <p>5.2 Power series are derived through Binomial expansion</p>
6. Apply Calculus	<p>6.0 Derivatives of functions are determined using Differentiation</p> <p>6.1 Derivatives of hyperbolic functions are determined using Differentiation</p> <p>6.2 Derivatives of inverse trigonometric functions are determined using Differentiation</p> <p>6.3 Rate of change and small change are determined using Differentiation.</p> <p>6.4 Calculation involving stationery points of functions of two variables are performed using differentiation.</p> <p>6.5 Integrals of algebraic functions are determined using integration</p> <p>6.6 Integrals of trigonometric functions are determined using integration</p> <p>6.7 Integrals of logarithmic functions are determined using integration</p> <p>6.8 Integrals of hyperbolic and inverse functions are determined using integration</p>
7. Solve Ordinary differential equations	<p>7.0 First order and second order differential equations are formed.</p> <p>7.1 First order and second order differential equations are solved using the method of undetermined coefficients</p> <p>7.2 First order and second order differential equations are solved from given boundary conditions</p>

8. Apply Laplace transforms	<p>8.1 Laplace transforms are solved using initial and final value theorems</p> <p>8.2 Inverse Laplace transforms are solved using partial fractions</p> <p>8.3 Differential equations are solved using Laplace transforms</p>
9 Apply Power Series	<p>9.1 Power series are obtained using Taylor's Theorem</p> <p>9.2 Power series are obtained using Maclaurin's theorem</p>
10 Apply Statistics	<p>10.1 Identification, Collection and Organization of data is performed</p> <p>10.2 Interpretation, analysis and presentation of data in appropriate format is performed</p> <p>10.3 Mean, median, mode and Standard deviation are obtained from given data</p>
11. Apply Fourier Series	<p>11.1 Fourier series coefficients are obtained using Fourier series techniques</p> <p>11.2 Fourier series for 2π to T is are obtained using Fourier series techniques</p> <p>11.3 Fourier series for odd and even functions are obtained using Fourier series techniques</p> <p>11.4 Harmonic analysis is performed using numerical methods</p>
12. Apply Vector theory	<p>12.1 Calculations involving vector algebra, dot and cross products using vector theory</p> <p>12.2 Gradient, Divergence and Curl are obtained</p> <p>12.3 Vector calculations are performed using Green's theorem</p> <p>12.4 Vector calculations are performed using Stoke's theorem</p> <p>12.5 Conservative vector fields and line and surface integrals are obtained using Gauss's theorem</p>
13. Apply Matrix	<p>13.1 Determinant and inverse of 3x3 matrix are obtained</p> <p>13.2 Solutions of simultaneous equations are obtained</p> <p>13.3 Calculation involving Eigen values and Eigen vectors are performed</p>
14. Apply Numerical methods	<p>14.1 Roots of polynomials are obtained using iterative numerical methods</p>

	14.2 Interpolation and extrapolation are performed using numerical methods
15. Apply concepts of probability for work	15.1 Calculations are performed based on Laws of probability 15.2 Calculation involving probability distributions, mathematical expectation sampling distributions are performed 15.3 Probability events are determined from dependent, independent and mutually exclusive 15.4 Counting is done using permutation, combination, tree diagrams and Venn diagrams techniques
16. Perform commercial calculations	16.1 Exchange rate calculations are done using devaluation and revaluation 16.2 Sales, stock turnover and profit and loss are determined 16.3 Incomes, salaries and wages are calculated
17. Perform estimations, measurements and calculations of quantities	17.1 Measurement information in workplace is extracted and interpreted 17.2 Appropriate workplace measuring tools and equipment are identified and selected 17.3 Conversions are performed between units of measurement 17.4 Measurements are estimated and taken 17.5 Length, width, height, perimeter, area and angles of <i>figures</i> are calculated 17.6 Volume and surface area of figures are calculated 17.7 Information is recorded using mathematical language and symbols appropriate for the task

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
Hyperbolic functions include but not limited to:	<ul style="list-style-type: none"> • Sinh x • Cosh x • Cosec x • Coth x • Tanh x • Sech x

Figures includes but not limited:	<ul style="list-style-type: none"> • Triangles • Squares • Rectangles • Circles • Spheres • Cylinders • Cubes • Polygons • Cuboids • Pyramids
Quantities includes but not limited to:	<ul style="list-style-type: none"> • Weight, • Mass • Area • Volume • Length • Width • Depth • Perimeter

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Applying fundamental operations (addition, subtraction, division, multiplication)
- Using and applying mathematical formulas
- Logical thinking
- Problem solving
- Applying statistics
- Drawing graphs
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

- Fundamental operations (addition, subtraction, division, multiplication)
- Calculating area and volume
- Types and purpose of measuring instruments
- Units of measurement and abbreviations

- Rounding techniques
- Types of fractions
- Types of tables and graphs
- Presentation of data in tables and graphs
- Vector operations
- Matrix operations

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills, knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> 1.1 Applied Trigonometry and hyperbolic functions 1.2 Applied complex numbers 1.3 Determined angles and length in triangles 1.4 Applied Calculus 1.5 Solved Ordinary differential equations 1.6 Applied Laplace transforms 1.7 Applied Power Series 1.8 Applied Fourier Series 1.9 Applied Vector theory 1.10 Applied Matrix 1.11 Identified and selected measuring equipment 1.12 Collected, Analyzed and presented data 1.13 Applied Numerical methods
2.0 Resource Implications	The following resources should be provided: <ul style="list-style-type: none"> 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Measuring equipment 2.3 Materials relevant to the proposed activity or tasks
3.0 Methods of Assessment	Competency in this unit may be assessed through: <ul style="list-style-type: none"> 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
Context of Assessment	Competency may be assessed: <ul style="list-style-type: none"> 4. 1 On-the-job 4. 2 Off-the –job

	4. 3During Industrial attachment
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PREPARE AND INTERPRET TECHNICAL DRAWINGS

UNIT CODE: ENG/OS/QS/CC/02/6/A

UNIT DESCRIPTION

This unit covers the competencies required to prepare and interpret technical drawings by a Quantity Surveyor. It involves competencies to select, use and maintain drawing equipment and materials. It also involves producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings of components and application of CAD softwares.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA
<p>These describe the key outcomes that make up workplace function.</p>	<p>These are assessable statements which specify the required level of performance for each of the elements.</p> <p><i>Bold and italicized terms are elaborated in the Range</i></p>
<p>1. Use and maintain drawing equipment and materials</p>	<p>1.1 <i>Drawing equipment</i> are obtained according to task requirements</p> <p>1.2 <i>Drawing materials</i> are obtained according to task requirements</p> <p>1.3 Drawing equipment are used and maintained according to manufacturer instructions</p> <p>1.4 Drawing materials are used according to task requirements</p> <p>1.5 Waste materials are disposed in accordance with workplace procedures and <i>environmental legislations</i></p> <p>1.6 <i>Personal Protective Equipment</i> is used according to occupational safety and health regulations</p>

<p>2. Produce plain geometry drawings</p>	<p>2.1 Lettering and line work is done according to drawing rules</p> <p>2.2 Sketches of <i>geometric forms</i> are interpreted according to standard conventions</p> <p>2.3 Different types of angles are constructed according to principles of trigonometry</p> <p>2.4 Different types of geometric forms are constructed according to standard drawing conventions</p> <p>2.5 Constructed geometric forms are dimensioned according to drawing requirements</p>
<p>3. Produce solid geometry drawings</p>	<p>3.1 <i>Sketches of patterns</i> e.g. are interpreted according to work requirements</p> <p>3.2 Interpenetrating surface of solids and truncated solids are developed according to work requirements</p> <p>3.3 <i>Interpenetrations of solids</i> of equal and unequal is done according to work requirements</p>
<p>4. Produce pictorial and orthographic drawings of components</p>	<p>4.1 Different symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions</p> <p>4.2 Isometric sketches and drawings of components are interpreted and produced in accordance with the standard conventions of isometric drawings</p> <p>4.3 First and third angle orthographic sketches and drawings of components are produced in accordance with the standard conventions of orthographic drawings</p> <p>4.4 Freehand sketching of different types of geometric forms, tools, equipment, diagrams and components is conducted</p>
<p>5. Produce assembly drawings</p>	<p>5.1 Orthographic views are exploded according to standard conventions of orthographic drawings.</p> <p>5.2 Pictorial views are exploded according to standard conventions of orthographic drawings.</p> <p>5.3 Part lists are identified according to drawing specifications</p> <p>5.4 Sectional views are produced according to standard conventions of drawing.</p> <p>5.5 Produced drawing is hatched according to standard conventions of drawings.</p>

6. Apply CAD in technical drawing	6.1 <i>CAD software</i> are identified according to work requirements 6.2 2-D models are produced according to work requirements 6.3 3D models are produced according to work requirements 6.4 Produced models are annotated according to work requirements
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RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
Drawing equipment may include but is not limited to:	<ul style="list-style-type: none"> • Drawing boards • T-square • Set squares • Drawing set • French curves • Computers
Drawing materials may include but is not limited to:	<ul style="list-style-type: none"> • Drawing papers • Pencils • Erasers • Masking tapes • Paper clips
CAD software may include but is not limited to:	<ul style="list-style-type: none"> • AutoCAD • Inventor • Solid Works • Archi CAD • Electronic work bench • Circuit maker • Proteus
Sketches of patterns may include but is not limited to:	<ul style="list-style-type: none"> • Cylinders • Prisms • Pyramids

Interpenetrations of solids may include but is not limited to:	<ul style="list-style-type: none"> • Cylinder to cylinder • Cylinder to prism • Prism to prism
Environmental legislations may include but is not limited to:	<ul style="list-style-type: none"> • EMCA 1999 • NEMA Regulations
Personal Protective Equipment may include but is not limited to:	<ul style="list-style-type: none"> • Dust coats • Closed leather shoes • Goggles for CAD
Geometric forms may include but is not limited to:	<ul style="list-style-type: none"> • Circles • Triangles • Rectangles • Parallelogram • Polygons • Pyramids • Conic sections • Prisms • Loci
Standard drawing conventions may include but is not limited to:	<ul style="list-style-type: none"> • Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) • Drawing scale (paper size and drawing symbols) • International drawing standards

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required skills

The individual needs to demonstrate the following skills:

- Critical thinking
- Drawing
- Interpretation
- Drawing equipment handling
- Analysis and synthesis
- Communication
- Inter personal relations
- Computer

Required knowledge

The individual needs to demonstrate knowledge of:

- Drawing equipment and materials
- Freehand sketching
- Lettering
- Geometrical constructions
- Types of drawings
- Types of lines
- Engineering calculations
- Isometric drawing conventions, features, characteristics, components
- Orthographic drawing conventions, features, characteristics, components
- Sketches and drawings of simple patterns

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied and adhered to safety procedures 1.2 Cared and maintained drawing equipment 1.3 Interpreted circuit, assembly and lay out diagrams 1.4 Applied appropriate technical standards, used proper tools and equipment for a given task 1.5 Produced sketches and drawings 1.6 Applied CAD in production of drawings
2. Resource Implications	Resources the same as that of workplace are advised to be applied. 2.1 Drawing room 2.2 Drawing equipment and materials 2.3 Computers 2.4 CAD software 2.5 PPE 2.6 Internet
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report

4. Context of Assessment	Competency may be assessed: 4. 1 On-the-job 4. 2 Off-the –job 4. 3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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APPLY MATERIAL SCIENCE PRINCIPLES

UNIT CODE: ENG/OS/QS/CC/03/6/A

Unit Description:

This unit describes the competencies required by a Quantity Surveyor in order to apply material science principles. It involves analyzing properties of engineering materials, utilize engineering materials, performing heat treatment, material testing and identifying corrosion and its prevention.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA
These describe the key outcomes which make up workplace function	These are assessable statements which specify the required level of performance for each of the elements <i>(Bold and italicized terms are elaborated in the Range)</i>
1. Analyse properties of engineering materials	1.1 Type of engineering materials are identified as per prescribed procedures 1.2 Physical properties of engineering material are determined according material specifications 1.3 Mechanical properties of engineering materials are identified according to material specifications 1.4 Crystal structures of materials and their characteristics are analysed according to material specifications
2. Utilise engineering materials	2.1 Identify and select engineering material according to production requirements. 2.2 Operation plan is developed according to engineering drawing. 2.3 Appropriate machine is set up according to manufacturer manual 2.4 Production parameters are set according to production requirement 2.5 Production is performed according to work requirements
3. Perform heat treatment	3.1 Safety practices are observed according to OSHA 2007 3.2 Heat treatment processes are identified according to material specifications 3.3 Procedure in heat treatment processes is identified according to work requirements 3.4 Heat treatment of metals is performed according to work requirements

4. Perform material testing	<p>4.1 Safety is observed in material testing procedures according to OSHA, 2007</p> <p>4.2 Material testing methods are identified according to work requirement</p> <p>4.3 Procedure of material testing is followed as per material testing method</p> <p>4.4 Material testing results are tabulated, presented, calculated and interpreted according to testing results</p> <p>4.5 Material testing equipment are maintained according to manufacturer specifications.</p>
5. Prevent material corrosion	<p>5.1 Safety is observed during corrosion prevention according to OSHA 2007</p> <p>5.2 Corrosion types are identified according to work requirements</p> <p>5.3 Methods of corrosion prevention are identified according to work requirements</p> <p>5.4 Corrosion is prevented as per the prescribed corrosion prevention methods</p>

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Physical properties may include but is not limited to:	<ul style="list-style-type: none"> • Density • Color • Texture • Melting point • Thermal conductivity • Electrical resistivity • Electro-magnetism
Mechanical properties may include but is not limited to:	<ul style="list-style-type: none"> • Ductility • Malleability • Elasticity • Toughness • Hardness • Brittleness • Plasticity

	<ul style="list-style-type: none"> • Strength
Material testing methods may include but is not limited to:	<ul style="list-style-type: none"> • Compression test • Hardness tests • Impact tests • Creep tests • Bending tests • Fatigue tests • Torsional tests • Sharing tests
Heat treatment processes may include but is not limited to:	<ul style="list-style-type: none"> • Annealing • Tempering • Normalizing • Hardening • Case hardening
Engineering materials may include but is not limited to:	<ul style="list-style-type: none"> • Metals • Metal alloys • Ceramics • Composites • Polymers • Plastics • Wood
Corrosion type may include but is not limited to:	<ul style="list-style-type: none"> • Galvanic • Stress corrosion cracking
Methods of corrosion prevention may include but is not limited to:	<ul style="list-style-type: none"> • Painting • Electroplating • Galvanizing • Cathodic • Chromizing

REQUIRED KNOWLEDGE AND SKILLS

The individual needs to demonstrate the following skills

Required Skills

- Measuring and marking
- Material testing
- Use of hand tools

- Inspection
- Testing

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

- Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
- National Environment Management Authority Act, Kenya 2004
- OSH ACT 2007
- Equipment manuals
- Mathematics & science
- Physics and mechanics
- Metallurgy and materials
- Inspection and testing
- WIBA ACT
- Report writing

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the learner 1.1 Observed safety as per work place procedures 1.2 Demonstrated understanding of physical, chemical and mechanical properties of engineering materials 1.3 Utilized engineering materials 1.4 Performed heat treatment 1.5 Performed material testing 1.6 Demonstrated understanding of corrosion types and its prevention
2. Resource Implications	2.1 Testing materials 2.2 Measuring instruments 2.3 Inspection tools
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test

	<p>3.4 Portfolio of Evidence</p> <p>3.5 Interview</p> <p>3.6 Third party report</p>
4. Context of Assessment	<p>Competency may be assessed:</p> <p>4. 1 On-the-job</p> <p>4. 2 Off-the –job</p> <p>4. 3 During Industrial attachment</p>
5. Guidance information for assessment	<p>Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended.</p>

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PERFORM WORKSHOP PROCESSES AND PRACTICES

UNIT CODE: ENG/OS/QS/CC/04/6/A

Unit description

This unit describes the competencies required by a Quantity Surveyor in order to apply a wide range of workshop processes and practice skills in their work. It involves use technical drawing to plan work operations, measuring and marking out dimensions on work pieces, use hand tools to cut and file parts, use drills to make holes, threading using taps and dies, production of components using a lathe and milling machine, assembling of metal parts and sub-assemblies, performing of surface finish, performing of housekeeping, inspecting finished work for accuracy and quality and maintenance of tools and equipment.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. <i>Bold and italicized terms are elaborated in the Range</i>
1. Use technical drawing to plan work operations	1.1 Technical drawings are produced <i>as per drawing standards</i> 1.2 Technical drawings and geometric symbols are read and interpreted as per drawing standards. 1.3 <i>Operation plan</i> is produced as per the technical drawings.
2. Measure and mark out dimensions on work pieces	2.1 Measuring tools suitable for the work are selected according to task description 2.2 Measuring tools are inspected and calibrated as per requirements 2.3 Dimensions are marked on the work piece as per the working drawing.
3. Use hand tools to cut and file parts	3.1 <i>Hand tools</i> are selected based on operation plan 3.2 Work piece is cut to specification based on job requirement 3.3 Work piece is filed to specification based on job requirement 3.4 Part are produced to <i>specifications</i> based on work requirement
4. Use drills to make holes	4.1 Hole centers are marked and center-punched as per operation plan.

	<p>4.2 Drill bits are selected and mounted according to work requirements</p> <p>4.3 Work piece is mounted and clamped according to workshop regulations</p> <p>4.4 Hole is drilled to specification according to work requirements</p> <p>4.5 Holes inspected to specification according to work requirements</p>
5. Thread using taps and dies	<p>5.1 Taps and dies selected based on operation plan.</p> <p>5.2 Taps and dies are set up on the work piece according to work specifications</p> <p>5.3 Work piece is clamped according to work requirements</p> <p>5.4 Threads are cut according to work specifications</p>
6. Produce components using a lathe and milling machine	<p>6.1 Work piece is faced according to work specifications</p> <p>6.2 Work pieces are turned according to work requirements</p> <p>6.3 Work piece is threaded according to work requirements</p> <p>6.4 Work piece is drilled according to work requirements</p> <p>6.5 Work piece is bored according to work requirements</p> <p>6.6 Work piece is milled according to specified milling operation</p>
7. Assemble metal parts and sub-assemblies	<p>7.1 Joining and assembly method is selected according to work requirements</p> <p>7.2 Parts joined, fitted and assembled according to the specified assembly and joinery methods</p> <p>7.3 Final assembly is inspected as per specification</p>
8. Perform surface finish	<p>8.1 Surface finishing method is selected according to work requirements</p> <p>8.2 Surface finishing materials are selected according to work requirements</p> <p>8.3 Work piece is surface finished according to work requirements</p>
9. Perform housekeeping	<p>9.1 Waste is segregated and disposed as per disposal guidelines.</p>

	<p>9.2 Housekeeping is carried out as per workplace requirement</p> <p>9.3 Tools and equipment are stored in accordance to manufacturer requirement</p>
10. Inspect finished work for accuracy and quality	<p>10.1 Inspection tools and methods are selected as per operation plan</p> <p>10.2 Finished work is inspected as per specification</p> <p>10.3 Adjustments are made based on inspections results</p>
11. Maintenance of tools and equipment	<p>11.1 Machines and tools are inspected in accordance to manufacturer specifications</p> <p>11.2 Machines and tools are lubricated according to manufacturer manual</p> <p>11.3 Tools are ground to manufacturer specification</p> <p>11.4 Faults on machines and tools are identified and reported according to maintenance manual</p>

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Measuring tools may include but is not limited to:	<ul style="list-style-type: none"> • Steel rule • Vernier calliper • Micrometre screw gauge • Vernier height gauge • Combination set • Bevels
Drawing Standards may include but is not limited to:	<ul style="list-style-type: none"> • ISO • BS • ANSI
Operation Plan may include but is not limited to:	<ul style="list-style-type: none"> • Sequence of operations • Measuring tools • Hand tools • Cutting tools • Inspection tools

Marking out tools may include but is not limited to:	<ul style="list-style-type: none"> • Scribes • Dividers • Dot punch • Centre punch • Engineers square • Straight edge • Surface plate
Work holding devices may include but is not limited to:	<ul style="list-style-type: none"> • Bench vice • V-Block • Angle plate • G-clamp • Jigs and fixtures • Hand vice
Hand tools may include but is not limited to:	<ul style="list-style-type: none"> • Files • Saws • Hammers • Chisels • Taps and dies
Threads may include but is not limited to:	<ul style="list-style-type: none"> • Internal and external threads • V-profile threads
Surface finishing methods may include but is not limited to:	<ul style="list-style-type: none"> • Filing/deburring • Tumbling • Plating • Painting
Joining and assembly method may include but is not limited to:	<ul style="list-style-type: none"> • Riveting • Fastening • Soldering • Brazing • Welding
Specifications may include but is not limited to:	<ul style="list-style-type: none"> • Dimensions • Tolerances • Geometry • Surface finish • Functionality

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Technical drawing
- Using measuring and inspection tools
- Using hand tools
- Using portable and bench drilling machines
- Soldering and brazing
- Riveting and fastening
- Use of the lathe machine
- Use of milling machine
- Using grinding machine

Required Knowledge

The individual needs to demonstrate knowledge and understanding of:

- Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
- National Environment Management Authority Act, Kenya 2004
- OSH act
- Equipment manuals
- Basic technical drawing complying to ISO, ANSI & BS standards
- ISO 1101 Geometrical tolerance and where to use the norm
- Work Planning and documentation
- Measuring tools
- Hand tools
- Bench work
- Portable and bench drilling machines
- Lathe machine
- Grinding machine
- Inspection and quality control
- Preventive maintenance of machine tools
- Metal cutting technology
- Materials and metallurgy
- WIBA act (2007)
- Report writing

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	<p>Assessment requires evidence that the learner:</p> <ul style="list-style-type: none"> 1.1 Observed rules and procedures in the workshop 1.2 Interpreted technical drawing 1.3 Produced operation plan 1.4 Produced holes on a work piece 1.5 Threaded using taps and dies 1.6 Assembled metal parts 1.7 Surface finished work piece 1.8 Maintained tools and equipment 1.9 Did housekeeping before, during and after operations
2. Resource Implications	<ul style="list-style-type: none"> 2.1 Hand measuring tools 2.2 Hand marking tools 2.3 Hand tools 2.4 Inspection tools and equipment 2.5 Hand drilling machine 2.6 Bench Drilling machine 2.7 Lathe machine 2.8 Grinding machine 2.9 Milling machines 2.10 Punching tools 2.11 Work benches
3. Methods of Assessment	<p>Competency in this unit may be assessed through:</p> <ul style="list-style-type: none"> 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	<p>Competency may be assessed:</p> <ul style="list-style-type: none"> 4. 1On-the-job 4. 2Off-the –job 4. 3During Industrial attachment
5. Guidance information for assessment	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

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EXECUTE BUILDING TEMPORARY WORKS

UNIT CODE: ENG/OS/QS/CC/05/6/A

UNIT DESCRIPTION

This Unit describes the competencies required to perform building temporary works. It involves erecting and dismantling building scaffolds and building shores, constructing and dismantling building formwork/shuttering and trench timbering.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. <i>Bold and italicized terms are elaborated in the Range</i>
1. Construct and dismantle trench timbering	1.1 <i>Trench timbering materials and tools</i> are determined according to the construction rules and regulations 1.2 Personal protective equipment is selected, fitted and used according to safety rules and regulations 1.3 Trench timbering is constructed as per <i>soil type</i> and site topography 1.4 Trench timbering is dismantled according to site procedures and critical structural safety requirements
2. Construct and dismantle building formwork/shuttering	2.1 <i>Formwork material</i> is identified as per structure complexity, job drawings or supervisor instructions 2.2 Formwork dimensions are determined as per the structural elements to be supported 2.3 Personal protective equipment is selected, fitted and used according to safety rules and regulations 2.4 <i>Formwork type</i> is erected according to the structural element to be cast 2.5 Oiling of timber formwork surface is carried out for easy dismantling after concrete setting 2.6 Formwork is fixed into position in accordance with the construction rules and regulations

	2.7 Formwork is dismantled according to site procedures and critical structural safety requirements
3. Erect and dismantle building scaffold	<p>3.1 Scaffold system is determined as per complexity of the building, engineering design, job drawings or supervisor instructions</p> <p>3.2 Personal protective equipment is selected, fitted and used according to safety rules and regulations and job specifications</p> <p>3.3 Scaffolds are erected to plan according to safe work practices and engineers' specifications</p> <p>3.4 Scaffolds are dismantled according to engineers' specifications, site procedures and critical structural safety requirements</p> <p>3.5 Site cleaned and cleared of all tools, excess material and waste</p>
4. Erect and dismantle building shores	<p>4.1 Type of shore is selected according to the nature of the work</p> <p>4.2 Shoring materials are selected according to the construction rules and regulations</p> <p>4.3 Personal protective equipment is selected, fitted and used according to safety rules and regulations</p> <p>4.4 Shoring is erected as per site conditions and building construction rules and regulations</p> <p>4.5 Shoring is dismantled according to site procedures and critical structural safety requirements</p>

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Scaffold system may include but is not limited to:	<ul style="list-style-type: none"> • Quick stage • Cup lock
2. Personal protective equipment may	<ul style="list-style-type: none"> • Helmets • Safety boots • Gloves

include but is not limited to:	<ul style="list-style-type: none"> • Overall • Reflectors
3. Formwork material may include but is not limited to:	<ul style="list-style-type: none"> • Timber • Metal plates • Plastic
4. Formwork type may include but is not limited to:	<ul style="list-style-type: none"> • Column formwork • Beam formwork • Slab formwork • Staircase formwork
5. Trench timbering materials and tools may include but is not limited to:	<ul style="list-style-type: none"> • Timber • Hammer • Metal plates • Pliers • Nails • Binding wires
6. Soil type may include but is not limited to:	<ul style="list-style-type: none"> • Unconsolidated soils • Consolidated soils
7. Type of shore may include but is not limited to:	<ul style="list-style-type: none"> • Raking/Inclined shore • Flying/horizontal shore • Dead/vertical shore
8. Shoring materials may include but is not limited to:	<ul style="list-style-type: none"> • Timber • Steel tubes

REQUIRED KNOWLEDGE AND SKILLS

Knowledge

- Measurement
- Formwork
- Scaffolding
- Soil properties
- Wall construction
- Trench excavation
- Basic arithmetic
- Technical drawings
- Design forces
- Timber properties

Skills

- Measurement skills
- Basic mathematic skills
- Reading skills
- Communication skills
- Management skills
- Design skills
- Problem solving skills
- Critical thinking
- Construction tools handling skills
- Technical drawing skills

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1. Erected and dismantled building scaffolds 1.2. Constructed and dismantled building formwork/shuttering 1.3. Constructed and dismantled trench timbering 1.4. Erected and dismantled building shores 1.5. Observed occupational health and safety procedures to create a safe working environment
2. Resource Implications	The following resources should be provided: 2.1 Training workshops 2.2 Construction tools and equipment 2.3 Occupational Safety and health manuals 2.4 Construction manuals 2.5 Reference textbooks 2.6 Qualified trainers 2.7 Personal protective equipment
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job

	4. 2Off-the –job 4. 3During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CORE COMPETENCIES

CONDUCT ENGINEERING SURVEY

UNIT CODE: ENG/OS/QS/CR/01/6/A

UNIT DESCRIPTION

This unit describes the competence in conducting engineering survey. It involves conducting levelling, setting out construction works, performing earthworks and carrying out road surveys.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Conduct levelling	1.1 Reconnaissance is carried out as per SOPs 1.2 Site clearance is carried out based on the <i>conditions of the site</i> 1.3 Reduced levels are determined based on the <i>nature of the ground</i> 1.4 Contours are plotted as per SOPs 1.5 Longitudinal profiles are produced based on the reduced levels 1.6 Mass haul diagram is produced based on the contours plotted 1.7 Formation level is achieved based on the mass haul diagram
2 Set out constructions works.	2.1 <i>Nature of the construction</i> is determined based on the working drawings 2.2 Site layout plan is obtained and interpreted as per SOPs 2.3 Construction plan is obtained and interpreted as per SOPs 2.4 Construction line is established according to the local authority 2.5 Construction base line is established based on the site plan 2.6 First corner/centre of the building is located based on the site plan 2.7 Construction works is set out based on the <i>setting out methods</i> 2.8 Profile boards are erected as per SOPs 2.9 Construction dimensions are transferred to the ground as per SOPs
3 Carry out road survey	3.1 Tacheometry survey is carried out as per SOPs 3.2 Survey maps and photographs are scaled as per SOPs 3.3 Circular curves are set out as per SOPs 3.4 Traverse details are plotted as per SOPs
4 Perform earthworks	4. 1Working drawings are interpreted as per SOPs 4. 2Site clearance works are carried out based on site conditions and project scope 4. 3Cross sections are set out based on the working drawings 4. 4Top soil is removed as per SOPs 4. 5Excavation to formation level/reduced level is carried out based on the working drawings 4. 6Embankments are formed as per working drawings 4. 7Formation level is compacted as per SOPs 4. 8Excess earthworks materials are disposed as per SOPs

RANGE

Variable	Range <i>May include but is not limited to:</i>
1. Conditions of the site	1.1 Bushy 1.2 Plain 1.3 Forest 1.4 Shrubs 1.5 Structures 1.6 Marshy
2. Nature of the ground	2.1 Slope 2.2 Flat 2.3 Rock
3. Nature of the construction	3.1 Single storey 3.2 Multi storey 3.3 Basement 3.4 Irregular shaped 3.5 Regular shaped 3.6 Circular 3.7 Road works 3.8 Tunnels 3.9 Bridges 3.10 Sewers 3.11 Railway lines
4. Setting out methods	4.1 3-4-5 method/Pythagoras theorem 4.2 Builder's square method 4.3 Site square method

REQUIRED KNOWLEDGE

- Mathematics
- Measurements
- Surveying instruments
- Surveying methods
- Tabulation of data
- Site clearance methods
- Use of surveying instruments
- Plan interpretation
- Technical drawing
- Use of setting out equipment
- Construction
- Setting out methods
- Local authority by-laws

- Surveying
- Soil mechanics
- Waste disposal
- Land use
- Mapping
- Photogrammetry
- Data interpretation
- Civil engineering construction
- Building construction

SKILLS

- Surveying
- Masonry
- Technical drawing
- Analytical

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> 1.1 Determined reduced levels 1.2 Plotted contour maps 1.3 Produced mass haul diagram 1.4 Determined setting out method 1.5 Set out a building 1.6 Interpreted working drawings 1.7 Set out cross sections 1.8 Carried out road survey
2. Resource Implications	The following resources should be provided: <ul style="list-style-type: none"> 2.1 Survey instruments 2.2 Storage facilities 2.3 Surveying technician 2.4 Appropriate plant and equipment 2.5 Plant operator
3. Methods of Assessment	Competency may be assessed through: <ul style="list-style-type: none"> 3.1 Written text 3.2 Interview 3.3 Observation

4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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PRODUCE BUILDING DRAWINGS

UNIT CODE: ENG/OS/QS/CR/02/6/A

UNIT DESCRIPTION

This unit describes the competence in producing building drawings. It involves producing scaled building drawings and producing detailed building drawings.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Produce scaled building drawings	1.1 <i>Building details</i> are obtained from the client 1.2 Site dimensions are determined based on the site layout 1.3 Floor layout sketches are produced based on the client's specifications 1.4 Scaled building floor plan is produced based on floor layout sketches 1.5 Roof plan is produced based on floor plan. 1.6 Building elevations are prepared based on the floor plan 1.7 Building sections through critical points are produced
2 Produce detailed building drawings	2.1 <i>Details of major materials</i> are prepared based on the nature of the building 2.2 <i>Details of exploded views</i> are prepared based on nature of the building 2.3 <i>Finishes</i> are determined based on the room function 2.4 <i>Detailed specifications</i> are prepared based on client's requirements and SOPs

RANGE

Variable	Range <i>May include but is not limited to:</i>
1. Building details	1.1 Type of building 1.2 Functional units 1.3 Building facilities 1.4 Coverage/plinth area 1.5 Room sizes 1.6 Shape of the building
2. Details of major materials	2.1 foundation materials 2.2 Walling materials 2.3 Roofing materials 2.4 Beams and column materials

3. Details of exploded views	3.1 Substructure works 3.2 Roofing works <ul style="list-style-type: none"> • Roof construction • Roof cover • Eaves and verges • Ridges • Rain water goods 3.3 Superstructure works 3.4 Finishes 3.5 Doors and windows 3.6 Staircases 3.7 Suspended slabs 3.8 Fixtures and fittings.
4. Detailed specifications	4.1 Substructure works 4.2 Superstructure works 4.3 Staircases 4.4 Suspended slabs 4.5 Roofing works 4.6 Doors and windows 4.7 Finishes 4.8 Doors and windows 4.9 External works

REQUIRED KNOWLEDGE

- Technical drawing
- Building drawings
- Scaling
- Measurements
- Construction trends
- Construction materials
- Building design by-laws
- Topography
- Site planning
- Plan interpretation
- Specifications
- Locally available materials

SKILLS

- Technical drawing
- Site planning
- Plan interpretation
- Building drawing

➤ Research

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> • Produced scaled building plans • Detailed specifications
2. Resource Implications	The following resources should be provided: <ul style="list-style-type: none"> • Drawing instruments • Computers • Drawing instruments and equipment • Stationery • Studio • CAD software • Printers • scientific calculators
3. Methods of Assessment	Competency may be assessed through: <ol style="list-style-type: none"> 3.1 Written text 3.2 Interview 3.3 Observation
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PRODUCE CIVIL ENGINEERING DRAWINGS

UNIT CODE: ENG/OS/QS/CR/03/6/A

UNIT DESCRIPTION

This unit describes the competence in producing civil engineering drawings. It involves preparing drainage drawings, preparing water tank drawings, preparing pavement drawings, preparing external works drawings, preparing bridge drawings, preparing waterfront structure drawings, preparing railway track drawings and preparing tunnel drawings

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Prepare drainage drawings	1.1 Drainage survey is conducted as per SOPs 1.2 Drainage line is located based on the drainage survey 1.3 Invert levels for drains and manholes are located based on the drainage line 1.4 Manhole dimensions are determined based on the invert levels 1.5 Drainage layout sketch is prepared as per SOPs 1.6 Detailed drainage drawings are produced to scale as per layout plan 1.7 <i>Exploded views</i> are prepared based on the drainage system
2 Prepare water tank drawings	2.1 Consumption details are determined based on site facilities and client requirements 2.2 <i>Type of water tank</i> is determined based on client requirements 2.3 Soil analysis is carried out based on the ground conditions 2.4 Water pipe layout is established based on-site facilities 2.5 Detailed water tank design is carried out as per SOPs 2.6 Water tank drawings are prepared based on design details
3 Prepare pavement drawings	3.1 Function of pavement is determined based on <i>road use</i> 3.2 <i>Type of pavement</i> is determined based on the pavement function 3.3 Pavement layout sketches are prepared as per SOPs 3.4 Detailed pavement drawings are produced to scale as per SOPs 3.5 <i>Exploded views</i> are prepared based on type of pavement
4 Prepare external works drawings	4.1 Draft <i>external works</i> layout is prepared based on the layout plan 4.2 <i>Item specifications</i> are prepared based on the layout plan and the client requirements 4.3 Detailed external works drawings are prepared based on the layout
5 Prepare bridge drawings	5.1 Function of bridge is determined based on <i>use</i> 5.2 <i>Type of bridge</i> is determined based on the bridge function and site conditions 5.3 Layout sketch is prepared as per SOPs 5.4 Bridge drawings are prepared to scale as per SOPs

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
	5.5 Exploded views are prepared based on type of bridge
6 Prepare waterfront structure drawings	6.1 Waterfront structure function is determined based on use 6.2 <i>Type of waterfront structure</i> is determined based on the function and site conditions 6.3 Layout sketch is prepared as per SOPs 6.4 Waterfront structure drawings are prepared to scale as per SOPs 6.5 Exploded views are prepared based on type of waterfront structure
7 Prepare railway track drawings	7.1 <i>Type of railway track</i> is determined based on the function 7.2 Layout sketch is prepared as per SOPs 7.3 Railway track drawings are prepared to scale as per SOPs 7.4 <i>Exploded views</i> are prepared based on type of railway
8 Prepare tunnel drawings	8.1 Tunnel function is determined based on the use 8.2 <i>Type of tunnel</i> is determined based on the function and site conditions 8.3 Tunnel drawings are prepared to scale as per SOPs 8.4 <i>Exploded views</i> are prepared based on the type and use of tunnel

RANGE

Variable	Range <i>May include but is not limited to:</i>
1. Exploded views	<ul style="list-style-type: none"> • Manholes • Drains • Septic tanks • Cesspools • Soak pits • Bio digester
2. Type of water tank	<ul style="list-style-type: none"> • Concrete • Steel • Plastic • Underground • Elevated
3. Road use	<ul style="list-style-type: none"> • Public • Private
4. Type of pavement	<ul style="list-style-type: none"> • Flexible • Rigid
5. Exploded views	<ul style="list-style-type: none"> • drains • carriageway • shoulders • embankments

	<ul style="list-style-type: none"> • cross sections • longitudinal profiles • cuts and slopes
6. External works	<ul style="list-style-type: none"> • Landscaping <ul style="list-style-type: none"> • Fencing • Gates • Site clearance • Demolition • Excavations <ul style="list-style-type: none"> • Hedges • Walkways • Parking
7. Item specifications	<ul style="list-style-type: none"> • Landscaping <ul style="list-style-type: none"> • Fencing • Gates • Site clearance • Demolition • Excavations <ul style="list-style-type: none"> • Hedges
7 Use	<ul style="list-style-type: none"> • Public • Private
8 Type of bridge	<ul style="list-style-type: none"> • Arch • Suspended • Cable stayed
9 Type of waterfront structure	<ul style="list-style-type: none"> • Jetties • Quays • Sea walls • Dolphins
10 Type of railway	<ul style="list-style-type: none"> • Normal • High speed • Subway rail track
11 Exploded views	<ul style="list-style-type: none"> • Base details • Railway track exploded views
12 Type of tunnel	<ul style="list-style-type: none"> • Double deck tunnels • Multipurpose tunnels • Covered passageways
13 Exploded views	<ul style="list-style-type: none"> • Invert • Crown

REQUIRED KNOWLEDGE

- Surveying
- Measurements
- Building code regulations

- Technical drawing
- Tabulation of data
- Soil analysis
- Plumbing
- Design
- Material technology
- Civil engineering works
- Computer literacy
- Material technology
- Landscaping
- Plan interpretation
- Scaling

SKILLS

- Technical drawing
- Scaling
- Landscaping
- Computer Aided Design
- Analytical
- Soil analysis
- Design
- Pipe laying
- Surveying

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

<p>1. Critical Aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> • Conducted drainage survey • Determined invert levels • Detailed drainage drawings • Determined type of water tank • Produced detailed water tank drawings • Determined pavement function • Determined types of pavements • Produced detailed pavement drawings • Prepared external works drawings • Prepared bridge drawings • Determined type of waterfront structure • Prepared waterfront structure layout sketch • Prepared waterfront structure drawings • Prepared railway track drawings
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2. Resource Implications	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> • Drawing instruments and equipment • Computers • Stationery • Studio • CAD software • Printers • Scientific calculators
3. Methods of Assessment	<p>Competency may be assessed through:</p> <p>3.1 Written text</p> <p>3.2 Interview</p> <p>3.3 Observation</p>
4. Context of Assessment	<p>Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.</p>
5. Guidance information for assessment	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

EXECUTE CONSTRUCTION WORKS

UNIT CODE: ENG/OS/QS/CR/04/6/A

UNIT DESCRIPTION

This unit describes the competence in executing construction works. It involves investigating construction site, performing building substructure works, performing civil works, performing superstructure works, installing building windows and doors, applying building/civil finishes and carrying out construction maintenance works.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Investigate construction site	1.1 Site boundary is determined based on land survey maps 1.2 Auxiliary services are identified as per site location 1.3 Trial pits are excavated based on ground conditions 1.4 Existing services are determined based on service provider's information 1.5 Existing structures are identified based on the site location 1.6 Labour and construction materials sources are identified based on the project scope and site location
2 Perform building substructure works	2.1 Site clearance is carried out based on the nature of the site 2.2 Excavation method is determined based on the nature of the works 2.3 Vegetable/top soil is excavated based on working drawings and nature of the site 2.4 Excavation to formation level/reduced level is carried out based on the working drawings 2.5 Foundation is marked based on profile board measurements and working drawings 2.6 Foundation is excavated based on the working drawings 2.7 Foundation is levelled as per SOPs 2.8 Substructure concrete works is carried out as per SOPs 2.9 Foundation walling is constructed based on the working drawings 2.10 Hard core is placed and compacted as per SOPs 2.11 Blinding layer is applied based on design specifications 2.12 Anti-termite treatment is carried out as per SOPs 2.13 Damp proofing is carried out as per design specifications 2.14 Formwork is erected as per SOPs 2.15 Concrete is cast as per SOPs
3 Perform civil works	3.1 Site clearance is carried out based on the nature of the site 3.2 Excavation method is determined based on the nature of the works 3.3 Vegetable/top soil is excavated based on working drawings and nature of the site

ELEMENT	PERFORMANCE CRITERIA (<i>Bold and italicized terms are elaborated in the Range</i>)
	3.4 Excavation to formation level/reduced level is carried out based on the working drawings 3.5 Foundation is marked based on profile board measurements and working drawings 3.6 Foundation is excavated based on the working drawings 3.7 Foundation is levelled as per SOPs 3.8 Sub grade is laid and compacted as per SOPs 3.9 Sub base is laid and compacted as per SOPs 3.10 Base course is laid and compacted as per SOPs 3.11 Wearing course is laid as per SOPs
4 Perform superstructure works	4.1 <i>Setting out of superstructure works</i> is carried out as per SOPs 4.2 <i>Superstructure concrete works</i> is carried out as per SOPs 4.3 Superstructure walling is constructed based on the working drawings 4.4 <i>Roof construction</i> is carried out as per working drawings 4.5 <i>Roof cover</i> is applied as per design specifications 4.6 <i>Eaves and verges</i> are constructed as per design specifications 4.7 <i>Rain water goods</i> are installed as per SOPs
5 Install building doors and windows	5.1 Door and window schedule is prepared based on design specifications 5.2 Door and window frames are set in position as per design details 5.3 Door linings are set in position as per design details 5.4 Doors and windows are fitted and fixed based on the design details
6 Apply building/civil finishes	6.1 Schedule of finishes is prepared as per design specifications 6.2 <i>Method of application</i> is determined based on the <i>type of finish</i> and place of application 6.3 Application surface is prepared based on the type of finish 6.4 Building/civil finishes are applied as per SOPs
7 Carry out construction maintenance works	7.1 <i>Building inspection</i> is carried out based on the type of facility and Occupational Safety and Health Act 7.2 Inspection report is prepared based on inspection carried out 7.3 <i>Maintenance program</i> is prepared based on inspection report 7.4 Building maintenance is carried out as per maintenance program

RANGE

Variable	Range <i>May include but is not limited to:</i>
1. Auxiliary services	1.1 Banks 1.2 Hospitals 1.3 Access roads 1.4 Electricity

	<p>1.5 Sewer lines</p> <p>1.6 Water pipes</p> <p>1.7 Communication cables</p>
2. Existing services	<p>2.1 Telecommunication</p> <p>2.2 Electrical</p> <p>2.3 Sewer lines</p> <p>2.4 Water supply lines</p> <p>2.5 Mechanical services</p>
3. Site clearance	<p>2.1 clear bushes</p> <p>2.2 cut trees</p> <p>2.3 removal of stumps</p> <p>2.4 demolish unwanted existing structures</p>
4. Existing structures	<p>4.1 Buildings</p> <p>4.2 Tunnels</p> <p>4.3 Railway tracks</p> <p>4.4 Bridges</p>
5. Profile board measurements	<p>5.1 Trench width</p> <p>5.2 Wall thickness</p> <p>5.3 Column sizes</p> <p>5.4 Column base sizes</p>
6. Substructure concrete works	<p>1.1 Blinding</p> <p>1.2 concrete to</p> <ul style="list-style-type: none"> • bases • strip footing • wall • columns • slabs • ground beams <p>1.3 formwork to</p> <ul style="list-style-type: none"> • bases • strip footing • wall • columns • slabs • ground beams <p>1.4 reinforcement to</p> <ul style="list-style-type: none"> • bases

	<ul style="list-style-type: none"> • strip footing • wall • columns • slabs • ground beams
7. Setting out of superstructure works	7.1 Superstructure walls 7.2 Columns 7.3 Suspended slabs 7.4 Stairs 7.5 Chimneys 7.6 Roofs
8. Superstructure concrete works	8.1 Concrete to <ul style="list-style-type: none"> • Walling • Columns • Suspended slabs • Beams 8.2 Formwork to <ul style="list-style-type: none"> • Walling • Columns • Suspended slabs • Beams 8.3 reinforcement to <ul style="list-style-type: none"> • Walling • Columns • Suspended slabs • Beams
9. Roof construction	9.1 Tie beams 9.2 Wall plates 9.3 Rafters 9.4 Ties and struts 9.5 Purlins 9.6 Ridge piece/boards 9.7 Hangers 9.8 King post
10. Roof cover	10.1 Tiles 10.2 Sheets 10.3 Roof underlays
11. Eaves and verges	11.1 Fascia board

	11.2 Barge board 11.3 Runners 11.4 Bearers 11.5 Hanger 11.6 Boarding
12. Rain water goods	12.1 Gutters 12.2 Down pipes 12.3 Shoe 12.4 Swan neck
13. Method of application	13.1 Spraying 13.2 Fixing 13.3 Dipping
14. Type of finish	14.1 Tiles 14.2 Terrazzo 14.3 Granolithic finish 14.4 Cladding 14.5 Painting 14.6 Timber parquet 14.7 Carpet 14.8 Plaster 14.9 Marble chips 14.10 Floor screed 14.11 Road markings 14.12 Guide posts 14.13 Light posts 14.14 Warning signs 14.15 Traffic signs 14.16 Painting
15. Building inspection	15.1 Functionality 15.2 Condition of the facility 15.3 Physical examination 15.4 Mechanical examination
16. Maintenance program	16.1 Routine 16.2 Ad hoc (emergency) 16.3 Planned

REQUIRED KNOWLEDGE

- Soil analysis
- Map interpretation
- Local Culture

- Construction by-laws
- Construction
- Occupational Safety and Health
- Construction plant
- Work programs
- Materials science
- Plumbing works
- Specifications
- Construction drawings
- Code of practice
- Formwork
- Bar bending
- Masonry
- Construction tools and equipment
- Method of application
- Construction technology
- Tools and equipment
- Carpentry and joinery
- Building diagnosis
- Report writing
- Computer literacy
- MS Project

SKILLS

- Report writing
- Digital
- Planning
- Painting
- Plastering
- Tile fixing
- Screeding
- Masonry
- Carpentry and joinery
- Management
- Bar bending
- Brick laying
- Management
- Analytical
- Map interpretation

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	<p>Assessment requires evidence that the candidate</p> <ol style="list-style-type: none"> 1.1 Conducted site investigation 1.2 Carried out site clearance 1.3 Performed excavation 1.4 Carried out substructure concrete works 1.5 Constructed substructure walls 1.6 Carried out anti termite treatment 1.7 Carried out setting out of superstructure works 1.8 Carried out superstructure concrete works 1.9 Executed roofing works 1.10 Constructed superstructure walling 1.11 Installed rain water goods 1.12 Installed building doors and windows 1.13 Applied building finishes 1.14 Carried out building maintenance
2. Resource Implications	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> • Workshop • Storage facilities • Construction materials • Stationery • Construction tools and equipment • Workshop technician
3. Methods of Assessment	<p>Competency may be assessed through:</p> <ol style="list-style-type: none"> 3.1 Written text 3.2 Interview 3.3 Observation
4. Context of Assessment	<p>Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.</p>
5. Guidance information for assessment	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

PREPARE BILLS OF QUANTITIES

UNIT CODE: ENG/OS/QS/CR/05/6/A

UNIT DESCRIPTION

This unit describes the competence in preparing bills of quantities. It involves interpreting working drawings, taking off quantities, working up dimensions, abstracting measured quantities, billing measured works, pricing bill of quantities and estimating the project cost.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Interpret working drawings	1.1 <i>Type of drawing</i> is identified based on the title 1.2 Drawing dimensions are read and scaled as per the unit of measure 1.3 Shape of the drawing is identified based on geometry 1.4 Schedules are read together with the drawings 1.5 Instructional notes are read for additional information on the drawing
2 Take off quantities	2.1 Dimension sheet/paper is prepared based on the standard format 2.2 List of quantities to be measured is prepared based on items to be measured 2.3 <i>Quantities</i> are calculated based on the unit of measure 2.4 Dimensions are booked based on the principles of measurement 2.5 Booked items are described based on the standard method of measurement for building and associated civil works (SMM) and civil engineering standard method of measurements (CESMM)
3 Work up dimensions	3.1 Timesing of dimensions is carried out as per SOPs 3.2 Dimensions are squared as per SOPs
4 Abstract measured quantities	4.1 Abstracting sheet is prepared based on the standard format 4.2 Description of booked items are transferred to the abstracting sheet as per SOPs 4.3 Squared quantities are transferred to the abstracting sheet 4.4 Net quantities are calculated as per SOPs 4.5 Running through dimensions is carried out as per SOPs
5 Bill measured Quantities	5.1 Billing paper is prepared based on the standard format 5.2 Abstracted quantities and their corresponding descriptions are transferred as per SOPs 5.3 Casting up is carried out as per SOPs 5.4 Price the bill of quantities as per the SOPs
6 Estimate the project cost	6.1 Unit rates are built up based on the work element 6.2 Unit rates are inserted as per SOPs 6.3 Total cost of each work element is calculated as per SOPs

RANGE

Variable	Range <i>May include but is not limited to:</i>
1. Type of drawing	1.1 Architectural 1.2 Structural 1.3 Electrical 1.4 Mechanical 1.5 Civil
2. Quantities	2.1 Volumes 2.2 Areas 2.3 Linear meters 2.4 Numbers (enumeration) 2.5 Items

REQUIRED KNOWLEDGE

- Technical drawing
- Building drawings
- Civil drawings
- Construction technology
- Civil technology
- Applied mathematics
- Technical terminologies
- Structural design
- Standard documents (CESMM and SMM)
- Quantity surveying practice and procedures
- Construction procedures
- Units of measurement
- Principles/terminologies
- Abstracting
- Casting up
- Running through
- Estimating and costing
- Work study
- MS Excel

SKILLS

- analytical
- computer literacy
- Construction
- Structural detailing
- Scaling
- Technical and building drawings

- Civil drawings
- Design

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

<p>1. Critical Aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> • Identified type of drawing • Read and scaled dimensions • Read instructional notes • Carried out taking off of quantities • Worked up dimensions • Transferred descriptions of booked items to abstract sheet • Transferred squared quantities • Run through dimensions • Billed measured works • Priced bill of quantities • Build up unit rates
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> • Stationery • Computers • Computer lab • Computer software • IT technician • Computer accessories • Scientific calculators • SMM/CESMM • WIN-QS
<p>3. Methods of Assessment</p>	<p>Competency may be assessed through:</p> <p>3.1 Written text</p> <p>3.2 Interview</p> <p>3.3 Observation</p>
<p>4. Context of Assessment</p>	<p>Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.</p>

5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.
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MANAGE PROJECT CONTRACTS

UNIT CODE: ENG/OS/QS/CR/06/6/A

UNIT DESCRIPTION

This unit describes the competence in managing project contracts. It involves preparing tender documents, carrying out tendering process, preparing day works accounts and preparing payment certificates

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Prepare tender documents	1.1 <i>Working drawings</i> are prepared as per client requirements 1.2 <i>Specifications</i> are prepared as per SOPs 1.3 Bill of quantities is prepared based on specifications and working drawings 1.4 Schedule of rates are prepared as per SOPs 1.5 Condition of contract is prepared based on nature of the project 1.6 Form of agreement is prepared as per the conditions of the contract 1.7 Form of tender is prepared based on the nature of the contract
2 Carry out tendering process	2.1 Need for goods, services and works is established based on user requirements 2.2 <i>Tendering method</i> is determined as per SOPs 2.3 Goods, services and/or works are advertised based on tendering method 2.4 Tenders are received and opened as per SOPs 2.5 Tenders are <i>evaluated</i> as per SOPs 2.6 Contract is <i>awarded</i> based on tender evaluation
3 Prepare day works accounts	3.1 Plant cost is determined based on day works 3.2 Material cost is determined based on day works 3.3 Labour cost is determined based on day works 3.4 Profits, overheads and taxes are determined as a percentage based on total day work costs
4 Prepare payment certificates	4.1 <i>Type of payment certificate</i> is determined as per SOPs 4.2 Site visit is conducted as per SOPs 4.3 Work re-measurement is carried out based on work done 4.4 Value of material on site/off site is determined based on the project 4.5 Amount of work done is determined based on project scope 4.6 Percentage of work done is determined as per SOPs 4.7 Retention fee value is determined as per SOPs 4.8 Value of previous payment certificates is determined as per SOPs 4.9 Payment certificate is prepared as per SOPs

RANGE

Variable	Range <i>May include but is not limited to:</i>
1. Working drawings	1.1 Architectural 1.2 Structural 1.3 Electrical 1.4 Mechanical 1.5 Civil
2 Specifications	2.1 Material 2.2 Workmanship
3 Tendering method	3.1 Open 3.2 Selective 3.3 Serial 3.4 Single sourcing 3.5 Package deal
4 Evaluated	4.1 Preliminary evaluation 4.2 Technical evaluation 4.3 Financial evaluation
5 Type of payment certificate	5.1 Interim 5.2 Penultimate 5.3 Final

REQUIRED KNOWLEDGE

- Procurement
- Construction law
- Buildings economics
- Measurements
- Technical drawing
- Building drawing
- Civil drawing
- Codes of practice
- Computer literacy
- Estimating and costing
- Tendering procedures
- Procurement
- Public Procurement and Disposal Act
- Public Procurement and Disposal General Manual
- E-Procurement
- Plant technology
- Materials
- Basic mathematics

- Mathematics
- Construction materials
- Construction technology
- Specifications
- Civil engineering works

SKILLS

- Technical drawing
- Digital
- Planning
- Analytical
- Management
- Building drawing

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> • Prepared tender documents • Determined tendering method • Received tenders • Evaluated and awarded tenders • Prepared day works accounts • Prepared payment certificates
2. Resource Implications	The following resources should be provided: <ul style="list-style-type: none"> • Stationery • Computers • Scientific calculators
3. Methods of Assessment	Competency may be assessed through: <ol style="list-style-type: none"> 3.1 Written text 3.2 Interview 3.3 Observation
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

MANAGE CONSTRUCTION PROJECT FINANCE

UNIT CODE: ENG/OS/QS/CR/07/6/A

UNIT DESCRIPTION

This unit describes the competencies required to manage construction project finance. It involves managing pre-construction project finance, preparing financial statements, preparing variation accounts, preparing financial claims, monitoring project costs, preparing final accounts and preparing final certificate.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Manage pre-construction project finance	1.1 Project preliminary costs are estimated based on the project scope 1.2 Financial cost plan is prepared as per set budget 1.3 Cash flow statement is prepared based on the financial cost plan/work program
2 Prepare financial statements	2.1 Cash inflows are determined based on value of certificates and other incomes 2.2 Cash outflows are determined based on work done, overheads and other expenses 2.3 Profit and loss accounts are prepared based on cash flows 2.4 Balance sheet is prepared as per SOPs.
3 Prepare variation accounts	3.1 Sources of variations are determined based on contract documents 3.2 Value of variations are determined based on the variation order, bill of quantities or market value
4 Prepare financial claims	4.1 Nature of claim is identified based on the contract documents 4.2 Financial claim is prepared based on the nature of the claim
5 Monitor project costs	5.1 Project costs are analysed based on actual and projected costs 5.2 Project costs are controlled based on project cost analysis results
6 Prepare final accounts	6.1 Value of all certificates are determined as per SOPs 6.2 Value of all claims are determined as per SOPs
7 Prepare final certificate	7.1 Defects made good value is determined based on the cost 7.2 Final certificate is prepared as per the SOPs

RANGE

Variable	Range <i>May include but is not limited to:</i>
1. Cash inflows	1.1 Income earned from <ul style="list-style-type: none"> • Payments for work done

	<ul style="list-style-type: none"> • Interest earned • Profits earned • Tax refunds • Invested cash
2. Cash outflows	2.1 Payments made to <ul style="list-style-type: none"> • Suppliers • Subcontractors • Statutory authorities • Salaries and wages • Utilities • Loan interest • Loan repayment
3. Sources of variations	3.1 Engineer/architect instructions 3.2 Client requirements 3.3 Statutory authority requirements 3.4 Finding of the antiquities 3.5 Contractor
4. Nature of claim	4.1 Insurance 4.2 Tax 4.3 Contract delays 4.4 Disputes 4.5 Extended project periods 4.6 Insufficient information

REQUIRED KNOWLEDGE

- estimation and costing
- accounting
- building economics
- mathematics
- MS Project
- MS Excel
- Market research
- MS Word
- Work study

SKILLS

- Analytical
- Computer literacy
- Research

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate <ul style="list-style-type: none">• Estimated preliminary project cost• Prepared project cost plan• Prepared financial statements• Prepared variation accounts• Prepared financial claims• Monitored project costs• Prepared final certificate• Prepared final accounts
2. Resource Implications	The following resources should be provided: <ul style="list-style-type: none">• Computers• Scientific calculators• Stationery• Computer software
3. Methods of Assessment	Competency may be assessed through: <ul style="list-style-type: none">3.1 Written text3.2 Interview3.3 Observation
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

MANAGE CONSTRUCTION PROJECT

UNIT CODE: ENG/OS/QS/CR/08/6/A

UNIT DESCRIPTION

This unit describes the competencies required to manage construction project. It involves conducting feasibility study, preparing construction cost budgets, preparing materials, plant and labour schedule, preparing work program, managing construction site, managing construction plant and equipment, preparing project progress report, carrying out project evaluation and participating in site/project handing over.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
1 Conduct feasibility study	1.1 Site visit is conducted as per SOPs 1.2 Investment cost is determined based on the project 1.3 PESTEL analysis is conducted as per SOPs 1.4 Feasibility study report is prepared based on PESTEL analysis
2 Prepare construction cost budgets	2.1 Preliminary costs are determined based on the project 2.2 Plant, labour and material costs are determined based on the project 2.3 Profits, overhead and tax costs are determined based on the project 2.4 Statutory authority fees are determined as per SOPs 2.5 Consultancy fees are determined based on the project 2.6 Cash flow statement is prepared based on the project
3 Prepare materials, plant and labour schedule	3.1 Project activities are determined based on the project scope 3.2 Material requirements are determined based on the project activities 3.3 Labour requirements are determined based on the project activities 3.4 Plant requirements are determined based on the project activities
4 Prepare work program	4.1 Project activities are identified based on the project scope 4.2 Time for each activity is estimated based on the project scope 4.3 Resources are allocated for each activity based on the project scope 4.4 Activities are arranged logically as per SOPs 4.5 Start and finish times are determined as per SOPs 4.6 Critical activities are determined as per SOPs 4.7 Float times are determined as per SOPs 4.8 Project duration is determined based on the start and finish time
5 Manage construction site	5.1 Site layout plan is implemented as per SOPs 5.2 Materials, plant and labour are procured based on schedules

ELEMENT	PERFORMANCE CRITERIA <i>(Bold and italicized terms are elaborated in the Range)</i>
	5.3 Safety and security measures are implemented as per site requirements and SOPs 5.4 Site records are maintained based on project activities
6 Manage construction plant and equipment	6.1 Plant and equipment requirement are determined based on the project scope 6.2 Plant and equipment are acquired based on the requirement 6.3 Safety and security requirements are determined as per SOPs 6.4 Maintenance schedule is prepared as per SOPs 6.5 Plant and equipment disposal procedures are determined as per SOPs
7 Prepare project progress report	7.1 Key performance indicators are determined based on the work program 7.2 Site visit is conducted based on the work program 7.3 Site meetings are conducted based on the work program 7.4 Project progress report is prepared as per SOPs
8 Participate in site/project handing over	8.1 Site inspection is carried out based on the project scope 8.2 Defects made good are ascertained as per SOPs 8.3 Invoices and claims are ascertained to be settled as per SOPs 8.4 Operator's manual and maintenance plan are prepared as per SOPs 8.5 Project/site is handed over as per SOPs
9 Carry out project evaluation	9.1 Project evaluation criteria is determined as per SOPs 9.2 Financial evaluation is carried out based on the project budget 1.1 Performance standards are evaluated as per SOPs 1.2 Project evaluation report is prepared as per SOPs 1.3 Site inspection is carried out based on the project scope
10 Manage conflicts and disputes	10.1 Types of conflicts and disputes are determined based on SOPs. 10.2 Sources of construction disputes and conflicts are determined as per SOPs 10.3 Methods of conflicts and disputes resolutions are determined as per SOPs 10.4 Conflicts and disputes resolutions procedure is determined as per SOPs
11 Carry out post construction management	11.1 Maintenance schedule is prepared as per SOPs 11.2 Maintenance budget is prepared based on maintenance schedule 11.3 Maintenance activities are carried out as per maintenance schedule

RANGE

Variable	Range
	<i>May include but is not limited to:</i>

1. PESTEL analysis	1.1 Political 1.2 economical 1.3 social 1.4 technological 1.5 environmental 1.6 legal
2. Cash flow statement	2.1 Incomes 2.2 Expenses
3. Start and finish times	3.1 Earliest start time 3.2 Latest start time 3.3 Earliest finish time 3.4 Latest finish time
4. Site layout plan	4.1 Access roads 4.2 Stores and offices 4.3 Equipment 4.4 Materials 4.5 Project layout
5. Performance standards	5.1 Workmanship 5.2 Project duration 5.3 Financial estimates/targets

REQUIRED KNOWLEDGE

- Construction technology
- Construction law
- Arbitration
- Building economics
- Computer literacy
- Planning
- Management
- Report writing
- Book keeping and accounting
- Work program
- Procurement
- Construction plant
- Occupational Safety and Health
- Scheduling
- Plant and materials
- Procurement
- Record keeping
- Accounting
- Mathematics
- Statutory requirements

- Environmental Impact Assessment
- Economics
- Construction technology
- Construction Materials, plant and labour
- Estimation
- Construction
- Materials

SKILLS

- Planning
- Management
- Digital
- Analytical
- Report writing
- Drawing
- Coordination

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

<p>1. Critical Aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Conducted feasibility study 1.2 Determined preliminary costs 1.3 Determined profits, overhead and tax costs 1.4 Prepared cash flow statement 1.5 Determined project activities 1.6 Determined materials, labour and plant requirements 1.7 Prepared work program 1.8 Managed construction site 1.9 Determined plant and equipment requirements 1.10 Acquired plant and equipment 1.11 Prepared maintenance schedule 1.12 Prepared project progress reports 1.13 Carried out project evaluation 1.14 Carried out site inspection 1.15 Ascertained defects made good 1.16 Ascertained invoices and claims to be settled 1.17 Handed over project
<p>2. Resource Implications</p>	<p>The following resources should be provided:</p> <ul style="list-style-type: none"> 2.1 Fully functional office 2.2 Office stationery and equipment

	2.3 Computers
3. Methods of Assessment	Competency may be assessed through: 3.1 Written text 3.2 Interview 3.3 Observation
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

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