

APPLY STRUCTURAL ANALYSIS PRINCIPLES I

UNIT CODE:0732 551 20A

TVET CDACC UNIT CODE: CON/OS/BUT/CC/05/6/MA

UNIT DESCRIPTION:

This Unit describes the principles required to perform structural Analysis. It involves Computing stresses and strain, describing composite materials, computing shear force and bending moments, determining properties of sections, Computing horizontal shear stress distribution and theory of simple bending.

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. Compute stress and strain	1.1 Stress and strain are defined in relation to structural design 1.2 Stress and strain <i>calculations</i> are computed as per standards. 1.3 <i>Stress-strain diagram</i> is drawn as per their relation
2. Describe composite materials	2.1 Composite materials are identified based on the work specifications 2.2 Compatibility and equilibrium equations are derived based on best practices 2.3 Composite materials problems are solved based on specifications 2.4 Forces are determined in composite materials based on design
3. Compute shear force and bending moments	3.1 <i>Types of supports and loads</i> are identified based on design 3.2 Shear force and bending at a point on a loaded beam are defined as per the building design codes 3.3 <i>Shear force diagrams</i> are drawn based on the loadings on beam 3.4 <i>Bending moment diagrams</i> are drawn based on the loadings on beam
4. Determine properties of sections	1.1 Sections properties are identified as per the standards 1.2 Determination of properties of sections is done as per the standard calculations 1.3 Computation of compound properties of sections is done as per the standards

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	1.4 Properties of common plane section is done as per the standards.
5. Compute Horizontal shear stress distribution	2.1 Derivation of Shear stress distribution formula is done as per the standard practice 2.2 Determination of shear stress for different sections is done as per the work requirement 2.3 Shear stress formula and computation are done as per the standard practice. 2.4 Shearing stress distribution curves are plotted as per the standard practice
6. Compute Theory of simple bending	3.1 Elements of simple bending are identified as per the code of practice 3.2 Bending moment and shear force are computed as per work procedures 3.3 Derivation of the simple bending formula is done as per the standard procedure 3.4 concept of neutral axis and section modulus are determined as per standard procedures 3.5 stress distribution in different cross section shapes are analysed as per standard procedures.

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 <i>May include but not limited to:</i>
1. calculations	• Stress • Strain • Young's modulus
2. Stress-strain diagram	• Plasticity limit • Failure
3. Types of supports and loads	• Fixed support • Pin support

	• Point load • Uniform distribution load
4. Shear force diagrams	• Point of contra-flexure • Shear forces at points
5. Bending moment diagrams	• Maximum moment • Bending points •
6. Assumptions	• All joints of the frame are rigid • Angle between the members do not change
7. Types of pressures	• lateral earth pressure. • Surcharge loads. • Axial loads. • Wind on projecting stem. • Impact forces. • Seismic earth pressure. • Seismic wall self-weight forces

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 moments
- Types and purpose of measuring instruments
- Units of forces and abbreviations
- Rounding techniques
- Types of forces

- Types of tables and graphs
- Presentation of data in tables and graphs
- Reactions operations
- Matrix operations

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 Calculated Stress and strain in accordance to structural design. 1.2 Drawn Stress-strain diagram as per their relation. 1.3 Composite materials problems are solved based on specifications 1.4 Drawn Shear force diagrams based on the loadings on beam 1.5 Drawn Bending moment diagrams based on the loadings on beam 1.6 Computed slope and deflection based on the design 1.7 Combined stresses based on the location of the load 1.8 Calculated Lateral thrust due to retained water or earth based on design load
2. Resource Implications	The following resources should be provided: 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. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Direct Observation 3.2 Demonstration with Oral Questioning 3.3 Written tests
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.