MECHANICAL SCIENCE PRINCIPLES

UNIT CODE: 0714441 09A

TVET CDACC UNIT CODE: ENG/CU/MDE/CC/04/5/MA
UNIT DURATION: 80 Hours

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Apply Mechanical Science Principles

Unit Description

This unit specifies the competencies required to apply Mechanical Science Principles. It involves Applying Forces in a System, Knowledge of Moments, Friction Principles and Motions Laws, Describing Work, Energy and Power, Demonstrating Gas Principles, Applying Heat Knowledge, Density Knowledge, Pressure Principles, Pneumatics and Hydraulics Principles, Optical Principles and Wave Principles.

Summary of Learning Outcomes

S/No.	Learning Outcome	Duration in hours.
1.	To apply forces in a system	10
2.	To apply knowledge of moments	10
3.	To apply friction principles	5
4.	To apply motions laws	10
5.	To describe work, energy and power	10
6.	To demonstrate gas principles	5
7.	To apply heat knowledge	5
8.	To apply density knowledge	5
9.	To apply pressure principles	5
10.	To apply pneumatics and hydraulics principles	5
11.	To apply optical principles	5
12.	To apply wave principles	5
	TOTAL	**80**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply forces in a system	1.1 Definition of terms 1.2 Resolution of forces 1.3 Statement and application of forces theorems 1.3.1. Newton's First law 1.3.2. Newton's Second Law 1.3.3. Newton's Third Law 1.4 Bow's Notation 1.5 Resultant of forces (Graphical methods and analysis) 1.6 Mechanical calculations 1.6.1 Mechanical advantage 1.6.2 Efficiency 1.6.3 Torque 1.6.4 Power/Energy 1.6.5 Work done	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
2. Apply knowledge of moments	2.1 Definition of moments 2.2 Principles of Moments 2.3 Stability and C.o.G 2.4 Couples 2.5 Engineering examples on	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence

	application of moments 2.6 Calculation of moments and reaction on beams 2.7 Single load on beam 2.8 Multiple loads on beam	• Written Assessment • Oral Questioning
3. Apply friction principles	3.1 Nature of friction 3.2 Laws of friction 3.3 Coefficient of friction 3.4 Angle of repose 3.5 Friction on a horizontal plane 3.6 Friction on an inclined plane 3.7 Advantages and disadvantages of friction 3.8 Applications of friction 3.9 Methods of increasing and reducing friction	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
4. Apply motions laws	4.1 Definition of terms 4.2 Laws of motion 4.3 Graphs of motion 4.4 Equations of motion 4.5 Relationship between linear and angular motion 4.6 Calculations of linear and angular motion	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
5. Describe work, energy and power	5.1 Definition of energy, work and power 5.2 Sources of energy 5.3 Types and forms of energy 5.4 Kinetic and potential energy 5.5 Energy work equation 5.6 Calculation of energy	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning

	5.7 Calculation of work 5.8 Calculation of power 5.9 Problems on simple machine parameters 5.9.1 Machine advantage 5.9.2 Velocity ratio 5.9.3 Efficiency	
6. Demonstrate gas principles	6.1 Gas laws 6.1.1 Boyles law 6.1.2 Charles law 6.1.3 Gas equation 6.2 Solution of engineering problems involving gas laws 6.3 Uses of gases in engineering systems	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
7. Apply heat knowledge	7.1 Heat concepts 7.2 Working principle of heat 7.3 Heat capacity 7.4 Heat problems	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
8. Apply density knowledge	8.1 Density terminology 8.2 Density measurements 8.3 Density problems	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
9. Apply pressure principles	9.1.Pressure concepts 9.2.Working principles of pressure 9.3.Pressure problems	• Practical Assessment • Project • Third Party Report

	9.4.Pressure applications 9.4.1 Braking systems 9.4.2 Vacuum pump 9.4.3 Hydraulic pump 9.4.4 Hydrometers	• Portfolio of Evidence • Written Assessment • Oral Questioning
10. Apply pneumatics and hydraulics principles	10.1. Pneumatics and hydraulic working principles 10.2. Types of pneumatic and hydraulics systems 10.3. Uses of pneumatic and hydraulics systems	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
11. Apply optical principles	11.1. Optics 11.2. Nature of Light concepts 11.3. Types of optics 11.3.1 Geometrical optics 11.3.2 Fibre optics 11.4. Geometric Optic Concepts 11.4.1. Light Propagation, 11.4.2. Reflection 11.4.3. Refraction 11.4.4. Image Formation 11.4.5. Mirrors 11.4.6. Lenses 11.5. Snell's laws 11.6. Optical devices 11.5.1 Mirrors 11.5.2 Lenses 11.5.3 Ray tracing	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning
12. Apply wave principles	12.1. Wave properties 12.1.1. Amplitude	• Practical Assessment • Project

	12.1.2. Wavelength 12.1.3. Speed 12.1.4. Frequency 12.2. Types of waves 12.2.1. Mechanical waves 12.2.2. Electromagnetic waves 12.2.3. Matter waves 12.3. Superposition principle 12.4. Characteristics of waves 12.5. Reflection 12.6. Diffraction 12.7. Refraction 12.8. Standing waves	• Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning

Suggested Methods of Instruction

- Practical
- Projects
- Demonstrations
- Group Discussions
- Role Play
- Interactive lectures
- Individual Assignments
- Industial Attachments
- Viewing of Related Videos
- Clinical and Hospital Trips

Recommended Resources for 25 trainees

S No.	Category Item	Description Specifications	Quantity	Recommended

				Ratio (Item: Trainee)
A	**Learning Materials**			
1.	Reference books	Engineering Mechanics: Statics and Dynamics by R.C. Hibbeler: Mechanics of Materials by R.C. Hibbeler: Fluid Mechanics by Frank M. White:	5 pcs for each	1:5
2.	Training kits	Fibre optical training kit, laser training kit	5 pcs for each	1:5
3.	Installation manuals	Assorted Systems component Manufacturer's manuals and data sheets Instrumentation Handbooks	5 pcs for each	1:5
4.	Charts	Assorted mechanical systems diagrams Relevant charts	1 pc for each	1:25
5.	Audio visual presentations	Projector	1	1:25
B	**Learning Facilities & Infrastructure**			
6.	Lecture theory room	$60m^2$	1	1:25
7.	Workshop	$150m^2$	1	1:25