

14.2.0 MECHANICAL SCIENCE II

14.2.1 Introduction

Mechanical science introduces the trainee to the science applicable to the engineering field. Its' aim is to equip the trainee with the basic concepts of engineering science. The instructional approach will emphasize on experiments, industrial visits and analysis of various engineering concepts.

14.2.2 General Objectives

By the end of the module unit, the trainee should be able to:

- a) explain the basic concepts of engineering science
- b) design simple engineering mechanism

14.2.3 Summary Table and Time Allocation

	Sub-Module Unit	Content	Time (Hrs)
14.2.01	Machines	<ul style="list-style-type: none">• Definition of terms• Examples of simple machines• Problems on simple machines• Laws of machine• Solution of problems using the law of the machines	12
14.2.02	Gases	<ul style="list-style-type: none">• Gas laws• Perfect gas equation• Solutions to problems on gases• Engineering examples	14
14.2.03	Heat	<ul style="list-style-type: none">• Definition of terms• Comparative scales• Simple thermometer• Application of thermal expansion• Methods of heat transfer• Solve problems on heat	14
14.2.04	Density	<ul style="list-style-type: none">• Definitions• Archimedes principle• Solution to problems	14
14.2.05	Pressure	<ul style="list-style-type: none">• Definition of terms• Simple barometer• Application of pressure• Solution to problems	12
Total Time			66

14.2.01 MACHINES

Theory

14.2.01T *Specific Objectives*

By the end of the sub module unit, the trainee should be able to;

- a) define related terms
- b) give examples of simple machines
- c) solve problems related to machines
- d) determine the law of the machine
- e) solve problems using the law of machine

14.2.01C **Competence**

The trainee should have the ability to solve problems on machines

Content

14.2.01T1 Definition of terms

- i) mechanical advantage
- ii) velocity ratio
- iii) efficiency

14.2.01T2 Examples of simple machines

- i) levers
- ii) wheel and axle
- iii) screw jack
- iv) pulleys
- v) belt and chain
- vi) gears

14.2.01T3 Problems on a simple machines

- i) mechanical advantages
- ii) velocity ration
- iii) efficiency

14.2.01T4 Laws of machine

- i) load-effort graphs

14.2.01T5 Solution of problems using the law of the machine

Practice

14.2.01P *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) determine mechanical advantage, velocity, ratio and efficiency of a simple machine
- b) determine the law of the machine

14.2.01P1 Mechanical advantage

- i) velocity ratio
- ii) efficiency

14.2.01P2 Law of the machine

Suggested

Teaching/Learning

Resources

- Weston differential pulley
- Weight
- Hangers
- Screw jack
- Spring balance
- Cords
- Metre rule
- Callipers

14.2.02T GASES

- b) verify Charles' law

Theory

- 14.2.02T *Specific Objectives*
By the end of the sub module unit, the trainee should be able to;
- a) state the gas laws
 - b) state engineering examples where gases are used
 - c) establish the ideal gas equation
 - d) solve the simple problems on gases

14.2.02P1 Boyle's law

14.2.02P2 Charles' law

Suggested Teaching/Learning Resources

- Glass tube sealed at one end
- Mercury reservoir
- Flexible rubber tube
- Metre rule

14.2.03 HEAT

Theory

- 14.2.02C **Competence**
The trainee should have the ability to work on gas systems

14.2.03T *Specific Objectives*
By the end of the sub module unit, the trainee should be able to;

- Content*
- 14.2.02T1 Gas laws
- i) Boyles law
 - ii) Charles law
- 14.2.02T2 Perfect gas equation
- 14.2.02T3 Solutions to problems on gas
- i) Boyle's law
 - ii) Charles' law
 - iii) Perfect gas equation
- 14.2.02T4 Engineering examples
- i) engines
 - ii) air compressors

- a) define terms
- b) describe temperature scales
- c) describe the working of a simple thermometer
- d) explain the application of thermal expansion
- e) describe methods of heat transfer
- f) solve problems

Practice

- 14.2.02P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- a) verify Boyle's law

- 14.2.03C **Competence**
The trainee should have the ability to:
- i) calibrate a thermometer
 - ii) determine the coefficient of

thermal conductivity
of a material

Content

- 14.2.03T1 Definition of terms
 - i) heat
 - ii) specific heat capacity
 - iii) specific latent heat
- 14.2.03T2 Temperature scales
 - i) celcius
 - ii) absolute zero (Kelvin)
 - iii) fahrenheit
 - iv) Rankine
- 14.2.03T3 Simple thermometer
- 14.2.03T4 Application of thermal expansion
- 14.2.03T5 Methods of heat transfer
- 14.2.03T6 Solution to problems

Practice

- 14.2.03P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
 - a) determine the specific heat capacity of a given material
 - b) determine the latent heat of a given material
 - c) determine the coefficient of thermal conductivity of a given material

Content

- 14.2.03P1 Specific heat capacity
- 14.2.03P2 Latent heat
- 14.2.03P3 Coefficient of thermal conductivity

Suggested

Teaching/Learning

Resources

- Calorimeter
- Thermometer

14.2.04 DENSITY

Theory

- 14.2.04T *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
 - a) define terms
 - b) state Archimedes principle
 - c) solve problems

14.2.04C Competence

The trainee should have the ability to use a hydrometer

Content

- 14.2.04T1 Definitions of terms
 - i) density
 - ii) relative density
- 14.2.04T2 Archimedes principle
- 14.2.04T3 Solution to problems

Practice

- 14.2.04P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to:
- determine density of a given material
 - verify Archimedes principles

Content

- 14.2.04P1 Density
14.2.04P2 Verification of Archimedes principle

Suggested Teaching/Learning

Resources

- Spring balance
- Beaker
- Weighing scales
- Specimen
- Water
- Lead slots
- Metre rule
- Test tube
- Hydrometer

14.2.05 PRESSURE

Theory

- 14.2.05T *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to;
- define terms
 - describe a simple barometer
 - explain the application of pressure
 - solve problems

14.2.05C Competence

The trainee should have the ability to:

- take pressure readings
- use barometers

Content

- 14.2.05T1 Definition of terms
- pressure
 - atmospheric pressure
 - gauge pressure
 - absolute pressure
- 14.2.05T2 Simple barometer
14.2.05T3 Application of pressure
- vacuum pump
 - hydraulic pump
- 14.2.05T4 Solution of problems

Practice

- 14.2.05P *Specific Objectives*
By the end of the sub-module unit, the trainee should be able to take pressure readings using pressure measuring devices

Content

- 14.2.01P1 Pressure readings

Suggested Teaching/Learning Resources

- Barometers
- Bourdon tube
- Manometers