

9.1.0 MECHANICAL SCIENCE

9.1.01 Introduction

The module unit is designed to equip the trainee with the knowledge, skills and attitudes necessary for the understanding the mechanical engineering principles that relate to the electrical and electronic engineering trade.

9.1.02 General Objectives

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

- a) Understand the concepts in mechanical engineering science.
- b) Apply the relevant mechanical engineering principles in design work and problem solving in the electrical engineering trade and other life experiences
- c) Appreciate safety programmes for mechanical science

9.1.03 Module Unit Summary and Time Allocation

Mechanical Science

Code	Sub Module Unit	Content	Time Hrs
9.1.1	Work, Energy and Power	<ul style="list-style-type: none">• Forms of Energy• Energy Conservation• Calculations	2
9.1.2	Statics	<ul style="list-style-type: none">• Resolution of Co-Planar Forces	6
9.1.3	Dynamics	<ul style="list-style-type: none">• Principles of dynamic rotation• Problem solving	8
9.1.4	Strength of materials	<ul style="list-style-type: none">• Stress and Strain• Material tests• Factors affecting choice of materials	10
9.1.5	Governors	<ul style="list-style-type: none">• Types of governors• Functions and Characteristics of governors	8
9.1.6	Power Transmission	<ul style="list-style-type: none">• Coupling and Drives• Motor analyses• Vibrations	8
9.1.7	Fluid mechanics	<ul style="list-style-type: none">• Fluid Pressure• Measurement of fluid pressure	10

		<ul style="list-style-type: none"> • Calculations • Applications of the principle of flow 	
9.1.8	Thermodynamics	<ul style="list-style-type: none"> • Terminologies • The principle of thermodynamics • The steam plant 	8
9.1.9	Impulse and momentum	<ul style="list-style-type: none"> • The principle of momentum • Principles Impulse 	6
Total time			66

easytvvet.com

9.1.1 WORK, ENERGY AND POWER

Theory

9.1.1T0 *Specific Objectives*

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

- a) describe forms of energy
- b) convert energy from one form to another
- c) carry out calculations on work, energy and power.

Content

9.1.1T1 Description of forms energy

- i) Work
- ii) Energy
- iii) Power
- iv) Energy
- v) conservation

9.1.1T2 Conversion of energy

- i) Kinetic
- ii) Potential

9.1.1T3 Perform calculations on Work, Energy and Power

Practice

9.1.1P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to perform experiments on conversion of energy

Content

9.1.1P1 Conversion of energy

- i) Potential energy
- ii) Kinetic energy

9.1.2 STATICS

Theory

9.1.2T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to verify the principles of resolution of co-planar forces.

Content

9.1.2T Verification of the principles of resolutions of co-planar

- i) Definitions
- ii) Resultant of co-planar forces
- iii) Equilibrium of co-planar forces
- iv) Definitions of moment, couple and torque.

Practice

9.1.2P0 *Specific Objectives*

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

- a) Verify the principles of resolution and composition of co-planer forces
- b) Determine moments of forces.
- c) Verify equilibrium of forces

Content

9.1.2P1 Verification of the principles of resolution and composition of co-planer forces

- i) Polygon of forces rule
- ii) Triangle of forces rule

- iii) Parallelogram of forces rule
- 9.1.2P2 Determination of moments of force
 - i) Centre of area of a lamina
 - ii) Centre of gravity of an irregular body
 - iii) Reaction at the support for uniform simply supported beams carrying a point load
- 9.1.2P3 Verification of equilibrium of forces

9.1.2C Competence
 The trainee should have the ability to: apply the knowledge of work, energy and power in the study of machines

9.1.3 DYNAMICS

Theory

- 9.1.3T0 *Specific Objectives*
 By the end of the sub module unit, the trainee should be able to:
- a) explain principles of dynamic of rotation
 - b) solve problems in dynamics

Content

- 9.1.3T1 Principle of dynamic
 - i) Angular velocity
 - ii) Angular acceleration
- 9.1.3T2 Problem solving
 - i) State equations
 - ii) Centripetal/ centrifugal forces

Practice

- 9.1.3P0 *Specific Objectives*
 By the end of the sub module unit, the trainee should be able to:

- a) perform experiment and plot the angular velocity time graphs
- b) demonstrate simple harmonic motion.

Content

- 9.1.3P1 Plotting angular velocity time graphs
- 9.1.3P2 Simple harmonic motion

9.1.4 STRENGTH OF MATERIALS

Theory

- 9.1.4T0 *Specific Objectives*
 By the end of the sub module unit, the trainee should be able to:
- a) determine stress and strain
 - b) explain tests carried out in materials
 - c) determine factors affecting choice of materials

Content

- 9.1.4T1 Stress and Strain
 - i) Direct and torsional stress
 - ii) Relationship between stress and strain
 - iii) Introduction to 3 dimensional stress
- 9.1.4T2 Material Testing
 - i) Destructive & non-destructive stress
 - ii) Tensile tests, , tension, impact, hardness, creep, fatigue

- iii) Corrosion & its prevention
- 9.1.4T3 Materials Selection
 - i) Ferrous and non-ferrous
 - ii) Sheet strip bar and other sections in common use
 - iii) Heat treatment of metals
 - iv) Selection of materials with reference to their mechanical & physical properties, indicating standard reference

Practice

- 9.1.4P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) Verify Hooke's' law
 - b) perform the tensile test of mild steel to destruction
 - c) determine the modulus of rigidity of rubber

Content

- 9.1.4P1 Verification of Hooke's law
Plot Hooke's law curve for an elastic material (force against extension)
- 9.1.4P2 Perform tensile testing of mild steel to destruction
- i) Elastic limit
 - ii) Proportional limit
 - iii) Yield point
 - iv) Tensile strength
 - v) Percentage elongation
 - vi) Percentage reduction in area
 - vii) Ultimate unit
- 9.1.4P3 Determination of the modulus of rigidity of rubber

9.1.5 GOVERNORS

Theory

- 9.1.5T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) describe types of governors
 - b) describe functions and characteristics of governors

Content

- 9.1.5T1 Description of the operations of governors
- 9.1.5T2 Description of the characteristics of governors
- i) Sensitivity
 - ii) Friction
 - iii) Stability

9.1.6 POWER TRANSMISSION

Theory

- 9.1.6T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) describe types of coupling devices
 - b) analyse motor under the action of forces giving linear and angular acceleration
 - c) discuss element vibrations and the effect of rotating machines

Content

- 9.1.6T1 Different types of coupling
- i) Clutches, belts, gears
 - ii) Ropes chains

- iii) Fluid and eddy current couplers
- 9.1.6T2 Motor under the action of forces giving linear and angular acceleration
- 9.1.6T3 Balancing of rotating systems including several rotors spaced along a shaft
- 9.1.6T4 Elementary vibrations and the effect of rotating machinery

9.1.6C Competence

The trainee should have the ability to: apply the knowledge of power transmission in the study of rotating machines

9.1.7 FLUID MECHANICS

Theory

9.1.7T0 *Specific Objectives*

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

- a) explain the transmission of fluid pressure.
- b) describe methods of measuring atmospheric and fluid pressure.
- c) perform calculation involving resultant pressure of a fluid.
- d) state the applications of the principle of flow

Content

- 9.1.7T1 Transmission of fluid pressure in hydraulic machines
- 9.1.7T2 Explanation of the different methods of measurement of fluid pressure
 - i) Piezo-tube

- ii) U-tube manometer
- iii) Bourdon gauge
- 9.1.7T3 Solve problems involving resultant pressure of liquid on curved surfaces
 - i) Lamina flow
 - ii) Turbulent flow
- 9.1.7T4 Application of flow principles through pipes
 - i) Tapered pipes
 - ii) Inclined pipes
 - iii) The venturimeter
 - iv) Pilot tube
 - v) Small and large orifices

Practice

9.1.7P0 *Specific Objectives*

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

- a) verify that pressure at any level in fluid is equal in all directions
- b) verify that pressure acts in a direction normal to its containing surfaces
- c) show that pressure due to a column of a liquid depends upon the density of the liquid and the height of the column
- d) verify Archimedes principle
- e) verify the principle of fluid flow

Content

- 9.1.7P1 Verification that pressure at any level in fluid is equal in all directions
- 9.1.7P2 Verification that pressure acts in a direction normal to its containing surfaces

9.1.7P3 Showing that pressure due to a column of a liquid depends upon the density of the liquid and the height of the column

9.1.7T4 Verification of Archimedes principle

i) Specific gravity of solids

ii) Specific gravity of liquid

9.1.7T5 Verification of the principle of fluid flow

i) through an orifice

ii) through a venturimeter

9.1.8 THERMODYNAMICS

Theory

9.1.8T0 *Specific Objectives*

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

a) define terms used in the study of thermodynamics

b) explain principles of thermodynamics

c) describe the steam plant and its cycle.

Content

9.1.8T1 Terms in thermodynamics

i) Working and pure substance

ii) Phase

iii) Cycle

iv) Enthalpy and entropy

9.1.8T2 Explanation of principles of thermodynamic

i) First law of thermodynamic

ii) Second law of thermodynamic

iii) Energy flow equation

iv) Gas process

v) Isothermal

9.1.8T3 Description of steam plant and its cycle

i) Component of the steam plant

ii) Carnot cycle

iii) Ranking cycle

iv) Efficiency

9.1.9 IMPULSE AND MOMENTUM

Theory

9.1.9T0 *Specific Objectives*

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

a) describe principles of momentum

b) describe impulse in reference to mechanical science

Content

9.1.9T1 Description of principles of momentum

9.1.9T2 Description of impulse

i) Collision of two bodies

ii) Thrust of a jet

iii) Applications

9.1.9C Competence

The trainee should have the ability to:

i) Perform experiments on conversion of energy

ii) Determine moments of forces

iii) Perform experiment and plot the angular velocity time graphs

iv) Perform the tensile test of mild steel to destruction

*Suggested Teaching /Learning
Resources*

- Laboratory instruments
- Over head projectors
- Text books

easyvet.com