c) calculate lengths of sides and angles using trigonometrical ratios.

7.2.8.S11 Trigonometric Ratios;
   i) sine,
   ii) cosine,
   iii) tangent.

7.2.8.S12 Using Tables to find Trigonometric Ratios

7.2.8.S13 Trigonometric calculations of;
   i) lengths of sides,
   ii) heights,
   iii) angles.

8.0 SCIENCE FOR ARTISAN COURSES

8.01 INTRODUCTION

This subject is designed to provide trainees with basic scientific principles which will enhance better understanding of their trades. Instructors will find it necessary to give illustrative examples that are relevant to their trades during the training period.

8.02 GENERAL OBJECTIVES

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

a) apply relevant scientific knowledge in their trades;

b) observe safety precautions and accuracy in the performance of their work;

c) appreciate the relationship between related science, machines and the people who operate them;

d) develop careful habits in accurate observation, recording and judgement;

e) solve practical problems in a planned manner.

SUBJECT CONTENT

FIRST YEAR (44 HOURS)

TOPIC	SUB-TOPIC	TIME (HRS)
8.1.1.S Units and Measurements	• Basic Concept • Units • Measurements	4
8.2.S Force, Work Energy and Power	• Kinetic • Potential • Application of power in machines	6
8.1.3.S Friction	• Definition • Causes of friction • Advantages and Disadvantages of friction • Friction experiments	2
8.1.4.S Light	• Reflection • Refraction	5
8.1.5.S Sound	• Speed • Frequency • Wave length	4
8.1.6S General Chemistry	• Experimental techniques • Classification of matter • Atomic structure • Chemical bonding	7
8.1.7.S Elements and Compound	• Oxygen • Hydrogen • Carbon, and Carbon Cycle • Acids • Bases • Salts	8
8.1.8.S Metals and Alloys	• Copper • Iron • Steel • Brass • Extraction of metals	8

FIRST YEAR SYLLABUS (44 HOURS)

8.1.1.S UNITS AND MEASUREMENTS (4 HOURS)

8.1.1.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) select appropriate units of measurements;
b) convert units from one form to another.

8.1.1.S11 Choice of appropriate units of measurements

8.1.1.S12 Conversion of units

8.1.2.S FORCE, WORK, ENERGY AND POWER (6 HOURS)

8.1.2.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) define force, work, energy and power;
b) describe forms of energy (K.E. & P. E);
c) convert energy from one form to another;
d) solve, simple calculations on work, energy and power.

8.1.2.S11 Definition of force, work, energy and power and their units

8.1.2.S12 Forms of energy and their conversion

8.1.2.S13 Simple exercises on work, energy and power

8.1.3.S FRICTION (2 HOURS)

8.1.3.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) state meaning of friction;
b) identify the advantages and disadvantages of friction;
c) solve simple problems on friction.

8.1.3.S11 Definition of friction

8.1.3.S12 Causes of friction and how to minimise them

8.1.3.S13 Advantages and disadvantages of friction on horizontal plane

8.1.3.S14 Friction experiments on horizontal plane using rough and smooth surfaces

8.1.4.S LIGHT (5 HOURS)

8.1.4.S1 Special Obejectives

At the end of this topic, the trainee should be able to:-
   a) name sources of light;
   b) state the laws of reflection and refraction;
   c) determine the characteristics of images formed by plane and curved mirrors;
   d) identify primary and secondary colours;
   e) mix two or more colours to form other colours;
   f) solve simple problems involving location of images formed by plane and curved mirrors.

8.1.4.S11 Sources of light

8.1.4.S12 Reflection and refraction of light (experimental treatment)

8.1.4.S13 Laws of reflection and refraction

8.1.4.S14 Experiments on types of images formed by plane and curved mirrors and the location of these images

8.1.4.S15 Identification of primary and secondary colours

8.1.4.S16 Mixing of coloured lights (practical treatment)

8.1.4.S17 Simple calculations of location of images formed by plane and curved mirrors

8.1.5.S SOUND (4 HOURS)

8.1.5.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
   a) identify sources of sound;
   b) determine the velocity of sound in air;
   c) describe the propagation of sound in a given medium;
   d) state the properties of sound.

8.1.5.S11 Sources and production of sound

8.1.5.S12 Simple experiments on sound

16

8.1.5.S13 Propagation of sound in;
   i) air,
   ii) liquids,
   iii) solids.

8.1.5.S14 Properties of sound;
   i) reflection,
   ii) absorption,
   iii) diffraction,
   iv) interference.

8.1.6.S GENERAL CHEMISTRY (7 HOURS)

8.1.6.S1 Specific Objectives

At the end of this topic the trainee should be able to:-
   a) apply the knowledge of experimental techniques correctly and safely;
   b) state the classification of matter;
   c) recognise the structure of atoms;
   d) describe the strengths of chemical bonds.

8.1.6.S11 Demonstration of experimental techniques

8.1.6.S12 Simple classification of matter

8.1.6.S13 Simple theory of atomic structure

8.1.6.S14 Chemical bonding in various atoms

8.1.7.S ELEMENTS AND COMPOUNDS (8 HOURS)

8.1.7.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
   a) state the properties of elements and compounds;
   b) prepare some gases;
   c) explain the carbon cycle;
   d) state the properties of acids and bases;
   e) define pH value;
   f) prepare salts from acids and bases.

8.1.7.S11 Properties of Elements and Compounds

8.1.7.S12 Preparation of hydrogen and oxygen and their uses (experiment)

17

8.1.7.S13 Carbon Cycle

8.1.7.S14 Properties of acids and bases (simple treatment)

8.1.7.S.15 Definition of pH value

8.1.7.S16 Preparation of salts from acids and bases (simple experimental treatment)

8.1.8.S METALS AND ALLOYS (8 HOURS)

8:1.8.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) describe the method of extraction of a given metal;
b) describe how given alloys are made;
c) state the uses of alloys.

8.1.8.S11 Methods of extraction of given metals;
  i) iron,
  ii) copper.

8.1.8.S12 Composition of alloys (brass, steel & chrome)

8.1.8.S13 Uses of given alloys

SUBJECT CONTENT

SECOND YEAR (44 HOURS)

TOPIC	SUB-TOPIC	TIME (HRS)
8.2.9.S Linear Motion	• Distance • Displacement • Speed • Acceleration • Velocity • Scalar • Vector	6
8.2.10.S Moment of Force	• Forces on a particle • Forces on a solid body • Principles of Moments and its application in machines	5
8.2.11.S Simple Machines	• Levers • Pulleys • Inclined Plane • Screw • Wheel and Axle	4
8.2.12.S Air	• Experimental determination of pressure • Atmospheric Pressure • Measurement of Pressure	2
8.2.13.S Pressure in Liquids	• Density • Floatation	3
8.2.4.S Electrolysis and its use	• Principles of Electrolysis • Electroplating • Metal purification • Corrosion	6
8.2.15.S Primary and Secondary Cells	• Construction of dry and wet cells • Leclanche Cells • Secondary Cells • Lead Accumulator	3

8.2.16.S Thermal properties of matter	• States of Matter • Change of state • Heat transfer • Expansion and Contraction • Energy Principles • Heat Engines (Motor Vehicle) • Heating of water	5
8.2.17.S Magnetism	• Magnetic and Non-magnetic materials • Laws of Magnetism • Magnetization and Demagnetization	3
8.2.18.S Electricity	• D. C and A. C • Heating Effect of Current • Sources of E. M. F • Ring Main • Measuring Instruments	7

SECOND YEAR SYLLABUS   (44 HOURS)

8.2.9.S LINEAR MOTION (6 HOURS)

8.2.9.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
  a) define distance, displacement, speed, velocity and acceleration;
  b) plot and sketch motion graphs;
  c) interpret motion graphs;
  d) solve simple problems involving bodies in linear motion.

8.2.9.S11 Definitions of distance, displacement, speed velocity and acceleration

8.2.9.S12 Mentioning of vector and scalar quantities

8.2.9.S13 Plotting and interpretation of motion graphs;
  i) slope,
  ii) area under the curve.

8.2.9.S14 Simple calculations involving bodies in linear motion

8.2.10.S MOMENT OF FORCE (5 HOURS)

8.2.10.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
  a) describe the motion of a body;
  b) solve problems involving force on a body;
  c) recognize the use of moments in everyday life situations.

8.2.10.S11 Effects of external forces on a solid body

16.2.S12 Principle of moment and its application in machines

8.2.10.S13 Simple calculations on moment of force

8.2.11.S SIMPLE MACHINES   (4 HOURS)

8.2.11.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
  a) define a simple machine;
  b) define M.A.,V.R. and Efficiency of a simple machine;
  c) apply the principles of pulleys and levers to do work;

d) explain how an inclined plane can be used as a machine;
e) apply the principle of the screw in lifting loads;
f) perform simple calculations on M.A., V.R. and Efficiency;
g) explain the use of wheel and axle in everyday life.

8.2.11.S11 Simple Machines;
  i) pulleys,
  ii) inclined plane,
  iii) screw,
  iv) wheel and axle and their practical application in everyday life.

8.2.11.S12 M.A., V.R. and Efficiency

8.2.11.S13 Principles of pulleys and levers

8.2.11.S14 Inclined planes

8.2.11.S15 Principle of the screw

8.2.11.S16 Wheel and Axle

8.2.11.S17 Simple calculations on M.A., V.R and efficiency involving machines

8.2.12.S AIR PRESSURE   (2 HOURS)

8.2.12.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
  a) explain what air pressure is;
  b) determine air pressure experimentally;
  d) state the units and take measurements of pressure;
  e) apply the knowledge of air pressure in relation to objects in everyday life.

8.2.12.S11 What air pressure is

8.2.12.S12 Experimental determination of pressure

8.2.12.S13 Variation of atmospheric pressure with height

8.2.12.S14 Excercises in taking measurements of pressure

8.2.12.S15 Uses of atmospheric pressure

8.2.13.S PRESSURE IN LIQUIDS   (3 HOURS)

8. 2. 13. S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
  a) define density;
  b) describe the variation of pressure;
  c) explain why bodies float or sink;
  d) solve simple problems involving liquids of different densities.

8.2.13.S11 Definition of density

8.2.13.S12 Experimental determination of density

8.2.13.S13 Variation of pressure in liquids

8.2.13.S14 Principle of floatation

8.2.13.S15 Simple calculations on pressure in liquids

8.2.14.S ELECTROLYSIS AND ITS USE   (6 HOURS)

8.2.14.S1 Specific Objectives

At the end of this topic the trainee should be able to:-
  a) describe the process of electrolysis;
  b) state the application of electrolysis process;
  c) explain what corrosion is.

8.2.14.S11 Principles of electrolysis (experimental treatment)

8.2.14.S12 Simple electroplating process

98.2.14.S13 Corrosion (simple treatment);
  i) disadvantages,
  ii) prevention.

8.2.15.S PRIMARY AND SECONDARY CELLS   (3 HOURS)

8.2.15.S1 Specific Objectives

At the end of this topic the trainee should be able to:-
  a) distinguish between primary and secondary cells;
  b) describe the construction of primary and secondary cells;
  c) describe the principles and operation of primary and secondary cells;

d) state the advantages of primary and secondary cells;
e) state uses of primary and secondary cells.

8.2.15.S11 Difference between primary and secondary cells

8.2:15:S12 Construction of primary and secondary cells e.g. Leclanche and lead accumulator

8.2.15.S13 Principle of operation of primary and secondary cells

8.2.15.S14 Advantages and disadvantages of primary and secondary cells

8.2.15.S15 Uses of primary and secondary cells

8.2.16.S THERMAL PROPERTIES OF MATTER   (5 HOURS)

8.2.16.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) state the sources of heat;
b) state the effects of heat on matter;
c) state the changes of matter as the heat varies;
d) describe methods of heat transfer;
e) explain how water is heated.

8.2.16.S11 Source of heat

8.2.16.S12 Effects of heat on matter

8.2.16.S13 Experimental determination of expansion and contraction

8.2.16.S14 Methods of heat transfer (experimental treatment);
i) conduction,
ii) convection,
iii) radiation.

8.2.16.S15 Application of heat energy in everyday life;
i) cooking,
ii) heating of water and rooms.

8.2.17.S MAGNESTISM   (3 HOURS)

8.2.17.S1 Specific Objectives

At the end of this topic, the trainee shoul be able to:-
a) differentiate between magnetic and non-magnetic materials;
b) state the laws of magnetism;
c) sketch simple magnetic field around a magnet;
d) magnetise and demagnetise magnetic objects;
e) apply the knowledge of magnetization in everyday life.

8.2.17.S11 Identification of magnetic and non-magnetic materials

8.2.17.S12 Basic laws of magnetism

8.2.17.S13 Simple magnetic fields (experiment);
i) bar magnet,
ii) horse-shoe magnet.

8.2.17.S14 Magnetization and demagnetization (experiment)

8.2.17.S15 Application of magnetization in everyday life;
i) electric bell,
ii) motors,
iii) generators.

8.2.18.S ELECTRICITY   (7 HOURS)

8.2.18.S1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) state sources of electricity;
b) state what causes an electric current;
c) differentiate d.c. from a.c.;
d) use given electrical instruments correctly;
e) measure the voltage and electric current;
f) state the work of the ring main.

8.2.18.S11 Sources of electricity;
i) static electricity,
ii) thermo electricity,
iii) chemical action,
iv) electromagnetic induction.

8.2.18.S12 E.M.F. and Potential difference in a simple circuit

8.2.18.S13 Simple treatment of D.C. and A.C

8.2.18.S14 Correct use of voltmeter and ammeter

8.2.18.S15 Measurement of voltage and current using;
  i) voltmeter,
  ii) ammeter.

8.2.18.S16 Purpose of a ring main in a home.

LIST OF SCIENCE TOOLS & EQUIPMENT

For a class of 20 trainees	Quantity
Ruler	10
Rule (1/2m, 1m)	20
Tape measure	2
Calipers (inside and outside)	10 (each)
Measuring cylinders	20
Burettes	20
Pippettes	20
Stop clocks	5
Stop watches	5
Vernier callipers	5
Micrometers (inside and outside)	5
Chemical balances	10
Spring balances	10
Trolleys	5
Weights (1Kg, 2Kg, 1/2Kg)	1 (each)
Weights (10g, 20g, 50g, 100g)	2 (each)
Ball bearings	2
Rollers	5
Ball bearings	5
Torches	2
Troughs	3
Plane mirrors	3
Convex mirrors	2
Concave lens	2
Convex lens	2
Electric bell	1
Vacuum pump	1
Atoms model with springs	
Single and combined pulleys	4 (each)
Block and tackle	2
Screws	10
Car jack	1
Pegboard stand	1
Inclined planes	2
Wooden blocks	3
Tin cans	3
Mercury manometers	2
Mercury barometers	2
Aneroid barometer	2
Bicycle pump	1
Syringes	3 (dif. sizes)
U-tube scales	3