

REPUBLIC OF SOUTH AFRICA

COORDINATOR: ENGINEERING STUDIES

SYLLABUS

FOR

PLUMBING THEORY

N1

CODE NUMBER

11022041

DATE OF IMPLEMENTATION

JANUARY 1996

DATE OF FIRST EXAMINATION

APRIL 1996

PLUMBING THEORY N1

1. AIMS

1.1 GENERAL AIMS

The student must, after having successfully completed Plumbing Theory, have enough theoretical knowledge to meaningfully integrate with the building industry's training programme.

1.2 SPECIFIC AIMS

The student must be taught the following:

Safety and housekeeping; tools and machines; metals and materials; soldering and welding; cold water supply; hot water supply; drainage; sheet metalwork; and calculations.

2. DURATION OF INSTRUCTIONAL OFFERING

Full time: One trimester

Part time: One trimester

3. EVALUATION

The students must be evaluated continuously.

4. EXAMINATION

4.1 One three-hour examination paper, comprising 100 marks and covering the complete syllabus, will be written after completing the instructional offering.

4.2 Students must obtain at least 40% in the examination to pass the instructional offering.

4.3 The levels of difficulty related to knowledge, application and insight are important and should be as follows:

Knowledge	±60 %
Application	±30 %
Insight	±10 %

5. GENERAL INFORMATION

5.1 All work must comply with

- * the latest National Building Regulations; and
- * all relevant SABS codes.

5.2 Practical examples must be used in all calculations.

5.3 All drawings must be made diagrammatically in pencil and must be supplied with the necessary labels. No scale drawings will be required from students.

5.4 The weight value [WV] of a module

5.4.1 gives an indication of the percentage of the total content of the work which is contained in the module;

5.4.2 gives an indication of the percentage of the total time available for the instructional offering which is to be spent on the module; and

5.4.3 gives an indication of the percentage of the total marks which is to be allocated to the module for examination purposes.

6. SUBJECT CONTENT

The modules for Plumbing Theory N1 consist of the following:

Module	Theme	Weighted Value
1	Safety and housekeeping	5
2	Tools and machines	10
3	Metals and materials	8
4	Soldering and welding	8
5	Cold water supply	17
6	Hot water supply	12
7	Drainage	20
8	Sheet metal work	12
9	Calculations	8

7. DETAILED SYLLABUS

MODULE 1: SAFETY AND HOUSEKEEPING

(WEIGHTED VALUE: 5)

The student must be able to

1.1 describe the following:

- * The causes of an accident
- * The methods of preventing an accident.

1.2 describe the aims of the

- * Workmen's Compensation Act
- * Occupational Health and Safety Act.

1.3 describe the following as applicable to the plumbing industry:

- * Safe use of ladders
- * Safeguarding of openings
- * Protection of excavations
- * Erection of scaffoldings
- * Manual handling of loads
- * Personal protective equipment.

MODULE 2: TOOLS AND MACHINES

(WEIGHTED VALUE: 10)

The student must be able to

2.1 identify the following hand tools and explain the safe uses and care thereof:

- * Screw-wrechs
- * Spanners
- * Screw driver
- * Pliers
- * Hammers
- * Chisels
- * Files
- * Measuring rule and measuring tape
- * Spirit level
- * Pop rivet apparatus
- * Snips
- * Hack saw
- * Soldering irons
- * Pipe cutter
- * Pipe threader and reamer
- * Pipe bending apparatus
- * Snappers
- * Groover
- * Gas blow torch (blowlamp)
- * Punch
- * Bench and pipe vices.

2.2 identify the following machines and explain the safe uses and care thereof:

- * Guillotine
- * Sheet bending machine
- * Shears
- * Rolling machine
- * Drilling machine
- * Grinding machine
- * Angle grinding machine
- * Thread cutting machine
- * Arc welding machine
- * Jenny
- * Generators
- * Compactors.

MODULE 3: METALS AND MATERIALS

(WEIGHTED VALUE: 8)

The student must be able to

3.1 describe the characteristics such as workability, coefficient of expansion and climatic restrictions and uses of the following metals as applicable in the plumbing industry:

- * Copper
- * Brass
- * Lead
- * Mild steel
- * Cast iron
- * Tin/zinc
- * Aluminium
- * Stainless steel.

3.2 describe the characteristics and uses of the following materials as applicable in the plumbing industry:

- * uPVC
- * Rubber
- * Fibre glass
- * Bitumen.

3.3 describe the following reactions:

- * Corrosion
- * Dezinctification
- * Electrolytic reaction.

MODULE 4: SOLDERING AND WELDING

(WEIGHTED VALUE: 8)

The student must be able to

4.1 describe the following:

- * Soft soldering
- * Hard soldering
- * Gas welding
- * Arc welding.

4.2 describe tinning of a soldering iron.

4.3 describe the reasons for using fluxes.

4.4 describe the soldering mediums and fluxes used with soft and hard soldering.

4.5 identify and describe the apparatus and explain the care thereof (high pressure and low pressure i.e oxy-acetylene/propane) used for soldering and gas welding.

4.6 identify and describe the different types of flames and their uses, used for hard soldering and gas welding.

4.7 describe the apparatus and the care thereof, used for arc welding.

4.8 describe safe arc welding.

MODULE 5: COLD WATER SUPPLY

(WEIGHTED VALUE: 17)

The student must be able to

- 5.1 describe the properties of water with regard to the following:
 - * Smell, colour and taste
 - * Boiling point and freezing point
 - * Expansion and contraction
 - * Density.
- 5.2 discuss the following sources of water for human use with their advantages and disadvantages:
 - * Well, borehole and fountain
 - * Rivers.
- 5.3 describe the uses and identify and describe the methods of joining and their fittings used with the following types of pipes:
 - * Copper pipe
 - * Galvanised pipe
 - * Non-metallic pipe.
- 5.4 identify, describe the working principles, the uses and installation (with the aid of diagrams) of the following:
 - * Water meter
 - * Stopcock
 - * Full way valve
 - * Pillar tap
 - * Non-return valve
 - * Ball (float) valve
 - * Bib cock.
- 5.5 describe the following:
 - * Fitting of pipes between fixed points
 - * Making provision for expansion and contraction in pipe lay-outs
 - * Protecting pipe work against frost
 - * Laying pipes underground.

MODULE 6: HOT WATER SUPPLY

(WEIGHTED VALUE: 12)

The student must be able to

- 6.1 describe, with the aid of drawings, the following principles of heat transfer as applicable to hot water installations:
- * Radiation
 - * Conduction
 - * Convection streams.
- 6.2 make simple section drawings through the following heating units and explain their working principles as well as the advantages and disadvantages of each:
- * Combination hot water geyser (low pressure)
 - * High pressure geyser
 - * Push through geyser
 - * Solar heating panel.
- 6.3 describe, with the aid of diagrams, the hot water installation of the following types of heating units, explain the working principles and advantages and disadvantages of each type of installation:
- * Installation with a boiler-cylinder and supply tank
 - * Installation with a combination hot water geyser.
- 6.4 describe the following:
- * Precautions against air-locks and rectifying thereof
 - * Precautions to be observed when installing a hot water installation.

MODULE 7: DRAINAGE

(WEIGHTED VALUE: 20)

The student must be able to

7.1 describe the following:

- * Waste water, waste water pipe and waste fixtures
- * Soil water, soil pipe and soil fixtures
- * Discharge pipe
- * Sewage
- * Drain
- * Drainage installation.

7.2 describe the uses and identify and describe the methods of joining and the fittings used with the following types of pipes:

- * Earthenware pipe
- * uPVC pipe
- * Cast iron pipe
- * Fibre pipe.

7.3 describe and discuss, with the aid of drawings, the use and installation of the following:

- | | |
|-----------------|------------------|
| * Sink | * Bath |
| * Shower | * Washing trough |
| * Water closet | * Urinal |
| * Squatting pan | * Bidet. |

7.4 describe and discuss, with the aid of drawings, the function, working principles, installation and construction of the following:

- * Ventilation pipe and valves
- * Anti-siphon pipe
- * Gully
- * Manhole
- * Inspection chamber
- * Inspection eye
- * Rodding eye
- * Ramp.

7.5 describe and explain, with the aid of diagrams, the sanitary pipe arrangement for single stack and stub stack pipe systems.

7.6 describe, with the aid of drawings, the function, working principles, installation and maintenance of the following:

- | | |
|-----------------------|----------------|
| * Cistern | * Flush valve |
| * Trap | * Grease-trap |
| * Sand-trap | * Stable-gully |
| * Petrol interceptor. | |

MODULE 8: SHEET METAL WORK

(WEIGHTED VALUE: 12)

The student must be able to

- 8.1 identify the following sheet metal joints and discuss the manufacturing and uses thereof:
 - * Grooved joints
 - * Overlap joints
 - * Pop rivet joints
 - * Solder joints.
- 8.2 calculate sheet metal allowances for sheet metal joints in 8.1.
- 8.3 draw, to a given scale, the sheet metal pattern development of the following:
 - * Gutters and down pipes of round, square and rectangular sections
 - * Right and oblique conical pyramid shaped sections.
- 8.4 describe, with the aid of drawings, the installation and joining method of rain water goods manufactured from the following:
 - * Sheet metal
 - * Fibre cement
 - * uPVC.
- 8.5 describe with the aid of drawings the setting out, development and the securing of flashing, made of sheet metal and suitable for profiled sheeted metal and tiled roofs, around vent pipes.
- 8.6 describe the method of application for non-metal flashing suitable for profiled sheeted metal and tiled roofs.

MODULE 9: CALCULATIONS

(WEIGHTED VALUE: 8)

The student must be able to

- 9.1 make area and volume calculations as applicable to the plumbing industry.
- 9.2 determine from given drawings the quantities of elementary plumbing installations (typical low cost housing) for the following:
 - * Hot and cold water installation
 - * Drainage installation.

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REPUBLIC OF SOUTH AFRICA

COORDINATOR: ENGINEERING STUDIES

SYLLABUS

FOR

PLUMBING THEORY

N2

CODE NUMBER

11022052

DATE OF IMPLEMENTATION

APRIL 1996

DATE OF FIRST EXAMINATION

AUGUST 1996

PLUMBING THEORY N2

1. AIMS

1.1 GENERAL AIMS

The student must, after having successfully completed Plumbing Theory, have enough theoretical knowledge to meaningfully integrate with the building industry's training programme.

1.2 SPECIFIC AIMS

The student must be taught the following: cold water supply; hot water supply; drainage; sheet metal work and flashing; and calculations.

2. DURATION OF INSTRUCTIONAL OFFERING

Full time: One trimester

Part time: One trimester

3. EVALUATION

The students must be evaluated continuously.

4. EXAMINATION

4.1 One three hour examination paper, comprising 100 marks and covering the complete syllabus will be written at the end of the instructional offering.

4.2 Students must obtain at least 40% in the examination to pass the instructional offering.

4.3 Levels of difficulty for knowledge, application and insight should be as follows:

Knowledge	±60 %
Application	±30 %
Insight	±10 %

5. GENERAL INFORMATION

5.1 All work must comply with

- * the latest National Building Regulations; and
- * all relevant SABS codes.

5.2 Practical examples must be used in all calculations.

5.3 All drawings must be made diagrammatically in pencil and must be supplied with the necessary labels. No scale drawings will be required from students.

5.4 The weight value of a module

5.4.1 gives an indication of the percentage of the total content of the work which is occupied by the module;

5.4.2 gives an indication of the percentage of the time available for the instructional offering which is to be spent on the module; and

5.4.3 gives an indication of the percentage of the total of the marks for the examination paper which is to be allocated to the module.

6. SUBJECT CONTENT

The modules for Plumbing Theory N2 consist of the following:

Module	Theme	Weighted Value
1	Cold Water Supply	20
2	Hot Water Supply	20
3	Drainage	35
4	Sheet Metal Work & Flashing	15
5	Calculations	10

7. DETAILED SYLLABUS

MODULE 1: COLD WATER SUPPLY

(Weighted value: 20)

The student must be able to

- 1.1 discuss the kinds of water with regard to the following:
 - * The characteristics and causes of hard and soft water
 - * The method of softening hard water
 - * The effect of the kinds of water on pipe installations;
- 1.2 describe, with the aid of a flow diagram, the purification process of water;
- 1.3 describe, with the aid of diagrams, the water supply to the consumer in respect of the following:
 - * Supply tanks and towers
 - * Gravity system
 - * A water reticulation system (grid)
 - * Pressure zones and zone valves;
- 1.4 describe the use and installation of fire hydrants and fire reels;
- 1.5 plan and set out, with the aid of diagrams and the necessary symbols, the cold water installations, with or without a supply tank (direct or indirect systems), of a house from the water meter to the consumer points;
- 1.6 describe the cause and the remedy of a water hammer; and
- 1.7 describe, with the aid of drawings, the working principles, uses and installation of the following:
 - * Flush valves
 - * Thermostatic valves
 - * Back flow preventers
 - * Pressure reducing valves/arrangement
 - * Air release valves.

MODULE 2: HOT WATER SUPPLY

[Weighted value: 20]

The student must be able to

- 2.1 describe, with the aid of drawings, the working principles and uses of the following fittings used in pressure hot water installations:
 - * Pressure reducing valves
 - * Pressure relief valves
 - * Vacuum breakers
 - * Temperature-pressure safety valves;
- 2.2 describe, with the aid of diagrams, the hot water installation for the following types of heating units and explain the advantages and disadvantages of each type of installation:
 - * Installations with a boiler-cylinder and supply tank
 - * Installations with a combination hot water geyser
 - * Installations with a high pressure hot water geyser
 - * Installations with a solar heating panel, with or without inter-connection of a geyser
 - * Installations with interconnected geysers
 - * Push-through geyser;
- 2.3 describe, with the aid of diagrams, the following hot water installations:
 - * Indirect water heating system
 - * Multi-storey installations (maximum of three storey buildings);
- 2.4 plan and set out, with the aid of diagrams and the necessary symbols, the hot water installation of a house or multi-storey building (maximum of three storey buildings);
- 2.5 describe the working principles, installation and advantages and disadvantages of a balanced and unbalanced hot water installation; and
- 2.6 plan and set out, with the aid of diagrams and the necessary symbols, a balanced and unbalanced hot water installation of a house or multi-storey building (maximum of three storey buildings).

MODULE 3: DRAINAGE

[Weighted value: 35]

The student must be able to

- 3.1 illustrate and explain, with the aid of a diagram, the reasons for the use, advantages, disadvantages and setting out of the pipe arrangement for one-pipe and two-pipe sanitary pipe system. Including a stub stack pipe systems;
- 3.2 describe, with the aid of drawings, the function, layout and working principles of the following sewage disposal units:
 - * Septic tank and French drain
 - * Conservancy tank;
- 3.3 describe, with the aid of a flow diagram, the purification process of sewage;
- 3.4 plan and set out a drainage system for a house with the necessary symbols and abbreviations. The principles of drainage must be taken into consideration in the planning and layout. The drainage system includes pipe arranging, sizes and connections from the fittings up to, and including, the municipal connections or conservancy tanks or septic tanks and French drains;
- 3.5 calculate the invert depths of excavations, for sewer systems;
- 3.6 discuss with the aid of drawings the excavations for drainage systems in respect of the following:
 - * The setting out and control of excavations with the aid of levelling instruments, sight rails and boning rods
 - * The prevention of excavations collapsing (trench timbering)
 - * Backfill compaction (150 mm layers);
- 3.7 describe and discuss the following tests which can be carried out on completed drainage systems:
 - * Air test
 - * Water test;
- 3.8 describe and discuss the purpose, working principles, methods of layout and installation of subsoil drainage; and
- 3.9 describe methods of lifting sewage, storm water and subsoil water from collecting sumps.

MODULE 4: SHEET METAL WORK AND FLASHING [Weighted value: 15]

The student must be able to

4.1 draw, to a given scale, the sheet metal pattern developments of the following:

- * Square to round transition pieces (by means of a triangulation)
- * T-pieces symmetrically placed at right angles or inclined, of pipes with the same or different diameters (branch pipe smaller than main pipe)
- * Oblique, cylindrical Y-pieces and connections; and

4.2 set out, develop and describe the securing of the following flashings, which must be suitable for sheet metal and tile roofs:

- * Flashing against parapet walls
- * Flashing around a chimney.

MODULE 5: CALCULATIONS

[Weighted value: 10]

The student must be able to

- 5.1 make applicable pressure calculations as applicable to the plumbing industry;
- 5.2 extract from given tables required information related to the following:
 - * Hot and cold water supply
 - * Gutter sizing
 - * Drainage installations; and
- 5.3 calculate the material price, from given price lists, of the following elementary plumbing installations:
 - * Hot and cold water installation
 - * Soil and waste pipe installation
 - * Drainage installation.