SYLLABUS

REPUBLIC OF SOUTH AFRICA

EDUCATION AND CULTURE SERVICE

SYLLABUS FOR

ELECTRICAL TRADE THEORY N1

CODE NUMBER: 11041861

DATE OF IMPLEMENTATION
JANUARY 1996

DATE OF FIRST EXAMINATION
APRIL 1996

ELECTRICAL TRADE THEORY N1

1. SUBJECT AIMS

1.1 General subject aims

Students must, upon successful completion of Electrical Trade Theory, be equipped with sufficient theoretical knowledge to enable him to integrate meaningfully into

1.1.1 an electrical apprenticeship;

1.1.2 an electrical contractors environment; and

1.1.3 an industrial electrical environment.

1.2 Specific subject aims

Students must

1.2.1 experience application of the theoretical subject content meaningfully through practical demonstration and by visual learning experiences; and

1.2.2 be equipped with knowledge about the following subject content:

Safety and basic handtools
Electrical circuits
Magnetism and transformers
Batteries and direct current sources
Alternating current
Measuring instruments
Conductors, cables and wireways
Wiring of premises
Testing
Electronics.

2. DURATION OF INSTRUCTIONAL OFFERING

The duration of the instructional offering is one trimester full-time or part-time.

3. EVALUATION

Candidates must be evaluated continually.

4. EXAMINATION

4.1 Knowledge, understanding, application and evaluation are important aspects in determining the students' knowledge and understanding of this subject and should be weighted as

follows in the examination:

Knowledge	Understanding	Application	Evaluation
±60	±20	±15	±5

4.2 One three hour question paper totalling 100 marks will be set at the end of each trimester.

4.3 A national examination paper will be set for April, August and November of each year.

4.4 To pass Electrical Trade Theory N1 the candidate must achieve a final examination mark of 40 %.

5. GENERAL INFORMATION

5.1 The regulations as prescribed in the SABS Code of Practice, SABS 0142 as amended, must be used in conjunction with each relevant section of work. All symbols and measurements must be in accordance with IEC (International Electrical Committee) and SI (Système International d'Unites) standards.

5.2 Practical examples and values must be used in all calculations.

5.3 The correct use of suitable technical and subject terminology must be stressed.

5.4 Neat, labelled drawings must be made when drawings are required. The students' artistic ability is not to be evaluated.

5.5 The student should be taught to relate the length of his answer to the marks allotted to the question.

5.6 All calculations in engineering notation are restricted to a maximum of three decimal places.

5.7 All calculations should apply standard formulae and their derivatives.

5.8 Calculations are only to be carried out where specified.

5.9 All safety aspects applicable to the learning content must be brought under the attention of the students.

6. SUBJECT MATTER

The modules for Electrical Trade Theory N1 consist of the following:

MODULE	DESCRIPTION	WEIGHT VALUE ±
1	Safety and basic handtools	[10]
2	Electrical circuits	[12]
3	Magnetism and transformers	[10]
4	Batteries and direct current sources	[10]
5	Alternating current	[8]
6	Measuring instruments	[6]
7	Conductors, cables and wireways	[10]
8	Wiring of premises	[18]
9	Testing	[8]
10	Electronics	[8]
	Total	[100]

6.1 The weight value [WV] of a module

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

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

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

7. DETAILED SYLLABUS

SYLLABUS: ELECTRICAL TRADE THEORY N1

MODULE 1: SAFETY AND BASIC HANDTOOLS [WV 10]

SAFETY

1.1 Use of electricity

On completion of this section of the module the students must be able to outline the practical applications and regulations contained within "The Minerals Act" (Act No. 50 of 1991) and "The Occupational Health and Safety Act" (Act No. 85 of 1993) and any amendments relating thereto regarding the following:

1.1.1 Isolation for inspection and repairs

1.1.2 Locking out entry where there are live conductors

1.1.3 Flame proofing

1.1.4 Electrical installations

1.1.5 Electrical equipment

1.1.6 Portable appliances.

1.2 Environmental

On completion of this section of the module the students must be able to describe methods of observing and/or maintaining the following:

1.2.1 Good housekeeping

1.2.2 Colour coding

1.2.3 Symbolic safety signs

1.2.4 Machine guarding

1.2.5 Grinding wheels

1.2.6 Ladders

1.2.7 Fires, with emphasis on electrical and combustible materials

1.2.8 Fire extinguishers

1.2.9 Environmental practices.

BASIC HANDTOOLS

1.3 On completion of this section of the module the students must be able to describe the care and use of the following handtools:

1.3.1 The flat screwdriver

1.3.2 The Phillips screwdriver

1.3.3 The long nose pliers

1.3.4 The combination pliers

1.3.5 The diagonal cutter (side cutter)

1.3.6 The crimping tool

1.3.7 The hacksaw

1.3.8 The cable knife

1.3.9 The spring bender

1.3.10 The draw tape.

DIDACTICAL GUIDELINE

Nosa or similar programmes must be used in all descriptions.

MODULE 2: ELECTRICAL CIRCUITS [WV 12]

On completion of this module the students must be able to

2.1 define the following terms:

2.1.1 Current

2.1.2 Potential difference

2.1.3 Electromotive force

2.1.4 Resistance.

2.2 define Ohm's law.

2.3 manipulate Ohm's law and perform calculations related to series, parallel and series/parallel circuits in terms of the following:

2.3.1 Current

2.3.2 Potential difference

2.3.3 Resistance

2.3.4 Power

2.3.5 Energy.

2.4 perform calculations related to cells connected in series, parallel and series/parallel in terms of electromotive force (emf), potential difference (Pd) and internal resistance.

2.5 perform calculations to indicate how the resistance of materials is influenced by resistivity, length, cross-sectional area and change in temperature.

NB The calculations must make use of the following prefixes: Micro, milli, kilo and mega.

DIDACTICAL GUIDELINE

The terms volt drop, conventional current flow and electron flow should also be explained.

MODULE 3: MAGNETISM AND TRANSFORMERS [WV 10]

MAGNETISM

On completion of this section of the module the students must be able to

3.1 explain why magnets are classified as natural, permanent and electromagnets.

3.2 describe, with the aid of drawings, the following terms related to magnets:

3.2.1 Poles

3.2.2 Lines of force

3.2.3 Flux

3.2.4 Flux density

3.2.5 Field strength.

3.3 describe, with the aid of a drawing, how a magnetic field is established when an electric current flows through a conductor. The right-hand grip rule must be demonstrated.

3.4 describe, with the aid of drawings, the effect on the magnetic field around a current carrying conductor when placed in a uniform magnetic field. Flemming's left-hand rule must be demonstrated.

TRANSFORMERS

On completion of this section of the module the students must be able to

3.5 describe, with the aid of drawings, the construction of a single phase transformer in terms of the following:

3.5.1 The magnetic circuit and its clamping structure

3.5.2 Primary and secondary windings and their clamping structures

3.5.3 The leads and tapping of coils

3.5.4 Tanks containing the transformer, together with cooling surfaces, isolators and breathers.

3.6 describe, with the aid of drawings, the principle of operation of a single phase transformer in terms of mutual inductance and the henry as the unit of inductance.

3.7 Define the term **IDEAL TRANSFORMER**

3.8 perform calculations on the general equation for an ideal transformer in terms of the following:

3.8.1 The terminal voltage ratios

3.8.2 The turns ratios

3.8.3 The currents ratios.

3.9 Explain, with the aid of drawings, the principle of operation of single phase auto-transformers.

MODULE 4: BATTERIES AND DIRECT CURRENT SOURCES [WV 10]

BATTERIES

On completion of this section of the module the students must be able to

4.1 differentiate between primary and secondary cells.

4.2 identify the following components of cells from given drawings:

4.2.1 Poles

4.2.2 Electrolyte

4.2.3 Positive and negative plates

4.2.4 Seperators

4.2.5 Casing.

4.3 describe the care and maintenance of lead-acid cells.

4.4 describe how the condition of lead-acid cells should be tested and state the instruments used for these tests.

4.5 explain, with the aid of drawings, the discharging and charging action of a lead-acid cell.

4.6 explain the terms potential difference, electromotive force, relative density and capacity of a lead-acid cell.

4.7 state the factors that influence the choice of cells for particular applications.

4.8 state and compare the advantages and disadvantages of primary and secondary cells.

DIRECT CURRENT SOURCES

On completion of this section of the module the students must be able to

4.9 explain, with the aid of drawings, and Flemming's right-hand rule, the principle of operation of the d.c generator.

4.10 explain, with reference to the d.c. generator, the following:

4.10.1 The use of the commutator, brushes and brushgear

4.10.2 Commutator-action

4.10.3 The direction of current flow.

4.11 list the following means of producing electricity and name an example of each:

4.11.1 Friction

4.11.2 Heat

4.11.3 Light

4.11.4 Chemical reaction.

MODULE 5: ALTERNATING CURRENTS [WV 8]

On completion of this module the students must be able to

5.1 explain, with the aid of drawings and Faraday's law, the principle of operation for the generation of a single-phase and three-phase alternating current.

5.2 draw wave-form diagrams of sine and cosine waves and emphasise the different starting point of these two waves.

5.3 explain with reference to the above mentioned wave-form the following terms:

* Cycle
* Period time
* Frequency
* Peak value
* Peak to peak value
* Root mean square (rms) value
* Average value
* Phase angle
* Instantaneous value

DIDACTICAL GUIDELINE

The basic circuit diagrams of a single and three phase alternator must be included in the wave-form diagrams.

MODULE 6: MEASURING INSTRUMENTS [WV 6]

On completion of this module the students must be able to

6.1 describe, with the aid of drawings, the basic construction and the principle of operation of moving iron and moving coil meter.

6.2 describe the principle of operation of the insulation resistance tester (Megger).

6.3 show by means of circuit diagrams how the following instruments are connected in a circuit:

6.3.1 Direct connection of the ammeter, the voltmeter and the ohmmeter

6.3.2 Indirect connection of the ammeter and the voltmeter by using instrument transformers (Potential transformer and current transformer).

MODULE 7: CONDUCTORS, CABLES AND WIREWAYS [WV 10]

CONDUCTORS AND CABLES

On completion of this section of the module the students must be able to

7.1 define the following terms and give examples of each:

7.1.1 Conductor (gold, silver, copper, aluminium and carbon)

7.1.2 Insulators (glass, porcelain, mica, asbestos, silicon rubber, bakelite, polyvinyl chloride, vulcanised rubber, polycarbonate compounds, moulded resins and plastics)

7.1.3 Semi-conductors (silicon and germanium)

7.2 describe, with the aid of labelled drawings, the construction of the following cables:

7.2.1 Impregnated paper insulated (PILCSTA and PILCSWA)

7.2.2 Cross-linked polyethylene (XLPE)

7.2.3 Polyvinyl chloride (PVC).

7.3 list and compare the advantages and disadvantages of the following cables:

7.3.1 Impregnated paper insulated (PILCSTA and PILCSWA)

7.3.2 Cross-linked polyethylene (XLPE)

7.3.3 Polyvinyl chloride (PVC).

WIREWAYS

On completion of this section of the module the students must be able to

7.4 define the term wireway as-given in the SABS Code of Practice.

7.5 discuss the general provisions for wireways as described in the SABS Code of Practice under the following headings:

7.5.1 General provisions

7.5.2 Rigid metallic wireways

7.5.3 Rigid non-metallic wireways

7.5.4 Flexible conduit.

MODULE 8: WIRING OF PREMISES [WV 18]

On completion of this module the students must be able to

8.1 identify and list all standard IEC electrical wiring symbols given on work drawings.

8.2 identify electric components, and draw wiring diagrams of the following:

8.2.1 Fixed, stationary and portable appliances

8.3 draw wiring diagrams of the following:

8.3.1 Bell circuits

8.3.2 Lighting circuits consisting of one way, two way, and intermediate switching.

8.3.3 Socket outlet circuits

8.3.4 Cooker circuits incorporating oven control, simmerstat and three heat control

8.3.5 Geyser circuits.

8.4 state the purpose of the following with regard to safety:

8.4.1 Earthing

8.4.2 Fuses and circuit breakers

8.4.3 Earth leakage.

8.5 describe, by means of neat labelled drawings, the connection from the supply authority's overhead lines to the consumer's meter boards in respect of single phase and three phase installations. Pre-paid metering systems must be included.

8.6 describe the principle of operation of the following:

8.6.1 Single phase circuit breakers

8.6.2 Three phase circuit breakers

8.6.3 Core balance earth leakage relay (wound primaries and straight primaries with tripping relay).

8.7 describe the purpose of the following:

8.7.1 Load distribution

8.7.2 Lightning arrestors

8.7.3 Energy control units.

MODULE 9: TESTING **[WV 8]**

On completion of this module the students must be able to describe, with the aid of neat labelled drawings, the procedure, as laid down in the SABS Code of Practice, and name the instrument used to carry out the following electrical tests:

9.1 Continuity of conductors

9.2 Insulation resistance between conductors

9.3 Insulation resistance between conductors and earth

9.4 Polarity

9.5 Earth continuity

9.6 Earth leakage relay

9.7 Motors.

MODULE 10: ELECTRONICS [WV 8]

On completion of this module the students must be able to

10.1 identify the IEC symbols used for the following electronic components:

10.1.1 Fixed, variable and pre-set resistors

10.1.2 Polarised and non-polarised capacitors.

10.2 describe the principle of operation and identify the IEC symbols used for the following diodes:

10.2.1 Junction diode

10.2.2 Light emitting diode

10.2.3 Zener diode.

10.3 describe the following terms with reference to capacitors:

10.3.1 Voltage ratings

10.3.2 Polarisation.

10.4 perform calculations on capacitors connected in series and parallel.

10.5 identify the colour codes and calculate the value of resistors by using these colour codes.

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SYLLABUS

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

EDUCATIONAL POLICY

SYLLABUS FOR

ELECTRICAL TRADE THEORY N2

NATIONAL CERTIFICATE

CODE NUMBER: 11041872

IMPLEMENTATION DATE
APRIL 1996

FIRST EXAMINATION DATE
AUGUST 1996

ELECTRICAL TRADE THEORY N2

1. SUBJECT AIMS

1.1 General subject aims

Students must, upon successful completion of Electrical Trade Theory, be equipped with sufficient theoretical knowledge to enable them to integrate meaningfully into

1.1.1 an electrical apprenticeship;

1.1.2 an electrical contractors environment; and

1.1.3 an industrial electrical environment.

1.2 Specific Subject aims

Student must

1.2.1 experience application of the theoretical subject content meaningfully through practical demonstration and by visual learning experiences; and

1.2.2 be equipped with knowledge about the following subject content:

Conductors and cables
Switchgear, contactors and relays
Direct current motors and starters
Alternating current machines and starters
Earthing
Protection
Measuring instruments
Transformers
Electronics.

2. DURATION OF INSTRUCTIONAL OFFERING

The duration of the instructional offering is one trimester full-time or part-time.

3. EVALUATION

Candidates must be evaluated continually.

4. EXAMINATION

4.1 Knowledge, understanding, application and evaluation are important aspects in determining students' knowledge and understanding of this subject and should be weighted as follows in the examination:

Knowledge	Understanding	Application	Evaluation
±50	±25	±15	±10

4.2 One three-hour question paper totalling 100 marks will be set at the end of each trimester.

4.3 A national examination paper will be set for April, August and November of each year.

4.4 To pass Electrical Trade Theory N2 the candidate must achieve a final examination mark of 40%.

5. GENERAL INFORMATION

5.1 The regulations as prescribed in the SABS Code of Practice, SABS 0142 as amended, must be used in conjunction with each relevant section of work. All symbols and measurements must be in accordance with IEC (International Electrical Committee) and SI (Système International d'Unites) standards.

5.2 Practical examples and values must be used in all calculations.

5.3 The correct use of suitable technical and subject terminology must be stressed.

5.4 Neat, labelled drawings must be drawn when required. The students' artistic ability is not to be evaluated.

5.5 Students should be made aware that they must relate the extent of their answer to the marks allotted to the question.

5.6 All calculations in engineering notation are restricted to a maximum of three decimal places.

5.7 All calculations should apply standard formulae and their derivatives.

5.8 Calculations are only to be carried out where specified.

5.9 All safety aspects applicable to the learning content must be brought under the attention of the students.

6. SUBJECT MATTER

The modules for Electrical Trade Theory N2 consist of the following:

MODULE	DESCRIPTION	WEIGHT VALUE ±
1	Conductors and cables	[11]
2	Switchgear, contactors and relays (380V max)	[12]
3	Direct current motors and starters	[12]
4	Alternating current machines and starters	[15]
5	Earthing	[12]
6	Protection	[10]
7	Measuring instruments	[6]
8	Transformers	[12]
9	Electronics	[10]
	Total	**[100]**

6.1 The weight value [WV] of a module

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

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

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

7. DETAILED SYLLABUS

SYLLABUS: ELECTRICAL TRADE THEORY N2.

MODULE 1: CONDUCTORS AND CABLES [WV 11]

On completion of this module the students should be able to

1.1 perform calculations to determine the cable current rating and volt drop.

1.2 list and compare the advantages and disadvantages of installing cables

1.2.1 in free air;

1.2.2 in ducts; and

1.2.3 buried.

1.3 describe the influence of inductance in an alternating current circuit on

1.3.1 phase difference between current and voltage;

1.3.2 current required to supply a given amount of power; and

1.3.3 power factor.

1.4 state the variables that must be considered when selecting a cable with respect to

1.4.1 load to be supplied for a non-inductive or inductive load using formulae;

1.4.2 permissible volt drop; and

1.4.3 calculating the smallest cable that can handle a fault current for a certain line duration fault from information given on a schematic diagram.

1.5 determine the cable size by performing the required calculations for

1.5.1 power delivered to inductive and non-inductive loads;

1.5.2 permissible volt drop; and

1.5.3 a given duration of specified fault current.

MODULE 2: SWITCHGEAR, CONTACTORS AND RELAYS [WV 12]

On completion of this module the students should be able to

2.1 describe with reference to electrical conductors

2.1.1 methods of joining low and high voltage conductors;

2.1.2 where joining is allowed; and

2.1.3 the procedure followed when sealing a joint.

2.2 identify different types of low and high voltage insulators and waterproof and heat-resistant insulation.

2.3 describe, with the aid of labelled drawings, the electrical reticulation network from the point of distribution to an industry, mine or municipality.

2.4 compare disconnectors, relays and contactors in terms of construction and operating principles with reference to the contacts, operating coils (where applicable) and operating mechanisms.

2.5 describe, with the aid of labelled drawings, the principle of operation of the overcurrent and earth leakage protection relays (I D M T type).

2.6 describe the following in conjunction with low tension (domestic and industrial type) circuit breakers:

2.6.1 Moulded cases

2.6.2 Positive indication

2.6.3 Trip position

2.6.4 Free bearing surfaces

2.6.5 Factory sealed

2.6.6 Thermal magnetic tripping

2.6.7 De-ion arc extinguishers

2.6.8 Silver tungsten contacts

2.6.9 Quick make, quick-break, trip free mechanism

2.6.10 Interpole barriers

2.6.11 Common trip

2.6.12 Surge arresters.

MODULE 3: DIRECT CURRENT MOTORS AND STARTERS [WV 12]

On completion of this module the students should be able to

3.1 identify the following components of a direct current motor from a given drawing:

3.1.1 Yoke

3.1.2 Field windings

3.1.3 Pole shoes

3.1.4 Pole core

3.1.5 Armature

3.1.6 Brushes

3.1.7 Commutator.

3.2 compare different motors (shunt, series and compound wound - long shunt & short shunt) in terms of

3.2.1 field windings;

3.2.2 full load speed;

3.2.3 no load speed; and

3.2.4 starting torque.

3.3 draw circuit diagrams of

3.3.1 shunt motors;

3.3.2 series motors; and

3.3.3 compound wound motors

3.3.3.1 long shunt; and

3.3.3.2 short shunt.

3.4 explain the need for starters.

3.5 describe, with the aid of circuit diagrams, the operation of a face-plate-starter, related to

3.5.1 series motors; and

3.5.2 shunt motors.

3.6 describe, with the aid of a diagram, methods of obtaining the reversal of direction of rotation of a motor.

MODULE 4: ALTERNATING CURRENT MACHINES AND STARTERS [WV 15]

On completion of this module the students should be able to

4.1 explain, with reference to AC motors, what is meant by the terms

4.1.1 stator; and

4.1.2 rotor.

4.2 compare cage and wound rotors in terms of their construction.

4.3 state how the currents in the stator windings of an AC induction motor produce a rotating magnetic field and its interaction with the rotor conductors.

4.4 define the term slip.

4.5 draw the circuit diagrams of the following single-phase motors:

4.5.1 Capacitor start/induction run

4.5.2 Capacitor start/capacitor run

4.5.3 Universal.

4.6 describe, with the aid of circuit diagrams, how the following three-phase motors may be connected in star or delta:

4.6.1 Squirrel cage

4.6.2 Wound rotor

4.7 explain how time delay and current rating of overload protection devices influence their use in protecting motors from damage in case of

4.7.1 locked rotors;

4.7.2 overload during operation; and

4.7.3 short circuits.

4.8 state the purpose of and the application of the following starters:

4.8.1 Direct-on-line

4.8.2 Star-delta manual, semi-automatic and automatic

4.8.3 Resistance starter

4.8.4 Auto transformer

4.8.5 Forword/reverse.

4.9 compare the advantages and disadvantages of single- and three-phase motors.

4.10 describe, with the aid of drawings, how the following tests are conducted on a motor:

4.10.1 Insulation resistance between conductors

4.10.2 Insulation resistance to earth

4.10.3 Short-circuit and open-circuit windings.

4.11 state the regulations for motor control.

MODULE 5: EARTHING [WV 12]

On completion of this module students should be able to

5.1 explain why earthing is important.

5.2 explain the concept of floating earths in portable appliances.

5.3 explain the earthing functions of

5.3.1 system earthing;

5.3.2 equipment earthing; and

5.3.3 combination of system and equipment earthing.

5.4 describe the earthing systems at power stations and substations.

5.5 explain how a common earth electrode is used in reticulation circuits.

5.6 describe the provision of earthing for underground cables and overhead lines.

5.7 describe how earth continuity is provided using the cable sheath in cable terminations and joint boxes.

5.8 describe the purpose of insulated glands in a cable system.

5.9 state methods by which the following protective earthing may be effected:

5.9.1 Direct earthing of all metalwork concerned

5.9.2 Direct metallic connection between metalwork and the neutral at the source of supply.

5.10 describe the earthing method of a separate earth wire to which all non-current carrying metalwork is connected.

MODULE 6: PROTECTION. [WV 10]

On completion of this module students should be able to

6.1 explain, with the aid of circuit diagrams, electrical installations (up to 380V) are protected against

6.1.1 earth leakage faults; and

6.1.2 phase imbalance.

6.2 describe the protection of overhead lines by means of earthing compensators and lightning arrestors.

6.3 define the following protective devices and describe their functions:

6.3.1 Thermal overload relays (trips)

6.3.2 Overload relays with manual reset

6.3.3 Overload relays with automatic reset

6.3.4 Fuses (different types).

6.4 describe the effect of the following conditions on protective devices:

6.4.1 Ambient temperature

6.4.2 Severe starting.

MODULE 7: MEASURING INSTRUMENTS [WV 6]

On completion of this module students should be able to

7.1 explain the function of the following measuring instruments:

7.1.1 Wattmeter (electrodynamometer type)

7.1.2 Kilowatt-hour meter

7.1.3 Frequency meter

7.1.4 Power factor meter

7.1.5 Maximum demand meter.

7.2 illustrate, by means of circuit diagrams, how the following instruments are connected in single phase circuits:

7.2.1 Wattmeter

7.2.2 Kilowatt-hour meter

7.2.3 Frequency meter

7.2.4 Power factor meter

7.2.5 Maximum demand meter.

MODULE 8: TRANSFORMERS **[WV 12]**

On completion of this module students should be able to

8.1 perform calculations to show the relationship of the ratios (voltage, current and turns).

8.2 explain how inductance causes a phase angle between voltage and current and its relationship with the concept power factor.

8.3 perform calculations to demonstrate the relationship between true power, apparent power and power factor.

8.4 calculate the line and phase voltages and currents relating to the following three-phase transformer connections:

8.4.1 Star/Star

8.4.2 Delta/Delta

8.4.3 Star/Delta

8.4.4 Delta/Star.

8.5 explain the concept of and need for transformer tappings.

MODULE 9: ELECTRONICS [WV 10]

On completion of this module students should be able to

9.1 explain, with reference to diodes, the following terms:

9.1.1 Rating

9.1.2 Biasing.

9.2 describe the following with reference to diodes:

9.2.1 Testing

9.2.2 Operation in dc and ac circuits (simple graphs where applicable).

9.3 draw circuit diagrams of the following showing input and output wave-forms:

9.3.1 Half-wave rectifier

9.3.2 Full-wave rectifier with a centre-tap transformer

9.3.3 Full-wave bridge rectifier.

9.4 compare the efficiency of half-wave and full-wave rectifier circuits.

9.5 explain, with reference to zener diodes, the following with the aid of a circuit diagram:

9.5.1 Biasing and series resistor

9.5.2 The zener as a regulator.

9.6 use line diagrams to illustrate circuit connections and current flow in an NPN and PNP transistor.

9.7 describe the operation of a transistor in a commonemmiter circuit in terms of I_E, I_B and I_C (amplifier and switch).

9.8 describe the operation of a thyristor.

9.9 describe the operation of a power controller circuit where the thyristor is used as the controlling device.

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