25.2.0 ELECTRICAL PROTECTION AND SERVICES FOR BUILDINGS

25.2.01 Introduction

This module unit is designed to equip the trainee with knowledge, skills and attitudes appropriate for carrying out electrical installation design work, protection of buildings from electrical related dangers, installation of special electrical wiring systems and utility services. A trainee who successfully completes this module unit will be equipped to work in the construction industry as a site foreman.

25.2.02 General Objectives

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

a) Design electrical installation works
b) Interpret parts of building structure for utility and electrical services
c) Understand the requirements for lightning protection
d) Select a suitable wiring system for special ambient conditions
e) Appreciate the need for quality control in electrical installations
f) Observe the IEE regulation requirements and standards for electrical installation

25.2.03 Module Unit Summary and Time Allocation

Electrical Installation Technology II

Code	Sub-Module Unit	Content	Time Hrs
25.2.1	Corrosion Protection	• Process of electrostatic corrosion • Methods of corrosion protection • Precaution to prevent corrosion • Regulations and codes of practice	8
25.2.2	Lightning Protection	• Definition of terms • Types of lightning strokes • Effects of lightning strokes • Factors necessary to consider when designing for lightning protection • Components of lightning protection system	6

		• Tests to be carried out on lightning protection • Maintenance required • Application of lightning protection system	
25.2.3	Special Installation	• Flame proof installations • Damp and electrostatic areas • Temporary installations • Caravan sites • Agricultural installations • Relevant IEE regulation	12
25.2.4	Illumination	• Law of inverse squares • Terms used in illumination • Types of lamps • Design of lighting schemes • Relevant IEE regulation	20
25.2.5	Building Services	• Building structure • Accommodating electrical services in building • Utility services	8
25.2.6	Installation planning and designs	• Factors determining choice of wiring systems • Determining final sub circuits • Rating of cables and devices • Distribution diagram • Layout of lightning and power points • Wiring systems layout • Relevant IEE regulations, codes of practice and catalogues	12
Total time			**66**

25.2.1 **CORROSION PROTECTION**

Theory

25.2.1T0 *Specific Objectives*
By the end of the sub-unit, the trainee should be able to:
a) describe the process of electrolytic corrosion
b) explain the methods of corrosion protection
c) state precautions to prevent corrosion
d) supply the regulations and code of practice requirement to prevent corrosion

Content

25.2.1T1 Description of the process of electrolytic corrosion
i) Susceptible metals
ii) Corrosive environment (electrolyte conditions)
iii) Electrolysis process

25.2.1T2 Explanation of the methods of corrosion protection
i) Cathodic protection
ii) Sacrificial anode
iii) Power impressed (impressed current)

25.2.1T3 Statement on precautions to prevent corrosion
i) Painting (bituminised paints) over surfaces liable to corrosion
ii) Prevention of contact between dissimilar metals
iii) Soldering operation
iv) Protection of metal sheaths of cables and metal conduct fittings where they come in contact with lime, cement.

25.2.1T4 Applications of regulations and code of practices requirements to prevent corrosion

Practice

25.2.1P0 *Specific Objectives*
By the end of the sub-unit, the trainee should be able to:
a) carry out installation for corrosion protection
b) apply precautionary measure to prevent corrosion

Content

25.2.1P1 Carrying out installation of equipment for corrosion protection
i) Artificial anode
ii) Impressed current method

25.2.1P2 Application of precautionary measure to prevent corrosion
i) Bituminous paints on metallic surfaces liable to corrosion
ii) Prevention of contact between two dissimilar metals

(copper and aluminium)

25.2.1C Competence

The trainee should have the ability to:

i) Install corrosion protection equipment
ii) Apply precautionary measure to prevent corrosion

Teaching/Learning Resources

- Electrodes
- Tool kit
- Measuring instruments
- Industrial visits

Suggested teaching/Learning Activities

- Discussion
- Illustration
- Demonstration
- Note taking
- Practical exercise

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests

25.2.2 LIGHTNING PROCTECTION

Theory

25.2.2T0 *Specific Objectives*

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

a) define terms used in lightning protection
b) describe types of lightning strokes and
c) explain the effects of lightning strokes
d) explain factors considered for lightning protection
e) describe the component of lightning protection system
f) explain the tests to be carried out on lightning protection system
g) explain the maintenance required for lightning protection system
h) state the areas of applications of lightning protection system.

Content

25.2.2T1 Definition of terms used in lightning protection system
i) Air termination
ii) Down conductors
iii) Zone of protection
iv) Earth electrode
v) Arresters

25.2.2T2 Description of types of lightning strokes
i) Direct strokes – (Stroke A)
ii) Indirect strokes – (Stroke B)
iii) Combinational strokes (Stroke A, B and C)

25.2.2T3 Explanation of the effects of lightning strokes
i) Damage to buildings, properties and transmission lines
ii) Death to human beings and livestock

iii) Fire risks

25.2.2T4 Explanation of factors considered for lightning protection for a building
i) Building structure
ii) Occupancy
iii) Building structure

25.2.2T5 Description of component of lightning protection system
i) Air termination (vertical & horizontal conductors)
ii) Down conductors
iii) Test points
iv) Earth electrode

25.2.2T6 Explanation of tests carried out on lightning protection system
i) Continuity
ii) Effectiveness of earthing

25.2.2T7 Explanation of maintenance required for lightning protection systems
i) Corrosion protection
ii) Joints and terminations

25.2.2T8 Statement on application of lightning protection systems
i) Buildings
ii) Farm installation
iii) Transmission systems

Practice

25.2.2P0 *Specific Objectives*
By the end of the sub-unit, the trainee should be able to:
a) carry out installation of lightning protection system
b) perform tests on lightning protection system
c) carry out maintenance required for lightning, protection system.

Content

25.2.2P1 Installation work of lightning protection system in:
i) Buildings
ii) Farm installation
iii) Transmission systems

25.2.2P2 Performing tests on lightning protection system
i) Earth continuity tests
ii) Earth electrode resistance area

25.2.2P3 Carrying out maintenance work on lightning protection system
i) Corrosion protection
ii) Test point, joints and terminations

25.2.2C Competence
The trainee should have the ability to:
i) Install lightning protection system
ii) Maintain lightning protection system

Teaching/Learning Resources
- Simulation of lightning strokes
- Tests equipment
- Electrical tool kit

Suggested teaching/Learning Activities

- Discussion
- Illustration
- Demonstration
- Note taking
- Practical exercise

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests

25.2.3 SPECIAL INSTALLATIONS

Theory

25.2.3T *Specific Objectives*

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

a) list and explain the wiring systems and equipment for systems and equipment for various special installations

b) state the relevant regulations/codes of practice for various special installation

Content

25.2.3T11 Flame Proof Installation
- i) Classification of hazardous area
- ii) Flammable gases
- iii) Flame proof equipment
- iv) Intrinsically safe equipment

25.2.3T12 Relevant Regulations
- i) Requirements for cables
- ii) Requirements for metal conduct wiring systems

25.2.3T21 Damp and electrostatic areas
- i) Definition of damp situation
- ii) Wiring systems in damp situation
- iii) Electrostatic areas
- iv) Methods of minimizing electrostatic charges

25.2.3T22 Relevant Regulations

25.2.3T31 Temporary Installation
Definition of temporary installations

25.2.3T32 Relevant Regulations
- i) Special requirement for temporary wiring systems
- ii) Requirements of distribution systems on construction sites
- iii) Testing of the installation

25.2.3T41 Caravan Sites
- i) Difference between caravan and caravan site

25.2.3T42 Regulation Requirements
- i) Protection requirements
- ii) Testing and inspection
- iii) Wiring systems and requirements

25.2.3T51 Agricultural Installation
Sources of danger

25.2.3T52 Relevant Regulation Requirements
- i) Fitting and accessories
- ii) Wiring between buildings
- iii) Earthing

iv) Cable wiring systems and their requirements

Practice

25.2.3P1 *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to:
a) carry out electrical installation of various special installations
b) perform tests and inspections on the various special installations

Content
25.2.3P11 Electrical installations in hazardous areas:
i) Flame-proof installation
ii) Damp and electrostatic areas
iii) Agricultural and horticultural installation
iv) Temporary installation
v) Caravan sites
vi) Electric fencing
vii) Wiring between buildings
viii) Connection of low voltage equipment

25.2.3P12 Tests and inspection on the various special installations
i) Main switch gear
ii) Effectiveness of earthing
iii) Circuit continuity

25.2.3C Competence
The trainee should have the ability to:
i) Carry out electrical installation work in hazardous areas
ii) Perform tests and inspection of wiring systems in hazardous areas

Suggested Teaching/Learning Resources
- Flame proof equipment
- Intrinsically safe equipment
- Testing equipment (multimedia & megger)
- Electrical tool kit.

Suggested teaching/Learning Activities
- Discussion
- Illustration
- Demonstration
- Note taking
- Practical exercise

Suggested Evaluation Methods
- Oral tests
- Timed written tests
- Assignments
- Timed practical tests

25.2.4 ILLUMINATION

Theory

25.2.4T0 *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to:
a) state the laws of lightning
b) define terms used in illumination
c) calculate for light requirements for a given area

d) discuss various types of electric luminaires as sources of light
e) apply the relevant IEE regulations in lighting design work

Content

25.2.4T1 Laws of lightning
Inverse square law
i) The cuisine law

25.2.4T2 Definition of terms used in illumination
i) Luminous intensity
ii) Luminance
iii) Illumination
iv) Lumen
v) Lux
vi) Candela
vii) BZ classification
viii) Colour rendering
ix) Flicker
x) General lightning
xi) Local lightning
xii) Localized lightning
xiii) General diffuse
xiv)Glare
xv) Maintenance factor
xvi)Utilization factor
xvii) Reflection factor

25.2.4T3 Electric luminaires
Incandescent filament lamps
i) Carbon filament lamps
ii) Tungsten filament lamps
iii) Gas filled tungsten filament lamps
iv) Coiled – coil filament lamps
v) Arc lamps
vi) Discharge lamps
vii) Sodium – vapour lamp
viii) Low – pressure mercury – vapour lamp
ix) Neon tubes

25.2.4T4 Calculations for illumination

Practice

25.2.4P0 *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to:
a) apply relevant regulations in the installation, repair and maintenance of electric luminaires
b) design lightning schemes

Content
Repair and maintenance of electric luminaires
Design of lightning schemes
i) Light control
ii) Calculation of illumination by the lumen method

Suggested teaching/Learning Resources
- Electrical measuring instruments
- Electrical tool kit
- Ac power supply
- Drawing instruments and materials
- Assorted cables and other electrical materials
- Assorted electric luminaires

Suggested teaching/Learning Activities
- Discussion

- Illustration
- Demonstration
- Note taking
- Practical exercise

Suggested Evaluation Methods
- Oral tests
- Timed written tests
- Assignments
- Timed practical tests
- Project
- Project Report writing and presentation

25.2.5 BUILDING SERVICES

Theory

25.2.5T0 *Specific Objectives*
By the end of the sub-unit, the trainee should be able to:
a) describe different types of building structures
b) explain electrical services in building
c) explain utility services in buildings

Content

25.2.5T1 Description of types of building structures
i) Substructures
ii) Super structures
iii) Walls and roofs
iv) Windows and doors
v) Floors and ceilings
vi) Stairs and staircases
vii) Finish and decoration

25.2.5T2 Explanation of electrical services in buildings
i) Ducts and channels
ii) Trunkings and conducts
iii) Chases and manholes

25.2.5T3 Explanation of utility services in buildings
i) Water system
ii) Water supply
iii) Water distribution
iv) Water treatment
v) Sanitation
vi) Discharge
vii) Sanitary appliances
viii) Trays and water seats
ix) Layout
x) Drainage system

Practice

25.2.5P0 *Specific Objectives*
By the end of the sub-unit, the trainee should be able to:
a) install electrical services in building
b) carry out maintenance work for the electrical services in buildings

Content

25.2.5P1 Installation of electrical services in buildings
i) Erection of trunking and conduit works
ii) Construction of ducts and channels system
iii) Installation and wiring of water heater systems and control

25.2.5P2 Carry out maintenance work for electrical services in building
i) Trunking and conduit
ii) Water heaters and control

25.2.5C Competence

The trainee should have the ability to:

i) Carry out installation of electrical services in buildings
ii) Carry out maintenance work for electrical services in buildings

Teaching/Learning Resources

i) Building services
ii) Electrical tools and instruments

25.2.6 INSTALLATION PLANNING AND DESIGN

Theory

25.2.6T0 *Specific Objectives*

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

a) explain factors considered when selecting a wiring system for a given installation
b) determine final sub circuits for a given installation
c) determine the ratings of cables, control and protective devices
d) design layout of all power points on architectural drawings of a given installation
e) draw distribution program for a given three phase installation
f) determine the layout for the wiring system used in an installation
g) apply relevant regulations and codes of practice in carrying out a given design installation.

Content

25.2.6T1 Factors determining choice of wiring systems

25.2.6T2 Determining final sub-circuits

i) Lighting sub-circuits
ii) Circuits for socket-outlets
iii) Circuits for fluorescent and discharge lamps
iv) Circuits for machinery motors
v) Grouping sub-circuits in contribution boards
vi) Balancing of single phase sub-circuits on three-phase supplies

25.2.6T3 Rating of cables and devices

i) Determination of cable sizes for final sub-circuits
ii) Calculation of cable sizes for mains and sub-mains
iii) Application of rating factors
iv) Application of diversity factors
v) Calculation of voltage drops on cables
vi) Determination of ratings of control and protective devices

25.2.6T4 Layout lighting and power points

i) Lighting points
ii) Socket outlets
iii) Switching arrangements for lamps

iv) Switching arrangements for machines
v) Distribution boards
vi) Labeling of circuits and loads

25.2.6T5 Distribution diagram
i) Intake point equipment
ii) Connection of distribution boards
iii) Labeling
iv) 25.2.6T6 Wiring System Layout
v) Cable runs
vi) Conduit runs
vii) Trunking/duct runs
viii) Number of cables in conduit/trunking/duct
ix) (Apply space factor)

25.2.6T7 Apply relevant regulations and codes of practice

Practice

25.2.6P0 *Specific Objectives*
By the end of this sub-module unit, the trainee should be able to:
a) design electrical installation for given architectural drawings and specification
b) estimate quantities of materials required for electrical works from the design

Content

25.2.6P1 Design electrical installation for a given architectural design and specifications

25.2.6P2 Estimate quantities of materials required for electrical works from the design

25.2.6C Competence
The trainee should have the ability to:
- Carry out electrical installation design for a given architectural design and specifications
- Estimate quantities of materials required for electrical works from the design

Suggested teaching/Learning Activities
- Discussion
- Illustration
- Demonstration
- Note taking
- Practical exercise
- Calculations
- Project work

Suggested Teaching and Learning Resources
- Architectural designs and specifications
- Take off sheets
- Drafting pens various sizes
- Tracing papers
- Electrical symbol templates
- Letter and number templates various sizes
- Lighting catalogues with photometric data
- Equipment catalogues
- IEE regulations book
- Interior lighting design code

Suggested Evaluation Methods

- Oral tests
- Timed written tests
- Assignments
- Timed practical tests
- Project
- Project Report writing and presentation