



**Institut Latihan
Lembaga Letrik Negara**

**KURIKULUM
KURSUS UNTUK
JURUTEKNIK**



Institut Latihan Lembaga Letrik Negara

KURSUS-KURSUS UNTUK JURUTEKNIK

<u>KOD</u>	<u>NAMA KURSUS</u>
5511, 5512	Talian Atas & Kabel Bawah Tanah
5511X	Teknologi AMKA-T
5513	Binaan dan Senggaraan Pencawang 11 kV
5514	Perlindungan
5531	Kendalian Pencawang 11 kV

KURIKULUM
JURUTEKNIK PEMBAHAGIAN
TALIAN ATAS & KABEL
5511,5512

OBJECTIVES

COURSE GOALS

Upon completing the course, the participant must be able to:

- have a sound working knowledge of the technical aspects of L.V. overhead lines including services, cable construction, joints and terminations in general use by the NEB.
- have experience of the present methods of carrying out work on overhead lines and underground cables sufficient for appraisal and supervision of the work of NEB teams and cable laying contractors.
- plan and organise the works normally carried out by the L.V. overhead section or the cable section.
- carry out estimates for overhead lines and underground cable projects.

COURSE ELIGIBILITY

- *New intake of Technicians from polytechnics or technicians having one year experience or less on L.V. overhead or underground cable distribution.*

COURSE DURATION

- *Four weeks*

CURRICULUM
TECHNICIANS DISTRIBUTION
OVERHEAD LINES & UNDERGROUND CABLES

5511
5512

4 Weeks

1. L.V. OVERHEAD LINES INCLUDING SERVICES

- Overhead Line Specification

- . Poles
- . Conductors
- . Stays
- . 5 foot way mains
- . Accessories

- Overhead Line Construction Procedure

- . Pegging
- . Transport
- . Pole dressing
- . Excavation and pole erection
- . Stays
- . Conductor erection
- . 5 foot way mains
- . Accessories

- Safety Rules and Regulations

- Estimating for L.V. Overhead Line Projects
 - . Materials
 - . Transport
 - . Salaries
 - . Contract work

2. UNDERGROUND CABLES

- Cable Construction and Design
 - . L.V./M.V. cable
 - . PVC insulated cables
 - . 4-core paper insulated L.V./M.V. belted cables
 - . Multicore paper insulated belted cables
 - . 11 kV paper insulated belted cables
 - . Screened cables
 - . Oil-filled cables

- Cable Joints and Terminations
 - . Definition and use
 - . 11 kV joints and terminations
 - . L.V./M.V. joints and terminations
 - . Methods of jointing and terminations

- Cable Jointing
 - . Tools, materials and equipment

- Cable Laying
 - . Contractors
 - . Preparation
 - . Removal of top surface
 - . Trench excavation
 - . Laying cables in ducts
 - . Bedding for cables
 - . Pulling in cables
 - . Laying OFF and positioning cable in trench
 - . Protection of cable ends
 - . Sand covering and bricks
 - . Reinstatement
 - . Security at site
 - . Cable records

- Cable Testing
 - . Instruments
 - . Tests

- Cable Estimates

3. SAFETY RULES AND REGULATIONS

- Authorisation and Competency
- Isolation of L.V./M.V. Cables
- Earthing and Discharging
- Cable Spiking
- Permit to Work

4. ARTIFICIAL RESPIRATION & FIRST AID

5. TECHNICIANS' ROLE

KURIKULUM
JURUTEKNIK, PEMBANTU TEKNIK
TEKNOLOGI AMKA-T
6611x , 5511 x

OBJECTIVES

COURSE GOALS

Upon completing the course, the participant must be able to:

- *plan, estimate and supervise the construction and maintenance of AMKA-T and SAXKA cables.*

COURSE ELIGIBILITY

- *Technicians and Technical Assistants (in Distribution and BELB) who have not been exposed to the new technology AMKA-T and SAXKA cables.*

COURSE DURATION

- *One week*

CURRICULUM
TECHNICIANS AND TECHNICAL ASSISTANTS DISTRIBUTION
(AMKA-T & SAXKA CABLES)

5511X
6611X

1 Week

1. AMKA-T

- Cables
- Electrical Properties of AMKA-T
- Accessories
- Tools and Equipment
- Construction of Lines
- Clearances and Crossings
- Stays and Struts
- Connection of AMKA-T to Existing System and Accessories
- Overload and Short Circuit Protection

- **Planning and Estimating**

- **Maintenance**

2. SAXKA CABLES

- **Cables**

- **Accessories**

- **Tools and Equipment**

- **Installation**

- **Joints and Terminations**

KURIKULUM
JURUTEKNIK PEMBAHAGIAN
BINAAN & SENGGARAAN PENCAWANG 11KV
5513

OBJECTIVES

COURSE GOALS

Upon completing this course, the participant must be able to:-

- differentiate the application of various tools, instruments and other equipment used in the construction and maintenance of 11 kV substation.
- do preparatory work for a construction gang.
- determine that the substation is capable of taking the supply, according to NEB regulations.
- overhaul the switchgears and maintain associated ancillaries of the substation.
- maintain relevant records.

COURSE ELIGIBILITY

- *Technicians (Distribution) who are involved in the construction and maintenance of 11 kV substations.*

COURSE DURATION

- *Two weeks*

CURRICULUM
TECHNICIANS DISTRIBUTIONS
(CONSTRUCTION & MAINTENANCE OF 11 KV SUBSTATION)

5513

2 Weeks

94 Periods

1. TOOLS AND EQUIPMENT

2. SUBSTATION INSTRUMENTS

- AVO
- Ampere tong/phase rotation meter and voltage indicator
- Megger/earth megger
- Voltage/current recorder
- Phasing stick
- Pressure testing set

3. SUBSTATION LAYOUTS (ENGINEERING STANDARD)

- Indoor
- Outdoor
- Pole-mounted

4. HANDLING PRINCIPLE

- Preparation of material
- Selection and pegging of site
- Tendering of job
- Costing and charges

5. SUBSTATION CONSTRUCTION (WORKING PRINCIPLE OF COMPONENT)

- Earthing system
- Transformer
- L.V. Board/Feeder Pillar
- OLU/HFU
- BVP
- SO-HI
- VSI

6. PRECOMMISSIONING TEST PROCEDURE

7. PROTECTION FOR 11 KV SUBSTATION (WORKING PRINCIPLE AND CONNECTION)

- Fuses
- C.T.
- O/C and E/F relay
- Translay
- Solkor R

8. SAFETY RULES AND REGULATIONS

- Routine maintenance
- Repair transformer leak
- Overhaul O.C.B.

9. ESTIMATING PROJECT FOR SUBSTATION

- New project for 11 kV system inclusive of H.T. mains and L.V. mains
- Increasing capacity of S/S.

KURIKULUM
JURUTEKNIK
PERLINDUNGAN
5514

OBJECTIVES

COURSE GOALS

To provide the participants with:

- a sound knowledge of the working principles of the various protection schemes in the NEB electrical supply systems.

- the training in the following:-
 - . Checking the protection system

 - . Use of testing equipment

 - . Commission and routine test procedure

COURSE ELIGIBILITY

- Newly appointed Protection Technicians fresh from technical institution.
- Technicians who have been promoted from JTAs in the protection departments.

COURSE STRUCTURE

- The course duration totals eight weeks.

Since the participants may not be available for a long stretch of time, the course is programmed over two modules of four weeks each.

First Module	196 Periods
Second Module	196 Periods

FIRST MODULE

CURRICULUM
TECHNICIANS (PROTECTION)

5514

4 Weeks

First Module

196 Periods

PERIODS

- | | | |
|----|---|----|
| 1. | <u>NEB ELECTRICAL SYSTEMS AND LOCATION FOR PROTECTION</u> | 6 |
| - | 11 kV S/S and equipment | |
| - | 33 kV S/S and equipment | |
| - | 66 kV S/S and equipment | |
| - | 132 kV S/S and equipment | |
| - | 275 kV S/S and equipment | |
| - | Transmission system layout including generation sources | |
| 2. | <u>NEB CONTROL SYSTEMS</u> | 3 |
| - | Central control | |
| - | District control | |
| 3. | <u>WORKING PRINCIPLES</u> | 21 |
| - | Fuses | |
| - | Switchgears | |
| - | Power transformer including tap-changer | |
| - | Current transformers | |

PERIODS

- Voltage transformers
- S/S auxiliary supplies

4. INTRODUCTION TO PROTECTION SYSTEM 7

- Common symbols
- Schematic diagram
- Wiring diagram including multi-core schedule
- Standard connections of CTs, VTs, etc.
- Tripping circuits
- Systems & S/S earthing and arc suppression coil

5. I.D.M.T. O/C AND E/F RELAYS 29

- Typical application
- Working principles of relays
- Examples of applications
- Testing equipment
- Installation and testing

6. FEEDER UNIT PROTECTION 36

- Typical application
- Working principles of relays

PERIODS

- Examples of applications
 - Testing equipment
 - Installation and testing
7. DISTRIBUTION FEEDER AUTO-RECLOSING 15
- Typical application
 - Working principles of relays and their use in typical scheme
 - Examples of applications
 - Testing equipment
 - Installation and testing
8. DIRECTIONAL PROTECTION 42
- Typical application
 - Working principles of relays
 - Examples of applications
 - Testing equipment (ASEA & ZENITH test sets)
 - Installation and testing

SECOND MODULE

CURRICULUM
TECHNICIANS (PROTECTION)

5514
Second Module

4 Weeks
196 Periods

PERIODS

- | | | |
|----|--|----|
| 1. | <u>BUSBAR - PROTECTION</u> | 27 |
| | - Typical application | |
| | - Working principles of relays | |
| | - Examples of applications | |
| | - Testing equipment | |
| | - Installation and testing | |
| 2. | <u>GENERATOR & GENERATOR-TRANSFORMER PROTECTIONS</u> | 51 |
| | - Typical application | |
| | - Working principles of relays | |
| | - Examples of applications | |
| | - Testing equipment | |
| | - Installation and testing | |
| 3. | <u>DISTANCE PROTECTION</u> | 49 |
| | - Typical application | |
| | - Working principles of relays | |

PERIODS

- Examples of applications
- Testing equipment
- Installation and testing

4. MESH CORNER AUTOMATIC SWITCHING FOR TRANSMISSION AUTO-RECLOSING CIRCUIT 39

- Typical application
- Working principles of relays
- Examples of application
- Testing equipment
- Installation and testing

5. SETTING UP PROTECTION SCHEME 30

Project will be designed by the training officer as seen appropriate for the course.

KURIKULUM
JURUTEKNIK PEMBAHAGIAN
KENDALIAN PENCAWANG 11KV
5531

OBJECTIVES

COURSE GOALS

Upon completing this course, the participant must be able to:-

- adopt the recommended methods of operating the switchgears and associated ancillaries.
- be conversant with the safety regulations and procedures.
- follow shutdown procedure and ascertain that the installation can be commissioned.
- locate cable faults.
- do artificial respiration and first aid.

COURSE ELIGIBILITY

- *Technicians (Distribution - operation) including Senior Technicians who have not been given the authorisation certificate yet.*

DURATION

- *Two weeks*

CURRICULUM
TECHNICIANS DISTRIBUTIONS (OPERATION)

5531

2 Weeks

94 Periods

1. SWITCHGEAR OPERATION

- OLU/HFU
- VSI
- BVP
- SO-HI

2. CERTIFICATION SYSTEM

- Officer in control
- Authorised person
- Competent person
- Officer-in-charge
- Permit to work
- Authorisation
- Sanction

3. SAFETY REGULATIONS

- Safety regulations for working on H.V. system and L.V. system
- Working safety

4. H.V. AND L.V. SYSTEM OPERATIONAL PROCEDURES

- Shutdown of supply for H.V. system
- Shutdown of supply for L.V. system

5. RELAY FOR 11 KV DISTRIBUTION SYSTEM

- Translay
- O/C and E/F
- Solkor
- Directional O/C
- R.E.F.
- Standby E/F

6. DIAGNOSIS OF FAULT FOR DISTRIBUTION

- Fault on underground cable
- Fault on transformer
- Fault on O/H lines

7. CABLE FAULT LOCATION

- Analysis of fault
- Megger insulation tester
- Cambridge fault localiser
- Capacitance bridge
- Bridge megger
- Cable locator

8. PRECOMMISSIONING TEST FOR 11 KV S/S

- Procedure for precommission test
- Phasing
- Pressure testing

9. TAP CHANGER OPERATION

- Principles
- Operation

10. FIRST AID AND ARTIFICIAL RESPIRATION

- Mouth to mouth
- Holger Neilson
- Syvester
- Cardiac massage
- First aid