

**1. Module details****Module name****Cables and Cabling (Optical Fibre)****Module duration**

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 18 – 20 hours.

**Module code**

NUE315

**Discipline code**

0703

**2. Module purpose**

To develop skills and knowledge in the installation and termination of optical fibre cables. The module will also assist participants to gain an understanding of safe work practices pertaining to the handling of optical fibre cables. Students will install, prepare for termination and terminate a range of optical fibre cables using techniques such as mechanical splicing, fusion splicing and direct termination.

**3. Prerequisites**

Nil.

**4. Relationship to competency standards**

This module provides some of the knowledge skills underpinning competence in the following: Electrical Contracting Industry Award Standards; Electrical Stream Units 5.9; Electronic Stream Units 5.3; E.S.I. Linework and Cable Jointing Competency Standards 2.11, 3.5 and 3.7.

**5. Content****Optical fibre cable construction**

Basic cable structures

Advantages of each type of cable for various applications

Strength of members used

Indoor and outdoor cables

**Installation procedures**

Types of installations

Cable hauling

Minimum bend radius

Optical fibre cable enclosures

Laying optical fibre into organiser trays

Connector pig-tails or direct termination

**Optical fibre safety**

Safe handling of glass

Use of cleaning agent

Hazards to the eye

**Mechanical splicing**

Removing cable jacket - stripping fibre coating - cleaning of fibre - cleaving fibre/acceptable ends

Index matching fluid  
Fitting mechanical splice  
Testing splice

**Fusion splicing**

Removing cable jacket; stripping fibre coating; cleaning of fibre; cleaving fibre/acceptable ends  
Aligning fibres in splicer  
Fitting splice protectors  
Testing splice

**Fitting connectors**

Connector types  
Cable preparation  
Epoxy preparation  
Connector cable assembly  
Polishing  
Inspection and testing

**Splice and connector testing**

Equalized mode distribution  
Basic loss measurement  
Use of power meter with reference facility  
Use of optical time domain reflectometer

**6. Assessment strategy**

**Assessment methods**

Ideally assessment of this module will be holistic in nature requiring the demonstration of knowledge and skills identified in the module content, and the integration of the knowledge with those skills. To be successful in this module, the student must show evidence of achievement of the module purpose. This is more than the independent achievement of individual learning outcomes.

Written tests: Learners will provide answers to a variety of questions.

Practical exercises: Learners perform skills and apply knowledge to complete various practical exercises.

Simulation: Learners participate in a structured exercise involving the successful completion of a specific task simulating ‘real-workplace’ situations.

Problem solving: Learners response to a number of questions relating to a diagrams, text, a plans and the like.

**Conditions of assessment**

Normally learning and assessment will take place in a classroom/simulated environment.  
 Assessment of practical skills should occur shortly after the completion of the relevant learning activity.  
 Learners must be assessed by an appropriately qualified teacher or trainer / assessor who hold a current General Premises Cabling (GPC) or Based General Premises License (BCL) license with endorsements relevant to the module as issued by AUSTEL. NFROT principles apply.

**7. Learning outcome details**

**Learning outcome 1**

**Describe the construction and identify uses of common optical fibre communication cables.**

**Assessment criteria**

- 1.1 Describe the construction of slotted core, loose tube and cord fibre cables.
- 1.2 List the advantages and applications of each cable type.
- 1.3 List common types of cable strength member used in optical fibre cables.
- 1.4 State the reasons for using strength members in optical fibre cables.

**Learning outcome 2**

**Explain the hazards of optical fibre systems and demonstrate safe working practices.**

**Assessment criteria**

- 2.1 Explain the safety requirements for handling optical fibre cables.
- 2.2 Explain the qualities of a work environment suitable for terminating optical fibre cables.
- 2.3 Apply safety procedures when terminating and jointing optical fibre cables.

**Learning outcome 3**

**Outline the installation procedures identified in AS 3080 for optical fibre cables in customer premises and install cables accordingly.**

**Assessment criteria**

- 3.1 State the installation situations optical fibre cables are suitable for.
- 3.2 List the types of cables suitable for each installation situation.
- 3.3 Outline the requirements for hauling optical fibre cable and determine hauling tension for a given cable under static and dynamic conditions in accordance with the manufacturer's recommendations.
- 3.4 Determine minimum bend radius for various optical fibre cables.
- 3.5 Outline the reasons for using termination enclosures and describe typical locations for these enclosures.
- 3.6 List the types of optical fibre cable suited to direct termination and those requiring connectorised pig-tails.
- 3.7 Install optical fibre cables in accordance with relevant standards and manufacturers' specifications.

**Learning outcome 4**

**Prepare and joint optical fibres using mechanical and fusion splicing.**

**Assessment criteria**

- 4.1 Apply appropriate break-out and securing techniques for termination of various indoor and outdoor cables.
- 4.2 Prepare fibres and cleave ends within acceptable tolerable limits.
- 4.3 Splice fibres in a typical multi-mode mechanical splice in accordance with the manufacturer's specification.
- 4.4 Splice fibres in fusion splicer in accordance with the recommended operating procedure for that splicer.
- 4.5 Test splice loss is within the limits recommended by the manufacturer.
- 4.6 Complete the splice by fitting appropriate protective sleeve.

**Learning outcome 5**

**Prepare and terminate optical fibre cable using optical connectors in accordance with AS 3080 and manufacturers' recommendations.**

**Assessment criteria**

- 5.1 Apply appropriate break-out and securing techniques for termination of various indoor and outdoor cables.
- 5.2 Prepare optical fibre cable end to suit chosen ST or SC connector in accordance with the manufacturer's strip dimensions.
- 5.3 Terminate the cable within the connector in accordance with the manufacturer's instructions.
- 5.4 For glued connectors, cure the epoxy following manufacturer's recommended procedure.
- 5.5 Cleave the fibre and polish the end in two stages to obtain a good surface finish free of imperfections across the core of the fibre.
- 5.6 Test the connector loss is within manufacturer's specification, typically 0.3 dB for a hand polish.

**Learning outcome 6**

**Test an optical fibre installation for compliance with AS 3080 using appropriate test equipment in accordance with manufacturers' recommendations.**

**Assessment criteria**

- 6.1 Define the term equilibrium mode distribution (EMD).
- 6.2 Outline methods of achieving EMD for loss measurements in multi-mode optical fibre cables.
- 6.3 Connect and adjust an optical light source and power meter for loss testing of splices and connectors.
- 6.4 Connect and adjust an optical time domain reflectometer (OTDR) for loss testing of splices and connectors.
- 6.5 Determine whether a tested optical fibre cable conforms with the requirements of AS 3080.
- 6.6 Connect and adjust an OTDR for fault location in an optical fibre cable.
- 6.7 Locate a fault (such as a break) in an optical fibre cable using an OTDR.

## 8. Delivery of the module

### Delivery strategy

Delivery strategies must be suitable for both theoretical and/or practical learning and module purpose. The recommendation is learning and assessment be facilitated holistically. This may require a learning outcome sequence other than that indicated in the body of this module. A further recommendation is for adopting an integrated theory/practice approach. This allows students to learn by experimentation and through research and laboratory reports.

### Resource requirements

Optical light source and power meter  
Fusion splicer  
Microscope  
Optical Time Domain Reflectometer (OTDR)

#### Consumables

Cable jacket strippers (various)  
Buffer stripper to suit 900  $\mu\text{m}$  and 250  $\mu\text{m}$  fibre  
Scissors to cut Kevlar  
ST or SC connectors  
Fibre cleaver to suit chosen connector  
Crimper to suit chosen connector  
Glue to suit chosen connector  
Lapping film to suit chosen connector  
Mechanical splice  
(e.g., 3M Dorrans, Siemen finger splice)  
Fibre cleaver to suit splicing  
Splice protectors for fusion splices  
Fibre organiser trays  
Fibre cable fan-out  
Optical fibre break-out box  
Underground enclosure box  
Various optical fibre cables for terminating  
Ethanol (70% to 100%)  
Protective equipment, safety glasses

#### Useful references include

Sterling, Donald J., *Technician's Guide to Fibre Optics*, 2nd Edition Delmar Publishing, Australian Distribution - Thomas Nelson Pty Ltd, ISBN 0-8273-6133-5

Palais Joseph C., *Fibre Optical Communications*, Prentice Hall, ISBN - 0-13-314585-9

**Occupational health  
and safety requirements**

Applications catalogues from manufactures such as Australian  
AMP - Netconnect and Mod Tap

AUSTEL, *Customer Premises Cabling Manual*, Standards  
Australia

A safe and healthy environment will be provided for students in  
regards to classroom and laboratory safety.