-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

Hanover House
24 Douglas Street
GLASGOW G2 7NQ

NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **4110060** **-Session- 1990-91**
-Superclass- **XJ**

-Title- **MATERIALS & JOINTING METHODS (ELECTRICAL) ($x^1/_2$)**

-DESCRIPTION-

Purpose

This module is designed to introduce a student to a range of materials commonly used in electrical installation work and to develop the skills involved in the termination and jointing of these materials.

It is intended that this module is taught in conjunction with other related modules and forms part of a course of study which should include complementary industrial experience. It is aimed at those following a career in electrical installation work.

It may also be of interest to those associated with electrical assembly techniques.

Preferred Entry Level

Standard Grade Science at Grade 5 or better.

Outcomes

The student should:

1. select the appropriate materials for use as electrical conductors and insulators for a range of applications;

2. terminate flexible, non-flexible and armoured cables into items of electrical equipment;

3. demonstrate methods of securing a range of materials.

Assessment Procedures

Acceptable performance in the module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:

PC Performance Criteria
IA Instrument of Assessment

Note: The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

Students should have access to the current edition of the IEE Wiring Regulations when carrying out the assessment of the Outcomes.

OUTCOME 1 **SELECT THE APPROPRIATE MATERIALS FOR USE AS ELECTRICAL CONDUCTORS AND INSULATORS FOR A RANGE OF APPLICATIONS**

PCs

(a) The identification of the materials is correct in terms of use as a recognised conductor or insulator.
(b) The selected material is the most appropriate for the given task in terms of its properties.
(c) The selected material is the most appropriate for the given task in terms of its applications.

IA Matching Exercise

The student will be presented with a matching exercise to test the recall of knowledge required to select the appropriate materials for use as electrical conductors and insulators for a range of applications.

The matching exercise will comprise 10 materials which could take the form of a list, samples or any other suitable medium. The exercise will be based on the Performance Criteria and structured as follows:

(a) identification of material as insulator or conductor;
(b) properties of each material;
(c) application/use of each material.

Satisfactory achievement of the Outcome will be based on all Performance Criteria being met. This will be demonstrated by the student producing 10 correct responses to (a) and 7 correct responses to each of (b) and (c).

OUTCOME 2 **TERMINATE FLEXIBLE, NON-FLEXIBLE AND ARMOURED CABLES INTO ITEMS OF ELECTRICAL EQUIPMENT**

PCs (a) The termination of the cable is in accordance with the current IEE Wiring Regulations for:

(i) flexible cable;
(ii) non-flexible cable;
(iii) armoured cable.

(b) Working practices followed are safe.
(c) The tools used are appropriate to the task.

IA Practical Exercise

The student will be set an exercise consisting of a series of practical tasks to test the application of knowledge and skills required to terminate flexible, non-flexible and armoured cables into items of electrical equipment.

The exercise will consist of 6 tasks allocated as follows:

(i) termination of 2 flexible cables;
(ii) termination of 3 non-flexible cables;
(iii) termination of 1 armoured cable.

The exercise must incorporate use of all of the following techniques:

pinch screw;
screw/nut and washer;
crimping/compressing;
soldering;
mechanical clamps.

Satisfactory achievement of the Learning Outcome will be demonstrated by the student meeting all the Performance Criteria for each task.

OUTCOME 3 **DEMONSTRATE METHODS OF SECURING A RANGE OF MATERIALS**

PCs (a) Working practices followed are safe.
(b) The methods used for securing the material is appropriate to the type of materials and nature of the task in terms of fastening or joining.
(c) The tools used for securing the material are appropriate to the task.
(d) The joint is mechanically and where appropriate electrically sound.

IA Practical Exercise

The student will be set an exercise consisting of a series of practical tasks to test the application of knowledge and skills required to secure a range of electrical materials.

The exercise will consist of 4 tasks allocated as follows:

(i) the joining of materials equal to or less than 2mm using self-tapping screws;
(ii) the joining of materials equal to or less than 2mm using pop rivets;
(iii) the joining of materials greater than 4mm using nuts and bolts;
(iv) the joining of materials greater than 4mm using tapped holes and bolts.

The student should be provided with suitable materials for each of the tasks.

Satisfactory achievement of the Outcome will be demonstrated by the student meeting all the Performance Criteria for each task.

The following sections of the descriptor are offered as guidance.
They are not mandatory.

CONTENT/CONTEXT

Safety regulations and safe working practices and procedures should be observed at all times.

Corresponding to Outcomes 1-3:

1. Definition of conductor and insulator.

   Consideration of the properties of conductors and insulators in relation to their resistivity, cost, availability, temperature change, tensile strength, ageing, malleability, toughness or hardness and rigidity or flexibility.

   Type of conductors to include copper, aluminium, steel, brass, carbon lead phospher-bronze, silver and gold.

   Types of insulators to include PVC, rubber, mica, wood, paper, porcelain, plastics, glass and asbestos.

   Selection of suitable conductors and insulators in terms of their properties and applications.

2. Appreciation of the function of the 3 main parts of a cable: conductor, insulation, physical protection (sheath).

   Need for sound electrical and mechanical connections and the resulting problems if not correctly carried out. Need to avoid damage to the conductor and insulation during the stripping and terminating of cables.

   Tools and techniques used for stripping and terminating: PVC insulated single core, solid conductor and stranded conductor cables; PVC and rubber insulated flexible cables; armoured type cables.

   Common methods of conductor terminations:
   pinch screw, screw/nut and washer, crimping, soldering, mechanical clamps.

   Use of cable glands and clamps to secure outer sheath or armour of cables.

   Need to preserve earth continuity when terminating metal armoured/sheathed type cables.

   Corrosion problems involved in the termination of aluminium conductors.

   IEE Wiring Regulations 527-1 to 527-3, 527-8, 523-10, 523-18.

3. Procedures for fastening sheet material by nut and bolt: assisting fastening by plain washer, spring, serrated and tab washers. Use of locking nut techniques: double nuts, castellated nuts, captive/self-locking nuts. Matching bolt-types, materials and nut types to task. Thread types: metric, BA; Whitworth etc.

   Procedures for fastening suitably thick material by means of threaded holes and bolt/machine screws.

   Procedures for fastening thin sheet metal by means of self-tapping screws and pop-rivets.

   Appreciation of using adhesives for fastening.

   Procedures for securing sheet metal by soft-solder, appreciation of securing metal by welding and brazing.

SUGGESTED LEARNING AND TEACHING APPROACHES

This module involves both classroom and workshop activities. The safety element must be stressed and assessed continuously.
Teaching will, in the first instance, be instructional but reinforced by workshop practice.

The suggested approaches may also include:

discussion	Outcomes 1-3
films	Outcomes 1-3
questionnaires	Outcomes 1
practical work	Outcomes 2,3
manufacturers' catalogues.	Outcomes 1-3
