-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

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NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **2160020** **-Session-1990-91**
-Superclass- **XJ**

-Title- **CIRCUIT ELEMENTS ($X^1/_2$)**

-DESCRIPTION-

Purpose

This module is designed to introduce the student to the knowledge required for an understanding of the three basic elements in an electric circuit ie. resistance, inductance and capacitance.

The module is written for electrical craft and technician students but can also be used by craft and technician students from other technology related backgrounds.

Preferred Entry Level

2160010 Electrical Fundamentals.
81052 Mathematics: Grade 2 (x2) or Standard Grade Mathematics.

Outcomes

The student should:

1. apply the factors which determine the resistance of a conductor;

2. apply the principles relating to self-inductance in an electric circuit;

3. apply the principles relating to mutual inductance in an electric circuit;

4. apply the principles relating to capacitance in an electric circuit.

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.)

OUTCOME 1 **APPLY THE FACTORS WHICH DETERMINE THE RESISTANCE OF A CONDUCTOR**

PCs

(a) The statement of Resistance as the ability of a circuit to oppose current flow is correct.
(b) The statement of the relationship between resistance, length, area and material constant r is correct.
(c) The calculation of values of R for a given material by proportion only using the expression R a l/A.
(d) The identification of the effect of temperature change on conductor resistance is correct.

IA Short Answer Questions

The student will be presented with questions to test understanding of factors and ability to apply these in determining the resistance of a conductor.

The test will consist of 7 short answer questions to be allocated as follows:

(a)	statement of Resistance	1 question
(b)	statement of relationship between R, l, A and r	1 question
(c)	calculation of resistance by proportion only using R a l/A	3 questions
(d)	statement of relationship between temperature change and resistance	2 questions

Satisfactory achievement of the Outcome is based on the student producing 5 correct responses including one for parts (a), (b) and (d) and two for part (c). An incorrect response should be considered as one which shows a lack of understanding and is not caused by a trivial arithmetic error.

OUTCOME 2 **APPLY THE PRINCIPLES RELATING TO SELF-INDUCTANCE IN AN ELECTRIC CIRCUIT**

PCs

(a) The statement of self-inductance as the ability of a circuit to induce an emf in itself is correct.
(b) The statement of the relationship between inductance, number of turns, magnetic length, area and material constant m is correct.
(c) The calculations of values of L by proportion only using the expression L a N^2A/l is correct.
(d) The application of the expression e = L x change of current/time is correct.

IA Short Answer Questions

The student will be presented with questions to test understanding of principles relating to
self-inductance in a circuit and ability to apply these to a given problem.

The test will consist of 7 short answer questions to be allocated as follows:

(a)	statement of inductance	1 question
(b)	statement of relationship between L, N, A, l and μ.	1 question
(c)	calculation of inductance by proportion using L a N^2A/l	3 questions
(d)	application of expression e = L x change of current/time	2 questions

Satisfactory achievement of the Outcome is based on the student producing 5 correct responses including one for parts (a), (b), and (d) and two for part (c). An incorrect response should be considered as one which shows a lack of understanding and is not caused by trivial arithmetic error.

OUTCOME 3 **APPLY THE PRINCIPLES RELATING TO MUTUAL INDUCTANCE IN AN ELECTRIC CIRCUIT**

PCs

(a) The statement of mutual inductance as the ability of one circuit to induce an emf in another is correct.
(b) The application of the expression e = M x change of current/time is correct.

IA Short Answer Questions

The student will be presented with questions to test understanding of principles relating to mutual inductance in electric circuits and ability to apply these to a given problem.

The test will consist of 3 short answer questions to be allocated as follows:

(a)	statement of mutual inductance	1 question
(b)	application of the expression e = M x change current/time	2 questions

Satisfactory achievement of the Outcome is based on the student producing 2 correct responses, including one for parts (a) and (b). An incorrect response should be considered as one which shows a lack of understanding and is not caused by trivial arithmetic error.

OUTCOME 4 APPLY THE PRINCIPLES RELATING TO CAPACITANCE IN AN ELECTRICAL CIRCUIT

PCs

(a) The statement of Capacitance as the ability of a device to store charge is correct.
(b) The statement of the relationship between Capacitance, plate area, distance between plates and material constant e is correct.
(c) The calculation of C by proportion only using C a A/d.
(d) The application of the expressions Q = It and Q = CV is correct.

IA Short Answer questions

The student will be presented with questions to test understanding of principles relating to capacitance in an electrical circuit and ability to apply these to a given problem.

The test will consist of 7 short answer questions to be allocated as follows:

(a)	statement of capacitance	1 question
(b)	statement of relationship between C, A, d and e	1 question
(c)	calculation of capacitance by by proportion using C a A/d	3 questions
(d)	application of expressions Q = It and Q = CV	2 questions

Satisfactory achievement of the Outcome is based on the student producing one correct response for (a) and (b) and two correct responses for (c) and (d). An incorrect response is one which shows a lack of understanding and is not caused by trivial arithmetic error.

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

CONTENT/CONTEXT

Appropriate units, symbols and unit-symbols should be used throughout.

Corresponding to Outcomes 1-4

1. Conductor resistance: The concept of conductor resistance and its dependence on material constant p(rho), conductor length and cross-sectional area.

   Statement of Resistance R = rl /A. Calculations using the expression RL a l/A. The effect of temperature change on conductor resistance (no formula required).

2. Self-inductance: meaning of self-inductance. Dependence on physical factors eg., for a torrid, the expression $L = N^2$ AU/l should be used to illustrate that the self-inductance depends on the core material constant u(mu), the coil turns, the core cross-sectional area and its length. Calculations using expression L a N^2A/l. Use of expression e = L x change of current/time to solve given problems.

3. Mutual inductance: meaning of mutual inductance.
   Use of the expression e = M x change of current/time to calculate emf induced in one coil due to the current changing in another.

4. Capacitance: meaning of capacitance. Dependence on physical factors, eg. for a parallel plate capacitor the expression
   C = eA/d should be used to illustrate that the capacitance depends on the cross sectional area, distance between the plates and a constant e (Epsilon).
   Calculations using the expression C a A/d. The use of capacitor to store charge. Application of the expressions Q = CV and Q = It to solve given problems.

SUGGESTED LEARNING AND TEACHING APPROACHES

1. Exposition lessons followed by student-centred practical activity in the laboratory/classroom. Use of student-centred material in which student logs data obtained from activity and then draws appropriate conclusions.

2. Exposition lessons including demonstration of practical effects of inductance in electric circuits. Student-centred worksheets with associated self-assessed questions (S.A.Q's) and tutorial.

3. Exposition lessons followed by student-centred practical activity in laboratory/classroom. Use of student-centred material in which student logs data obtained from activity and then draws appropriate conclusions.

4. Exposition lessons followed by discussion and practical demonstration in laboratory and classroom. Use of student-centred material and tutorial sheets.

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