higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N1

(11040601)

29 November 2023 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 7 pages.

144Q1E2329

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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NATIONAL CERTIFICATE
MOTOR ELECTRICAL THEORY N1
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. All sketches must be drawn neatly and in good proportion.
5. All answers including sketches must be done in the answer book.
6. Use only a black or blue pen.
7. Write neatly and legibly.

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 The starting circuit ensures high amperage current to the …

A coil to produce a high tension spark.
B starter motor to crank the engine.
C generator during cranking.
D headlight circuit during cranking.

1.1.2 An ion is an atom that carries …

A an electrical charge.
B no electrical charge.
C electrons that are positive.
D a nucleus is that is negative.

1.1.3 The function of a fuse in the circuit is to …

A complete an electronic circuit.
B decrease circuit current.
C protect the circuit against current overload.
D insulate the circuit from external electrical interference.

1.1.4 In a conventional ignition system, the low tension circuit would mean a …

A secondary circuit.
B primary circuit of 12 V.
C primary dwell angle of the points.
D transistor circuit.

1.1.5 How many coils are combined in a coil pack as used in a 4-cylinder engine?

A 4
B 2
C 8
D 1

1.1.6 The specific gravity of a fully charged battery is …

A 1,28.
B 1,15.
C 1,2.
D 1,25.

1.1.7 The latest design in headlight bulb technology is the …

A halogen bulb.
B incandescent bulb.
C Xenon bulb.
D LED bulb.

1.1.8 The standard wattage of park light circuits is …

A 10 A.
B 5 W.
C 60 W.
D 5 A.

1.1.9 The reference voltage of most electronic sensors is …

A 5 V.
B 6 V.
C 12 V.
D Any of the above.

1.1.10 When diffusing P and N type material, it forms a diode. The barrier area form between the two materials is known as the …

A forward bias zone.
B reverse bias zone.
C buffer zone.
D depletion zone.

(10 × 1) (10)

1.2 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.2.1–1.2.10) in the ANSWER BOOK.

1.2.1 Electric current is the flow of electrons in a closed circuit.

1.2.2 Among all metals, aluminium offers the least resistance to current flow.

1.2.3 A transistor is a combination of at least three diodes.

1.2.4 Strong electromagnets can even attract metals that do not contain iron.

1.2.5 A good auto electrician diagnoses and repairs electrical circuits by replacing components until the problem is solved.

1.2.6 It is advisable to always fit a higher amperage fuse if the designated fuse continuously blows.

1.2.7 To read the fuel level in the tank, a rheostat is connected to the float.

1.2.8 The abbreviation 'TPMS' stands for tyre pressure monitoring system.

1.2.9 The electrolyte of a conventional lead-acid battery is a mixture of water and sulphur.

1.2.10 Light emitting diodes can also be used for automotive lighting.

(10 × 1) (10)
[20]

QUESTION 2

2.1 A 12 V starter draws a current of 100 A during cranking.

Calculate the resistance offered by the starter. (2)

2.2 Draw the following electrical symbols.

2.2.1 Diode

2.2.2 Bulb

2.2.3 Transistor

2.2.4 Switch

2.2.5 Fuse

2.2.6 Relay

2.2.7 Motor

2.2.8 Battery

2.2.9 Galvanometer

2.2.10 Zener diode

(10 × 1) (10)

2.3 A park light circuit consists of 2 bulbs of 5 W each. The globes are connected over a switch to a 6 V battery.

2.3.1 Sketch the circuit. (3)

2.3.2 Determine the total resistance offered by one of the globes. (5)
[20]

QUESTION 3

3.1 As engine speed and load varies, the ignition timing should also vary.

Explain the function and operation of a mechanical advance unit. (9)

3.2 Why is it important for the ignition timing to be advanced according to engine load? (4)

3.3 List any THREE important components that forms part of the secondary circuit of a conventional ignition system. (3)

3.4 Draw a fully labelled sketch of a bar magnet, showing the poles, magnetic lines and the direction thereof. (4)

[20]

QUESTION 4

4.1 All car batteries have a label indicating the Amp/hour rating of the battery.

Briefly explain what a 85 Ah specification means. (2)

4.2 What is the difference between a *gel cell* and a *conventional lead acid cell*?. (2)

4.3 How can one clean corrosion from a battery terminal clamp? (1)

4.4 Name FIVE standard electrical circuits fitted to modern vehicles. (5)

[10]

QUESTION 5

5.1 List FOUR possible reasons for a fuel gauge not working. (4)

5.2 Make a neat, labelled sketch of a bellows-type electric fuel pump. Only sketch the electrical section of the pump. (5)

5.3 Which accessory does one use to warn other road users of one's presence? (1)

[10]

QUESTION 6

6.1 Name the TWO applications of a transistor. (2)

6.2 List the THREE possible configurations of a transistor used as an amplifier. (3)

6.3 Explain the operation of a diode connected in forward bias. Pay special attention to the depletion zone. (3)

6.4 Make a neat labelled sketch of a PNP transistor. (3)

6.5 Sketch the characteristic curve of a transistor used as a switch. (5)

6.6 What is the main difference between *OBDI* and *OBDII*? (4)

[20]

TOTAL: 100