higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MOTRO ELECTRICAL THEORY N1

(11040601)

22 November 2019 (X-Paper)
09:00–12:00

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MOTRO 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 neat and in good proportion.
5. Use the formulae provided on the last page of this question paper.
6. Write neatly and legibly.

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QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the correct answer from the options given 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 voltage measured across battery terminals when the switch is open :

A Potential difference
B Electromotive force
C Voltage
D Current

1.1.2 A amp meter is generally used to measure current flow ranges:

A Above 10A but below 20A
B Between 0A and1A
C Below 10A
D Above 10A

1.1.3 Mutual induction occurs when …

A one coil is used to induce current into a second coil.
B a bar magnet induces current into a coil.
C a horseshoe magnet induces current into a coil.
D current is passed through a coil.

1.1.4 An ignition coil can be regarded as a:

A Secondary coil
B Primary coil
C Step-up transformer
D Step-down transformer

1.1.5 The function of a condenser in an ignition system is to …

A condense the ignition circuit.
B give power to the coil.
C reduces arcing over the points.
D switch the primary circuit on.

1.1.6 The hydrometer is used to measure:

A Battery voltage
B Electrolyte level
C Electrolyte SG level
D Battery current flow

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1.1.7 The standard power consumption of a conventional headlight low beam is:

A 60 W
B 80 W
C 100 W
D 55 W

1.1.8 The halogen filament is made of:

A Copper
B Aluminium
C Tungsten
D Iron

1.1.9 The flasher unit turns on the …

A direction indicator.
B brake lights.
C headlights.
D No influence on any lighting circuit

1.1.10 The engine temperature is sensed by the… sensor unit.

A tank
B oil pressure
C temperature
D crank angle

(10 × 1) (10)

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

1.2.1 Car electrical circuits operate on DC current.

1.2.2 Current remains constant over parallel circuits.

1.2.3 Brake lights are connected in series.

1.2.4 Thinner cables offer more resistance than thicker cables.

1.2.5 Faulty spark plugs can cause the engine to misfire.

1.2.6 Negative temperature coefficient means an increase in temperature causes a decrease in resistance.

1.2.7 It is acceptable to fit head light bulbs with a much higher wattage to improve brightness of the lights.

1.2.8 Headlight focus and alignment improves visibility during night time driving.

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1.2.9 You can replace a blown fuse with a solid wire to prevent new the fuse from blowing.

1.2.10 Semiconductor material can conduct or restrict current flow at the same time.

(10 × 1) (10)
[20]

QUESTION 2

2.1 Explain the terms *voltage*, *current* and *resistance*. (6)

2.2 List THREE factors that influence the resistance in a conductor. (3)

2.3 The primary windings in an ignition coil have a resistance of 1.2Ω if a current of 10A flows through the circuit. It is connected to a 12V battery.

Make a diagrammatic sketch of the circuit and calculate the resistance offered by the ballast resistor to maintain this current flow. (8)

2.4 Two resistors, 10Ω and 12Ω are connected in parallel.

Calculate the total resistance offered by the parallel circuit. (3)
[20]

QUESTION 3

3.1 Explain how the high voltage spark is generated in the ignition coil. (6)

3.2 Name TWO types of ignition systems. (2)

3.3 List THREE important functions of the spark plug. (3)

3.4 What is the first step in diagnosing a complaint of an engine misfiring. (2)

3.5 Make a neat labelled sketch of a vacuum advance system as used on the conventional ignition system. (7)
[20]

QUESTION 4

4.1 Draw a complete fully labelled wiring diagram of a park light circuit. (include a dashboard warning light and separate fuses for left and right) (8)

4.2 What is the function of the head light relay? (3)

4.3 Explain the term 'sulphation' as it occurs in a lead acid battery. (4)

4.4 Construct a hooter circuit to show how a conventional 4-pin relay is connected. (show the internal circuit of the relay) (5)
[20]

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QUESTION 5

5.1 Explain why a relay is sometimes connected in the lighting circuit of a motor vehicle. (3)

5.2 How would you do a quick test to isolate the sender unit as the faulty component in the heat gauge circuit? (2)

5.3 What does *headlamp levelling technology* mean? (1)

5.4 What is the difference between a conductor and an insulator and give examples of each? (4)
[10]

QUESTION 6

6.1 Define *doping.* (3)

6.2 Sketch a circuit with a transistor connected in common base configuration. Also show the input and output signals. (6)

6.3 Which mechanism is used in conventional analogue test equipment? (1)
[10]

TOTAL: 100

FORMULAE

$R_t = R_1 + R_2 + \ldots\ldots R_n$

$\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2} + \ldots\ldots R_n$

$I = \frac{V}{R}$

$P = VI$

$P = I^2R$

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