higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N1

(11040601)

22 November 2022 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 6 pages and 1 formula sheet.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

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 neat and in good proportion.
5. All answers including sketches must be done in the ANSWER BOOK.
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 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 An electrical circuit is a … .

A pathway to transport electrical current
B globe and switch
C iron conductor
D series of electrical components

1.1.2 An ion is an atom that has … .

A an electrical charge
B a neutral charge
C a nucleus is that is positive
D a nucleus is that is negative

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 The TWO poles on a bar magnet are … .

A East and South
B North and South
C West and South
D West and North

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

A 4
B 2
C 8
D 1

1.1.6 The hydrometer is used to measure … .

A battery voltage
B electrolyte level
C electrolyte specific gravity level
D battery current flow

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1.1.7 Which gas is released when a battery is charged?

A Hydrogen
B Carbon dioxide
C Carbon monoxide
D Oxygen

1.1.8 The standard wattage of park light circuits is … .

A 10 w
B 5 w
C 60 w
D 5 A

1.1.9 The flasher unit … .

A turns on the direction indicator
B turns on the brake lights
C turns on the headlights
D has no influence on any lighting circuit

1.1.10 Fog lights are designed … .

A to be used in fog or falling snow
B to be used instead of the head lights
C to add to the aesthetics of the car
D for daytime visibility

(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 The halogen light bulb is the latest development in car lighting systems.

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

1.2.3 Brake lights are connected in series.

1.2.4 In NCT thermistors, the resistance decreases with an increase in temperature.

1.2.5 A good auto electrician diagnoses and repairs electrical circuits by the trial and error method.

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

1.2.7 A reversing camera is currently considered as a non-mandatory accessory.

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1.2.8 The abbreviation 'TPMS' stands for Tyre Pressure Monitoring System.

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

1.2.10 A transistor can be used as a solid state switch.

(10 × 1) (10)
[20]

QUESTION 2

2.1 Name the FIVE most common electrical circuits found in modern engines. (5)

2.2 A circuit consists of 3 resistors. The values of two of the resistors are 10 ohm and 15 ohm respectively. The resistors are connected in series and the circuit is powered by a 24V battery.

2.2.1 Sketch the circuit. (3)

2.2.2 If the total current in the circuit is 0.6 A, calculate the value of the third resistor. (3)

2.2.3 Determine the power consumption of the circuit. (1)

2.3 Two resistors, 10 ohm and 15 ohm are connected in parallel.

2.3.1 Calculate the total resistance of the circuit. (4)

2.3.2 Determine the current flowing in the circuit if the circuit is powered by a 12V battery. (1)

2.4 Name THREE insulating materials used in electrical circuits. (3)
[20]

QUESTION 3

3.1 Explain the function and operation of the 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 the THREE most important functions of the spark plug. (3)

3.4 Draw a fully labelled sketch of a bar magnet, showing the poles, magnetic lines and its direction. (4)
[20]

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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.) (7)

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

[10]

QUESTION 5

5.1 Complete the table below by selecting the instrument/meter/gauge from the list provided to match the information in the table. (Only write down the letter and the answer in the ANSWER BOOK.)

Action	Instrument
Direction indicators on	A
Vehicle speed indication	B
Engine temperature	C
Engine speed	D
Engine oil pressure	E

Speedo meter, revolution counter, oil pressure gauge, temperature gauge, direction indicators warning lamps, high beams warning lamp, brake light switch, indicator switch. <<Should these be marked, A, B, etc?> (5)

5.2 Make a neat, labelled sketch of an oil pressure warning lamp circuit showing normal oil pressure. (5)

[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 reverse bias. Pay special attention to the depletion zone. (3)

6.4 Make a neat, labelled sketch of a NPN 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

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MOTOR ELECTRICAL THEORY N1

FORMULA SHEET

1. $I = \frac{V}{R}$ (A)

2. $P = I.V(W)$

3. $Rt = R_1 + R_2 + R_3 + \ldots R_n (\Omega)$

4. $\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots \left(\frac{1}{\Omega}\right)$

5. $V = E - I.r$ (V)

6. $I = \frac{e.m.f}{R_T + r_T}$

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