higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N2

(11040612)

1 December 2023 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 5 pages and 1 formula sheet.

213Q1G2301

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MOTOR ELECTRICAL THEORY N2
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. Start each question on a new page.
5. Use only a black or blue pen.
6. Write neatly and legibly.

Copyright reserved

QUESTION 1

1.1 Six cells, each with an emf of 1,2 V and an internal resistance of 1,2 Ω, are connected in series with a resistance of 10 Ω.

Calculate:

1.1.1 The emf of the battery

1.1.2 The current in the circuit

1.1.3 The potential difference of the battery

1.1.4 The total power of the circuit

(4 × 2) (8)

1.2 Three resistors are connected in parallel with a 48 V supply. The values of the resistors are 6 Ω, 8 Ω and 12 Ω respectively.

Calculate:

1.2.1 The total resistance in the circuit (2)

1.2.2 The total current (2)

1.2.3 The current flowing through each resistor (6)

1.3 Define each of the following:

1.3.1 Electromotive force

1.3.2 Potential difference

(2 × 2) (4)
[22]

QUESTION 2

2.1 List FOUR specifications required to test a starter motor on a test bench. (4)

2.2 State the function of the overrunning clutch inside a starter motor drive. (3)

2.3 List FOUR characteristics of a good brush lead in a starter motor. (4)

2.4 Explain the purpose of starter motor brushes and name TWO materials that are within the composition of the brushes. (3)

2.5 Which type of DC motor is used for a starter motor? Explain why this type of motor is required. (2)
[16]

Copyright reserved

QUESTION 3

3.1 Explain, step by step, how to set the dynamic ignition of an engine by using a stroboscopic timing light. (5)

3.2 List FOUR components of a conventional oil-filled coil ignition system. (4)

3.3 Explain each of the following as it relates to a coil ignition system:

3.3.1 Static timing

3.3.2 Dynamic timing

3.3.3 Dwell angle

(3 × 2) (6)

3.4 Briefly explain how to test the primary and secondary windings of an ignition coil for open-circuit fault. Name the instrument used to conduct the test. (5)

[20]

QUESTION 4

4.1 Explain in detail how to test the armature of a generator for each of the following faults:

4.1.1 Earth fault

4.1.2 Open-circuit fault

4.1.3 Short-circuit fault

(3 × 3) (9)

4.2 Name THREE types of generators. (3)

4.3 Give TWO purposes of the commutator of a DC generator. (2)

4.4 Give TWO sources of direct current. (2)

[16]

Copyright reserved

QUESTION 5

5.1 Explain the purpose of the rectifier in a battery charger. (2)

5.2 Explain the procedure to test a lead-acid battery for sulphation. (4)

5.3 Explain the procedure for fast charging a lead-acid battery. (4)

5.4 List THREE factors that may lead to a sulphated lead-acid battery. (3)

[13]

QUESTION 6

6.1 Draw a graph that represents the characteristics of a silicon diode. Indicate the conducting voltage, forward and reverse characteristics and breakdown point. (5)

6.2 State the forward-conducting voltages of each of the following components:

6.2.1 Silicon diode

6.2.2 Germanium diode

(2 × 2) (4)

6.3 Explain the purpose of a transformer. (2)

6.4 What is the purpose of a diode in a circuit? (2)

[13]

TOTAL: 100

Copyright reserved

(11040612)

FORMULA SHEET

$R_t = R_1 + R_2 + \ldots R_n$

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

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

$I = \frac{E}{R + r}$

$P = VI$

$P = I^2R$

$V = E + Ir$

$E = blv \sin\theta$

$F = bli$

Copyright reserved