higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

1190(**E**)(A6)T

NATIONAL CERTIFICATE

MOTOR ELECTRICAL THEORY N2

(11040612)

6 April 2018 (X-Paper)
09:00–12:00

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 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. Write neatly and legibly.

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QUESTION 1

1.1 Explain the difference between *electromotive force* and *potential difference*. (2 × 1) (2)

1.2 A battery consists of six cells, each with an EMF of 2,1 volts, which are connected in series to an external resistance. The terminal potential difference of the battery is 9 volts when a current of 1,2 amperes flows.

Calculate the following:

1.2.1 The value of the external resistance (3)

1.2.2 The internal resistance of each cell (5)

1.2.3 The power dissipated by the load resistance (3)

1.3 Name, and explain, THREE factors that determine the amount of induced voltage. (6)

[19]

QUESTION 2

2.1 2.1.1 Explain the principle of mutual induction that is used in an ignition coil of the conventional ignition system. (3)

2.1.2 Make a sketch to show the components. (2)

2.2 Self-induction in an unprotected circuit may damage the surface of contact breaker points.

Make a neat sketch, and with reference to the sketch explain the principle of self-induction. (3 + 3) (6)

2.3 With the aid of a sketch, show how self-induction arises. (5)

[16]

QUESTION 3

3.1 List SIX principal parts of the self-starter of starting motors. (6)

3.2 The insulation of starter motor windings often burn, causing failure of the starter motor.

Give THREE possible causes that may lead to this condition. (3)

3.3 Explain the function of the spiral splines on an armature shaft. (2)

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3.4 A solenoid consists of a pull-in coil and a hold-in coil. The solenoid levers drive into the ring gear of an engine and connect the battery to the motor.

Explain clearly the procedure to test the two coils of the solenoid, and indicate the equipment that is used. (6)

3.5 Explain the procedure to test the field coils of a starter motor for an earth fault (windings touching frames) of the type where one end of the coil is riveted to the frame. (3)
[20]

QUESTION 4

4.1 When a starter is operated, its armature rotates until its piston is fractionally engaged, then stops.

Give FOUR possible causes of this, and also the remedy for each. (4 × 2) (8)

4.2 Explain what is meant by *cranking speed*. (5)

4.3 The rotating armature magneto, which was widely used over a period of many years, was later challenged and to a large extent replaced by other types.

Name TWO of these other types. (2)
[15]

QUESTION 5

5.1 A full-wave rectifier converts AC to DC that is necessary for a battery charger to restore the charge of a battery.

Draw a diagram of a full-wave bridge rectifier that is connected to the following components:

- the input AC waveform
- the output DC waveform
- a filter capacitor. (10)

5.2 Explain the procedure that is used to quick-charge a lead acid battery. (6)

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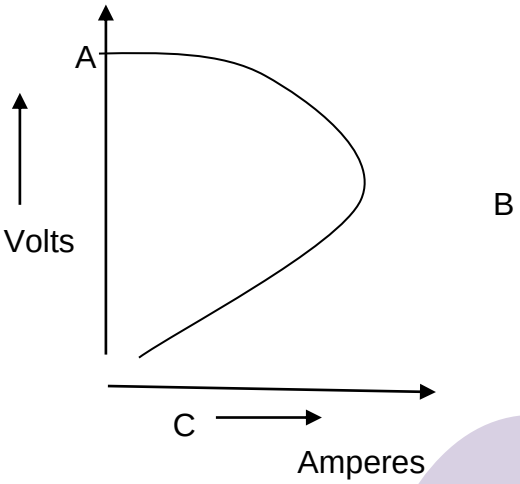
5.3 The typical external characteristics A, B and C of a shunt-wound generator are shown below.



What are the THREE causes producing the decrease in terminal pd with load? (3)

[19]

QUESTION 6

6.1 Choose an item or a description from COLUMN B that matches an item or a description in COLUMN A. Write only the letter (A–E) next to the question number (6.1.1–6.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
6.1.1	A device that provides switching without having moving parts	A	the reverse voltage across a diode that leads to diode failure
6.1.2	The minimum conducting voltage of a silicon diode	B	a common-emitter-type amplifier
6.1.3	Breakdown voltage	C	the connection of the diode that is used to block reverse current
6.1.4	Reverse bias	D	transistor
6.1.5	This type of amplifier has an input 180° opposite to the output	E	forward voltage of 0,6 volt

(5 × 1) (5)

6.2 A transistor may be used as an amplifier.

Name THREE types of transistor amplifiers. (3)

6.3 One of the battery faults is overcharging.

Briefly explain the effects that overcharging has on a battery. (3)
[11]

TOTAL: 100

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MOTOR ELECTRICAL THEORY N2

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. $\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots \frac{1}{R_n}\ (\Omega^{-1})$

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

6. $E = B.\ell.v\ (V)$

7. $F = B.\ell.I\ (N)$

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