



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T540(E)(A11)T

NATIONAL CERTIFICATE

ELECTROTECHNICS N5

(8080085)

11 April 2019 (X-Paper)

09:00–12:00

Calculators may be used.

This question paper consists of 5 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
ELECTROTECHNICS N5
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. Sketches must be large, neat and fully labelled.
 5. Write neatly and legibly.
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QUESTION 1

1.1 How may the number of parallel paths in a lap-wound armature be increased? (1)

1.2 A six-pole DC motor has a lap-connected armature with 800 conductors. The brushes are displaced through six mechanical degrees from the geometrical axis. The armature current is 155 A.

Calculate the following:



1.2.1 Demagnetising and cross-magnetising ampere-turns per pole (7)

1.2.2 Additional field current required to neutralise this demagnetisation if the field winding has 1 340 turns per pole (2)

1.3 A 120 V DC shunt motor takes an armature current of 58 A at a speed of 750 r/min, the flux per pole being 0,05 wb and the armature circuit resistance 0,23 ohms.

Determine each of the following if the flux is suddenly reduced to 0,018 Wb.

1.3.1 Value to which the armature current will increase

1.3.2 Speed to which the motor will accelerate. Ignore inductive effects and armature reaction and assume that the load torque remains constant.



(2 × 5) (10)
[20]

QUESTION 2

2.1 A circuit has a resistance of 8 ohms, an inductance of 0,6 henry and a variable capacitance which are connected in series across a 125 V 50 Hz supply.



Calculate each of the following:

2.1.1 Capacitance to give resonance (4)

2.1.2 Voltage across the resistance, the inductance and the capacitance (3)

- 2.2 A coil takes a current of 10 A and dissipates 2 100 W when connected to a 240 V 50 Hz sinusoidal supply. When another coil is connected in parallel with it the total current taken from the same supply is 26 A at a power factor of 0,87 lagging.

Calculate the following when the two coils are connected in series across the same supply:




- 2.2.1 Total current (11)
- 2.2.2 Power factor (2)
- [20]**

QUESTION 3

- 3.1 Explain the power factor of a transformer at no load and at load. (2)
- 3.2 Give THREE methods of reducing a leakage flux in a transformer. (3)
- 3.3 A 135 kVA single-phase transformer has a transformation ratio of 4:1. The primary and secondary resistances are 0,2 ohms and 0,03 ohms respectively and the corresponding leakage reactances are 1,4 ohms and 0,045 ohms respectively. The supply voltage is 2 000 V.



Calculate each of the following:

- 3.3.1 Secondary terminal voltage at full load if the power factor is 0,86 lagging (9)
-  3.3.2 Reactance per unit (2)
- 3.3.3 Resistance per unit (2)
- 3.3.4 Impedance per unit (2)
- [20]**


QUESTION 4

- 4.1 The power input to a 2 200 three-phase delta-connected induction motor is 82 kW and the power factor of the motor is 0,899 lagging.

Calculate each of the following:



- 4.1.1 Phase current (3)
- 4.1.2 kVA rating of the motor (1)


- 4.2 A three-phase overhead line of 10 km long has solid copper conductors with diameters of 0,8 cm. 

Calculate the inductance and capacitance if the lines are spaced in each of the following ways:

4.2.1 40 cm between adjacent centres in flat regular spacing

4.2.2 On the corners of a triangle having sides of length 40 cm, 70 cm and 100 cm

(2 × 5) (10)

- 4.3 The two-wattmeter method is applied to a three-phase, three-wire 120 volt system. The reading of wattmeter one (W_1) is 400 watts and that of wattmeter two (W_2) is 850 watts. 

Determine the impedance of the balanced delta-connected load.

(6)
[20]

QUESTION 5

- 5.1 Name TWO methods used to find the slip of an induction motor. (2)

- 5.2 A three-phase star-connected alternator of 50 Hz has to give a line voltage of 12 kV when the machine is on open circuit. The flux per pole is 0,18 Wb. Assume the full-pitch coils and the stator to have 6 slots per pole per phase. The speed is 600 r/min and the distribution factor is 0,97.

Calculate the number of stator conductors per slot. 

(7)

- 5.3 A three-phase slip-ring induction motor with a star-connected rotor has an induced emf of 170 volts between the slip rings at standstill with normal voltage applied to the stator. The rotor winding has a resistance per phase of 0,8 ohms and a standstill leakage reactance per phase of 4,2 ohms.

Calculate the following:

5.3.1 Rotor current per phase when the motor is running at 4% slip (5)

5.3.2 Percentage slip and rotor current per phase when the motor is developing maximum torque

(6)
[20]

TOTAL: 100