NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

IEL – Electrical Machines Operations

T051

Thursday, 29/7/2021

08:30 – 11:30 AM

Names: .....

Index number: .....

TVET NATIONAL EXAMINATION, RTQF LEVEL 5, 2020-2021

QUESTIONS and ANSWERS BOOKLET

OPTION/TRADE: **INDUSTRIAL ELECTRICITY**

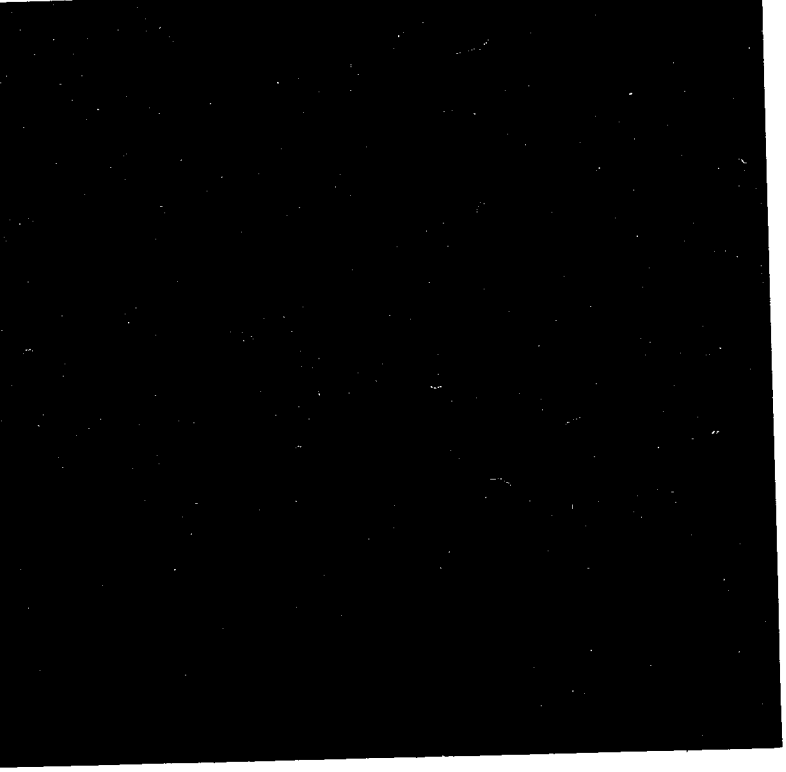
SUBJECT: **Electrical Machines Operations**

ACADEMIC YEAR: **2020-2021**

Read carefully the instructions on page (i) & (ii).

FOR EXAMINER'S USE ONLY

QUESTIONS	1	2	3	4	5	6	7	8	9	10	Total
Marks											
QUESTIONS	11	12	13	14	15	16	17	18	19	20	Total
Marks											
QUESTIONS	21	22	23	24	25	26	27	28	29	30	Total
Marks											



TVET NATIONAL EXAMINATION, RTQF LEVEL 5, 2020-2021

INSTRUCTIONS TO CANDIDATES: PART I (Answer Booklet)

1. A candidate should fill in the actual names and the index number on the cover of this questions and answer booklet on the provided place (Black Box).

2. It is illegal for a candidate to write any of his/her names, index number or a school name inside the answer booklet.

3. A candidate should check if all pages of the answer booklet are complete. No candidate should remove or tear any pages or part of it from the answer booklet.

4. A candidate should answer in the language in which the examination is set. (See page ***(ii)***)

5. A candidate should sign on the sitting plan when submitting the answer booklet. He/she has also to check if the answer booklet is well sealed.

6. No extra paper is allowed in the examinations room. If a candidate is caught with it his/her results will be nullified.

7. No candidate is allowed to write answers not related to the subject being sat for, otherwise it will be considered as a cheating case.

8. Write your answers on the 12 lined pages (From page 1 of 12 to page 12 of 12).

9. Use the last non-lined pages as draft.

10. Results for any candidate who is caught in examination malpractices are nullified. The cheating can be recognized during examinations administration, marking exercise or even thereafter.

TVET NATIONAL EXAMINATION, RTQF LEVEL 5, 2020-2021

OPTION/TRADE: INDUSTRIAL ELECTRICITY

SUBJECT: Electrical Machines Operations

DURATION: 3 hours

INSTRUCTIONS TO CANDIDATES: PART II (Question paper)

The paper is composed of two (2) main Sections as follows:

Section I: Attempt all the Twelve (12) questions	**(60 marks)**
Section II: Attempt any Four (4) questions out of Six (6)	**(40 marks)**

Allowed materials:

-Ruler and square

-Calculator

Note:

Every candidate is required to carefully comply with the provided assessment instructions.

Section I: Attempt all the Twelve (12) questions **(60 marks)**

01. Explain the following terms:

a) Electrical generator
b) Armature reaction
c) Generator critical resistance. **(5 marks)**

02. Explain the function of the following measuring instruments:

i) Tachometer
ii) Earth Resistance Meter
iii) Manometer
iv) Wattmeter
v) Ohmmeter. **(5 marks)**

03. a) Define "Generator voltage regulation".

b) Calculate the percentage of regulation of Generator with a no-load voltage of 462 volts and a full-load voltage of 440 volts. **(5 marks)**

04. Enumerate at least five (5) parameters provided on name plate of 3-phase induction motor. **(5 marks)**

05. State any five (5) advantages and disadvantages of Direct Online (DOL) starting method of three-phase induction motor. **(5 marks)**

06. Three phase induction motor is started in star/delta method, list down any five (5) disadvantages for that method. **(5 marks)**

07. **a)** What is a transformer?

b) Compare transformer to shell type transformer. **(5 marks)**

08. By the help of a sketch, show how the windings of a 3-phase induction motor can be connected in delta on its terminals board.

(5 marks)

09. List down any five (5) tools used for the winding/Rewinding of an electric motor. **(5 marks)**

10. The frequency of the supply to the stator of an 8-poles induction motor is 50 Hz and the rotor frequency is 3 Hz. Determine:

a) The slip
b) The rotor speed. **(5 marks)**

11. A long shunt dynamo is running at 1000 rpm supply a 22kW at a terminal voltage of 220V. The resistances of armature shunt field and the series fields are 0.05,110 and 0.06 Ω respectively. The overall efficiency at the above load is 88%. Find:

a) Cu losses
b) Iron and friction losses
c) The torque exerted by the prime mover. **(5 marks)**

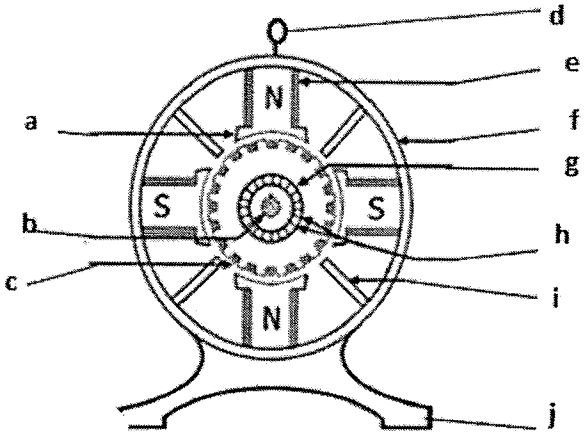
12. A shunt generator delivers 450A at 230V and the resistance of the shunt field and armature are 50Ω and0.03Ω respectively. Calculate the generated e.m.f. **(5 marks)**

Section II: Attempt any Four (4) questions out of Six (6) **(40 marks)**

13. a) An 8-pole, wave-connected armature has 600 conductors and is driven at 625 rev/min. If the flux per pole is 20 mWb, determine the generated e.m.f .

b) A 4-pole generator has a lap-wound armature with 50 slots with 16 conductors per slot. The useful flux per pole is 30 mWb. Determine the speed at which the machine must be driven to generate an e.m.f. of 240 V. **(10 marks)**

14. A DC motor has many parts, as you are motor operator, name all the ten (10) parts of the following DC motor :



(10 marks)

15. A 240V shunt motor takes a total current of 30A. If the field winding resistance Rf =150Ω and the armature resistance Ra =0.4Ω Determine:

a) The current in the armature

b) The back e.m.f. **(10 marks)**

16. Below is a table showing a list of different meters used in motor operation. Fill it correctly:

S/N	Measuring instrument	Role	Units used (reading units)
i.	Watt meter		
ii.	Earth resistance tester		
iii.	Power factor meter		
iv.	Insulation tester		
v.	Voltmeter		
vi.	Ammeter		
vii.	Tachometer		
viii.	Thermometer		
ix.	Frequency meter		
x.	Ohm meter		

(10 marks)

17. **a)** A 3.3 kV /220v, 50 Hz single phase transformer is to have an approximate emf per turn of 44V and operate with a maximum flux density of 1.5T and. Calculate

i. The number of primary and secondary turns
ii. The cross sectional area of the core **(6 marks)**

(b) What are the transformer dismantling processes? **(4 marks)**

18. A 100 kVA, 3000V, 50Hz, 3-phase star connected alternator has effective armature resistance of 0.2 Ω. The field current of 40A produces short-circuit current of 200A and an open circuit of 1040V (line value). Calculate the full-load voltage regulation at 0.8 pf lagging and 0.8pf leading. Draw phasor diagrams. **(10 marks)**