



TVET NATIONAL EXAMINATIONS, LEVEL 5, 2022-2023

INSTRUCTIONS TO CANDIDATES (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.
2. It is illegal for a candidate to write any of names, Index number or school name inside the answer booklet.
3. No candidate should remove or tear any pages or part of it in the answer booklet.
4. A candidate should answer in the language in which the examination is set.
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 16 lined pages (From page 7 to page 22).
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.

- N.B:** 1) After results publication, there is no remarking and no candidate is given his/her answer booklet for review. This answer booklet is a property of NESAS.
- 2) Claims are only received online within 30 days after results publication. A link will be provided after results publication.

TVET NATIONAL EXAMINATIONS, LEVEL 5, 2022-2023

OPTION/TRADE: INDUSTRIAL ELECTRICITY

**SUBJECT/EXAM: ELECTRICITY, ELECTRONICS AND ELECTRICAL
MEASUREMENTS**

DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES

This Exam paper is composed of Three Sections (A, B, and C). Follow the instructions given below, and answer the indicated questions for a total of 100 marks

Section **A**: Fourteen (**14**) questions, all **Compulsory** **55 marks**

Section **B**: Among the five (**5**) questions, attempt any three (3) **30 marks**

Section **C**: Among the two (**2**) questions, attempt any one (1) **15 marks**

Allowed materials:

- Blue or black pen
- Mathematical set
- Non-programmable calculator

Note:

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

T 048_ Electricity, Electronics and Electrical measurements

SECTION A: Attempt all questions

(55 marks)

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- 01.** List any four (4) applications of diodes. **(4marks)**
- 02.** Define the below electrical elements: **(4marks)**
- a)** Conductors;
 - b)** Semiconductors.
- 03.** Define the following terms: **(3marks)**
- a)** Frequency;
 - b)** Peak-to-peak;
 - c)** Instantaneous values.
- 04.** Suggest an appropriate term to fill in the following statement: **(5marks)**
The area around a magnet is called the and it is in this area that the effects of the Produced by the magnet can be detected. The magnetic flux density is calculated using the following formulaand expressed inIn vacuum (in free space) the Permeability of free space is equal to
- 05.** Explain the following types of capacitors: **(3marks)**
- a)** Fixed capacitors;
 - b)** Variable capacitors.
- 06.** Differentiate passive from active sensors. **(4marks)**
- 07.** A moving-coil instrument gives a full-scale depletion (f.s.d). when the current is 40 mA and its resistance is 25 Ω . Calculate the value of the shunt to be connected in parallel with the meter to enable it to be used as an ammeter for measuring currents up to 50 A. **(5marks)**
- 08.** List any four (4) examples of sensors. **(2marks)**
- 09.** A current of 20 A flows through a load of resistance of 2 ohms. A wattmeter of current coil has a resistance of 0.01 ohms is connected as its internal resistance. **(5marks)**
- a)** Determine the power dissipated in the load.
 - b)** Determine the wattmeter reading.
 - c)** Draw the circuit of the above wattmeter.
- 10.** **a)** Describe an error of measurement system. **(3marks)**
b) List any two (2) electrical measuring instruments.
- 11.** The three similar coils, each having a resistance of 8 Ω and an inductive reactance of 8 Ω are connected in star across a 415 V, 3-phase supply. Calculate the readings on each of two wattmeters connected to measure the power by the two-wattmeter method. **(5marks)**
- 12.** Compare the series with parallel connections of capacitors and sketch those connections. **(4marks)**

T 048_ Electricity, Electronics and Electrical measurements

- 13.** Explain the following laws and theorem: **(3marks)**
- a)** Kirchhoff's Voltage Law;
 - b)** Maximum Power Transfer;
 - c)** Thevenin's theorem.
- 14.** A 20Ω resistor is connected in parallel with an inductance of 2.387mH across a 60V , 1 kHz supply. Calculate **(5marks)**
- a)** The current in each branch,
 - b)** The supply current,
 - c)** The circuit phase angle,
 - d)** The circuit impedance, and
 - e)** The power consumed.

Section B: Attempt any three (3) questions

(30 marks)

- 15. a)** A magnetic pole face has a rectangular section having dimensions **(10marks)**
 200 mm by 100 mm . If the total flux emerging from the pole is $150\text{ }\mu\text{Wb}$, calculate the flux density.
- b)** Determine the peak and mean values for a 240 V mains supply.
- c)** A coil of inductance 0.20 H and resistance $60\text{ }\Omega$ is connected in parallel with a $20\text{ }\mu\text{F}$ capacitor across a 20V , variable frequency supply. Calculate:
- i.** The resonant frequency,
 - ii.** The dynamic resistance,
 - iii.** The current at resonance.
- 16. a)** What are any four (4) applications of inductor? **(10marks)**
- b)** Three resistors of 3Ω , $4\text{ }\Omega$ and $6\text{ }\Omega$ respectively are connected in derivation(parallel) to a source of 12V .
- i.** Calculate the voltage and the current followed in terminals of each resistor.
 - ii.** Determine the total current and the principal resistance in the circuit.
 - iii.** Find the power and the energy developed during 5 minutes .

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17. a) Complete the sentences below by using: “**silicon-type semiconductor, unidirectional switch, covalent, p-type semiconductor or n-type semiconductor**” (10marks)

- i) A semiconductor is formed by bonds
- ii) The most commonly used semiconductor is.....
- iii) When a pentavalent impurity is added to a pure semiconductor, it becomes
- iv) When a trivalent impurity is added to a pure semiconductor, it becomes.....
- v) A pn junction acts as a

b) Convert the following numbers:

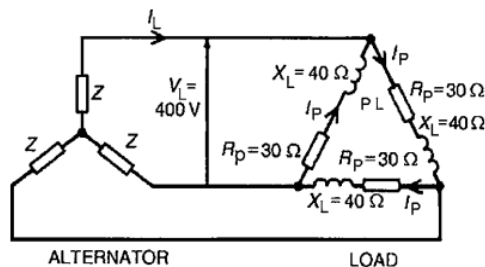
- i) $(58)_{10} = (\dots\dots\dots)_2$
- ii) $(49)_{10} = (\dots\dots\dots)_2$
- iii) $(101101)_2 = (\dots\dots\dots)_{10}$
- iv) $(10001)_2 = (\dots\dots\dots)_{10}$
- v) $(1000010)_2 = (\dots\dots\dots)_{10}$

18. a) Describe the applications of integrated circuits (ICs) used in electronics circuits. (10marks)

b) Sketch the following electronic components:

- i) NPN and PNP bipolar transistor;
- ii) NPN and PNP physical construction;
- iii) NPN and PNP two diode analogy;
- iv) NPN and PNP circuit symbol of transistor.

19. A 400V, 3-phase star connected alternator supplies a delta-connected load, each phase of which has a resistance of $30\ \Omega$ and inductive reactance $40\ \Omega$. (10marks)



Calculate:

- a) the current supplied by the alternator,
- b) the output power and the kVA of the alternator, neglecting losses in the line between the alternator and load,
- c) Draw the phasor diagram.

Section C: Attempt only one (1) question**(15 marks)**

- 20.** The following table gives the corresponding values of current and time for a half cycle of alternating current: **(15marks)**

Time t (ms)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Current I (A)	0	7	14	23	40	56	68	76	60	5	0

Assuming the negative half cycle is identical in shape to the positive half cycle,

- a) Plot the waveform, and find:
 - b) The frequency of the supply,
 - c) The instantaneous values of current after 1.25 ms and 3.8 ms,
 - d) The peak or maximum value,
 - e) The mean or average value,
 - f) The r.m.s. value of the waveform.
- 21.** a) Differentiate absolute errors from the relative errors. **(15marks)**
- b) Three 12Ω resistors are connected in star to a 415 V, 3-phase supply. Determine the total power dissipated by the resistors.
 - c) An alternating voltage is given by $v = 75 \sin (200\pi t + 0.25)$ volts. Find:
 - i) the amplitude,
 - ii) the peak-to-peak value,
 - iii) the rms value,
 - iv) the periodic time,
 - v) the frequency,
 - vi) the phase angle (in degrees and minutes) relative to $75 \sin 200\pi t$.

END OF ASSESSMENT

**Do not
write in
this margin**

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