TEVETA

Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN SCIENCE LABORATORY

LEVEL 6 YEAR II EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: NOVEMBER / DECEMBER 2025

SUBJECT: SCIENTIFIC INSTRUMENTATION

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

1. Write your Examination Number and National Registration Card (NRC) Number on the answer booklet provided.
2. Write the ANSWER SCRIPT SERIAL NUMBER on the examination register and on the entry slip.
3. This paper has seven (7) Questions. Question one (1) is compulsory.
4. Answer four (4) Questions from the remaining six (6) Questions.
5. Diagrams may be used where necessary to clarify your answer.
6. Cellphones and programmable calculators are not allowed in the examination room.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

QUESTION ONE (COMPULSORY)

(a) Draw a labelled schematic diagram of a spectrophotometer. **[6 marks]**

(b) Sketch block diagrams of electrical components that can be connected to assemble an incubi tor. **[8 marks]**

(c) Explain the following:

(i) Functions of at least two electrical components in part (b) above **[2 marks]**

(ii) The working principle of a spectrophotometer. **[4 marks]**

[Total: 20 marks]

QUESTION TWO

(a) State the following:

(i) Fuel source of a Bunsen burner. **[2 marks]**

(ii) **Four (4)** heating instruments used in laboratory. **[4 marks]**

(iii) The heating instrument suitable for precise temperature control. **[2 marks]**

(b) Explain the following:

(i) application heating instruments in in chemistry. **[2 marks]**

(ii) The principle of a refrigerated circulator. **[2 marks]**

(c) Sketch the flame zones of a Bunsen burner flame. **[2 marks]**

(d) (i) Calculate the energy required to heat 100 mL water from 20°C to 80°C, (c = 4.18 J/g°C). **[2 marks]**

(ii) Distinguish between dry-block heaters and water baths. **[4 marks]**

[Total: 20 marks]

QUESTION THREE

(a) State **two (2)** uses of the following materials:

(i) Semiconductors **[3 marks]**

(ii) Insulators **[3 marks]**

(b) Explain the differences between a conductor and a semiconductor. **[4 marks]**

(c) With the aid of diagrams, describe the molecular structure of intrinsic and extrinsic semiconductors. **[10 marks]**

[Total: 20 Marks]

QUESTION FOUR

(a) Calculate the resistance of the following resistors whose colour codes are:

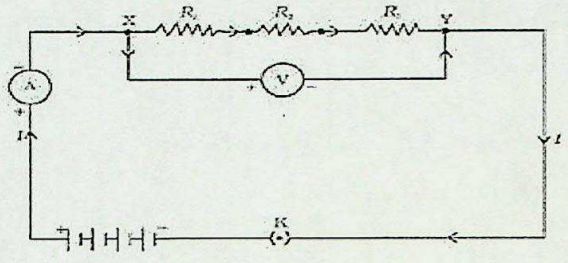
(i) Blue, white, black, red and red **[2 marks]**

(ii) White, red, blue, green and silver **[2 marks]**

(iii) Yellow, grey, brown, silver and gold **[2 marks]**

(iv) Brown, green, white, blue and red **[2 marks]**

(b) The diagram below shows a network of resistors R_1=3 Ω, R_2=2 Ω, and R_3=10 Ω connected to a 30V battery.



Determine the following:

(i) Total resistance **[4 marks]**

(ii) Ammeter reading **[4 marks]**

(iii) Voltmeter reading **[4 marks]**

[Total: 20 marks]

QUESTION FIVE

(a) State the following:

(i) The turns ratio equation of a transformer. **[2 marks]**

(ii) **Four (4)** essential components of a DC power supply. **[4 marks]**

(iii) Common type of a voltage regulator. **[2 marks]**

(b) Define a transformer and its role in power supplies. **[2 marks]**

(c) Identify the component of a DC power supply that converts AC to DC. **[2 marks]**

(d) (i) Explain the function of a voltage regulator. **[2 marks]**

(ii) Calculate the secondary voltage if a 1:2 transformer has 120 V primary. **[2 marks]**

(e) Distinguish between step-up and step-down transformers. **[4 marks]**

[Total: 20 marks]

QUESTION SIX

(a) Define rectification in power supply systems. **[2 marks]**

(b) State the following:

(i) Difference between half-wave and full-wave rectification. **[2 marks]**

(ii) **Four (4)** components required to build a full-wave bridge rectifier. **[4 marks]**

(d) (i) Draw the circuit diagram of a bridge rectifier. **[4 marks]**

(ii) Calculate the ripple frequency for full-wave rectification of 50 Hz AC. **[2 marks]**

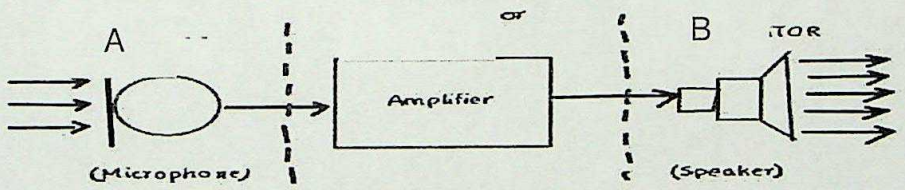
(e) (i) Distinguish between peak inverse voltage (PIV) in half-wave and bridge rectifiers. **[4 marks]**

(ii) Compare the average in (i) above to the output of a full-wave rectifier under the same conditions. **[2 marks]**

[Total: 20 marks]

QUESTION SEVEN

(a) Study diagram below and label the transducers A and B, State the role of these transducers. **[5 marks]**



(b) Fill the blank spaces:

TRANSDUCER NAME	ENERGY CHANGES IT PERFORM
MICROPHONE	SOUND TO ELECTRICAL
.....	ELECTRICAL TO SOUND
PIEZOELECTRIC CRYSTAL	.....
.....	PRESSURE TO RESISTANCE
.....	VOLTAGE OF SOLUTION TO ELECTRIC CURRENT
THERMISTOR	.....

[15 marks]

[Total: 20 Marks]