

Names.

Index number

QUESTIONS and ANSWERS BOOKLET

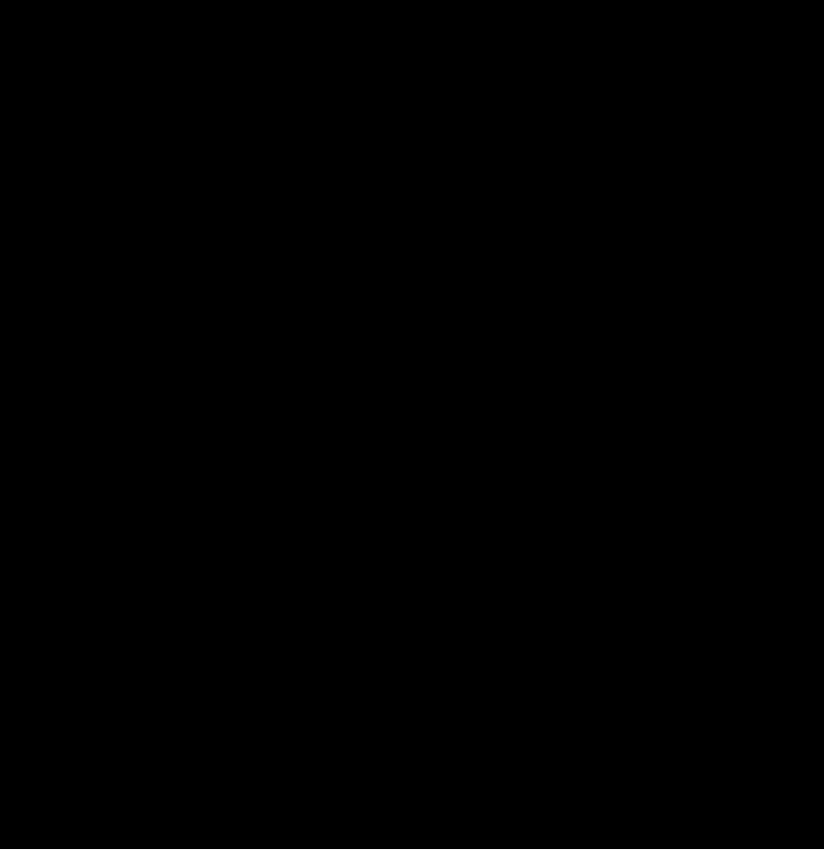
SUBJECT/EXAM: EMBEDDED SYSTEMS

DURATION: 3 Hours

Read carefully the instructions on page 1 & 2.

FOR EXAMINER'S USE ONLY

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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: SOFTWARE PROGRAMMING AND EMBEDDED SYSTEMS

SUBJECT/EXAM: EMBEDDED SYSTEMS

DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES (QUESTION PAPER)

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

Note:

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

SECTION A: Attempt all questions

(55 marks)

- 01. a)** What is the purpose of a resistor in a circuit? **(4marks)**
- (i) To increase the flow of electrical current
 - (ii) To decrease the flow of electrical current
 - (iii) To store electrical energy
 - (iv) To amplify electrical signals
- b)** What is the unit of resistance?
- (i) ohm
 - (ii) watt
 - (iii) volt
 - (iv) ampere
- 02.** What is the purpose of a capacitor in an electronic circuit? **(4marks)**
- 03. a)** What does LED stand for? **(4marks)**
- (i) Light Emitting Diode
 - (ii) Laser Emitting Diode
 - (iii) Light Emitting Device
 - (iv) Laser Emitting Device
- b)** Which of the following is a common application of LEDs?
- (i) Heating water
 - (ii) Cooking food
 - (iii) Lighting rooms
 - (iv) Cooling air
- 04. a)** Which of the following is a type of digital logic gate? **(4marks)**
- (i) Transistor
 - (ii) Capacitor
 - (iii) Resistor
 - (iv) XOR
- b)** Which of the following is a characteristic of volatile memory?
- (i) It retains data even when power is removed
 - (ii) It is slow to access
 - (iii) It loses data when power is removed
 - (iv) All the above

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05. a) What is a p-type semiconductor? **(4marks)**

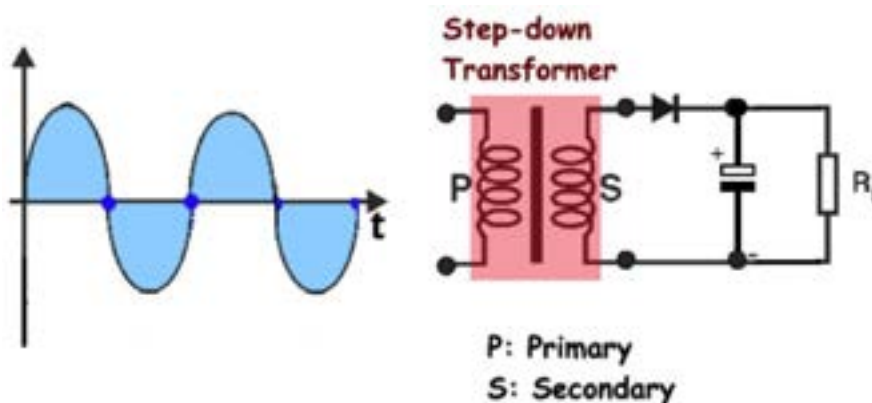
- (i) A semiconductor with a positive charge carrier
- (ii) A semiconductor with a negative charge carrier
- (iii) A semiconductor with both positive and negative charge carriers
- (iv) A semiconductor with no charge carriers

b) What is an n-type semiconductor?

- (i) A semiconductor with a positive charge carrier
- (ii) A semiconductor with a negative charge carrier
- (iii) A semiconductor with both positive and negative charge carriers
- (iv) A semiconductor with no charge carriers

06. How does a full-wave rectifier differ from a half-wave rectifier? **(4marks)**

07. The diagram below shows what the AC signal looks like before adding the transformer, the rectifier, and the smoothing capacitor. **(4marks)**



Draw the resulting signal across the load R_L

08. What is the difference between a general-purpose computer and an embedded system? **(4marks)**

09. a) What is the purpose of the LiquidCrystal.h library? **(4marks)**

- (i) To interface with I2C devices
- (ii) To control servo motors
- (iii) To read analog sensors
- (iv) To control an LCD display

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b) What is an Arduino library?

- (i) A collection of pre-written code that can be used to extend the functionality of an Arduino board
- (ii) A hardware component that can be attached to an Arduino board to add new features
- (iii) A type of sensor that can be used with an Arduino board
- (iv) A program that is used to compile and upload code to an Arduino board

10. Rewrite the code below, making the optimization if any is needed. **(4marks)**

Explain how your re-written code is optimized

```
#define led 6  
#define relayPin 7  
void setup() {  
  pinMode(relayPin, OUTPUT);  
}  
void loop(){  
  digitalWrite(relayPin, HIGH);  
  delay(500);  
}
```

11. What is the function of the MOSI line in an SPI system? **(4marks)**

12. a) What is the main goal of computer vision? **(4marks)**

- (i) To enable computers to see and understand the visual world
- (ii) To make computers faster and more efficient
- (iii) To create virtual reality environments
- (iv) To develop new hardware devices

b) What is OpenCV?

- (i) A software library for computer vision and machine learning
- (ii) A programming language
- (iii) An operating system
- (iv) A hardware device

13. What does RFID stand for, and how does it work? **(4marks)**

14. How does an HTTP request differ from an HTTP response? **(3marks)**

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Section B: Attempt any three (3) questions

(30 marks)

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- 15.** What is a broker in MQTT? **(10marks)**
 - 16.** Illustrate with the help of a diagram how FOUR IoT devices connected in a full mesh topology connect to the internet through a gateway. **(10marks)**
 - 17.** With the help of a diagram explain how you would connect two microcontrollers using I2C protocol one being a master and another being a slave. **(10marks)**
 - 18.** What is the difference between supervised and unsupervised learning in Machine Learning? **(10marks)**
 - 19.** Explain any two (2) disadvantages of deploying a PC as an embedded system. **(10marks)**

Section C: Attempt only one (1) question

(15 marks)

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- 20.** How might you adapt an existing OCR system to recognize text that is distorted or skewed due to perspective or other geometric transformations. **(15marks)**
 - 21.** How do you connect the ESP8266 to a Wi-Fi network? **(15marks)**

END OF ASSESSMENT

**Do not
write in
this margin**

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