



**ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO  
STATE  
FACULTY OF ENGINEERING  
DEPARTMENT OF COMPUTER ENGINEERING**

**FIRST SEMESTER EXAMINATION, 2020/2021 ACADEMIC SESSION**

**COURSE TITLE: EMBEDDED SYSTEM DESIGN                      3 UNITS**

**COURSE CODE: ECE 513**

**EXAMINATION DATE: MARCH 2020**

**COURSE LECTURER: PROF A. O. OLUWATOPE**

**HOD's SIGNATURE**

**TIME ALLOWED: 3 HOURS**

**INSTRUCTIONS:**

1. ANSWER FOUR QUESTIONS ONLY, QUESTION ONE IS COMPULSORY.
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

### QUESTION #1 (Compulsory)

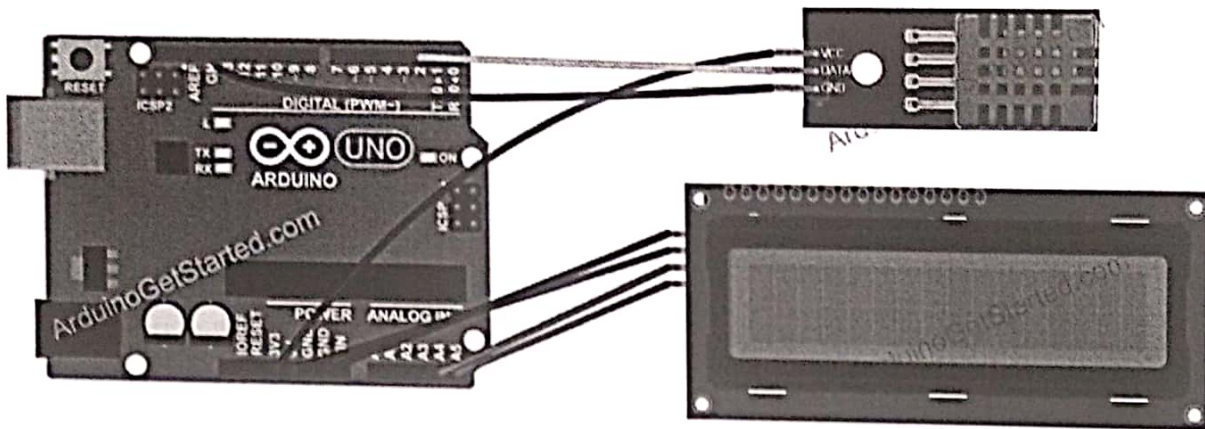


Figure 1.0 Room Temperature and Humidity Sensing Using Arduino Uno

- a. Figure 1.0 above illustrates the connections of DHT11 sensor and Liquid Crystal Display (LCD) to Arduino Uno board. Write a complete code for the Microcontroller on the board to capture and display the values of the Room Temperature and Humidity on LCD. [8 marks]
- b. State and describes any six (6) features of an Arduino Uno. [3 marks]
- c. Describe the use of the following functions with examples in Arduino IDE: [4 marks]
  - i. `pinMode()`
  - ii. `digitalWrite()`
  - iii. `digitalRead()`
  - iv. `Serial.println()`

### QUESTION #2

- a. Briefly discuss the followings:
  - i. Asynchronous Event-Driven Program [2 marks]
  - ii. Real Address Space Process Model [2 marks]
  - iii. Interrupt Latency [2 marks]
  - iv. Priority Inheritance [2 marks]
  - v. Process Control Block [2 marks]
- b. Highlight the design principle of Real-time operating system [4 marks]
- c. Mention the advantages of microprocessor over custom logics and FPGAs in the design of digital systems. [1 mark]

### QUESTION #3

- a. Discuss extensively the ARM processor from the processor mode perspectives. [10 marks]
- b. Discuss the steps involved in handling exception in ARM processor. [5 marks]

### QUESTION #4

- a. What is an embedded system? Describe the components of embedded system? [3 marks]
- b. What are the three (3) common design metric for embedded system? [3 marks]
- c. Briefly describe instruction sets and list the characteristics of instruction sets. [4 marks]

- d. What is your understanding of “Harvard Architecture” and “Von Neumann Architecture”? Which of these architecture is most predominantly used in digital signal processing and why? [5 marks]

**QUESTION #5**

- a. What do you understand by “hard deadline” and “soft deadline” for a real time system? Give an example of both. [4 marks]
- b. In what ways CISC and RISC processor s differ? [4 marks]
- c. Discuss Real time operating system [2 marks]
- d. Draw the Data Flow Graph for the following basic expressions. [5 marks]

$$x = a * b + 5 * (c - d)$$

**QUESTION #6**

- a. Draw a state machine or diagram to describe the behavior of a simple car seat belt controller.  
The controller’s job is to turn on a buzzer if a person sits in a seat and does not fasten the seat belt within a fixed amount of time. This system has three inputs and one output. The inputs are a sensor for the seat to know when a person has sat down, a seat belt sensor that tells when the belt is fastened, and a timer that goes off when the required time interval has elapsed. The output is the buzzer. [10 marks]
- b. Using the following set of processes as described in Table 1 and their characteristics, explain the principle of Rate-Monotonic scheduling used in scheduling these processes. [5 marks]

Table 1: Process Scheduling

| Process | Execution time | Period |
|---------|----------------|--------|
| P1      | 1              | 4      |
| P2      | 2              | 6      |
| P3      | 3              | 12     |