LAIKIPIA UNIVERSITY

UNIVERSITY EXAMINATIONS

1ST SEMESTER 2022/2023 ACADEMIC YEAR

FOURTH YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (COMPUTER SCIENCE)

COMP 418: MICROCONTROLLER BASED DESIGN

STREAM: R ***TIME: 2 HRS***

DAY: MONDAY [11.30AM – 13.30] ***DATE: 19/12/2022***

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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INSTRUCTIONS TO CANDIDATES:

This paper consists of Five Questions.

Question ONE is Compulsory. Answer Question one and any other two questions.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

QUESTION ONE (Compulsory, 30 marks).

(a) Explain the fundamental differences between a microprocessor and a microcontroller citing the major application areas of microcontrollers **(4 marks)**

(b) What are the salient features of: **(4 marks)**

i) Integrated circuit (I^2C) bus
ii) Harvard architecture.
iii) a memory-mapped I/O.

(c) List out some of ARM development tools **(4 marks)**

(d) Explain how context saving and retrieval is done during Interrupts? **(4 marks)**

(e) Below is a four instruction of PIC microcontroller. State the operation being performed by each line. **(4 marks)**

```
MOVLW 25H;
ADDLW 0X34;
ADDLW;
ADDLW
```

(f) What are the pipeline stages in five stage pipeline? **(3 marks)**

(g) There are two methods of communication between the microcontroller and external system: Polling and Interrupt. Explain **(4 marks)**

(h) A microcontroller with an eight-bit counter/timer system is used to measure the width of an input pulse. The microcontroller has been programmed to measure the time of occurrence of rising and falling edges of an input pulse on a certain I/O pin. If the microcontroller uses a 10 MHz clock and the count values observed at the time of occurrence of rising and falling edges of the input pulse are FE and 9A (in hex), determine the pulse width as measured by the microcontroller. **(3 marks)**

QUESTION TWO (20 marks)

(a) Briefly explain and draw the architecture of PIC16CXX microcontroller **(5 marks)**

(b) Explain how the instruction is pipelining is implemented in PIC **(5 marks)**

(c) Briefly explain the instruction set of PIC microcontroller. **(5 marks)**

(d) Explain in detail about any two addressing mode of PIC microcontroller. **(5 marks)**

QUESTION THREE (20 marks)

(a) Name any two types of ADCs?What is the difference between A/D and D/A converters? **(5 marks)**

(b) Explain features of RISC architecture that were used in ARM architecture. **(5 marks)**

(c) With neat sketch, explain the functional block diagram of ARM processor. **(5 marks)**

(d) Explain the internal ALU implementation of ARM6 ALU organization. **(5 marks)**

QUESTION FOUR (20 marks)

(a) With neat sketch, explain the 3-Stage pipeline ARM organization. **(5 marks)**

(b) Explain how ARM instruction execution is done in ARM processor. **(5 marks)**

(c) Define the term buffer data and write back in 5 stage pipeline. **(5 marks)**

(d) Explain briefly about ARM programmer's model. **(5 marks)**

QUESTION FIVE (20 marks)

(a) What is Interrupt? Explain the interrupt structure of PIC microcontroller with neat diagram. **(5 marks)**

(b) Briefly explain the timer modules in PIC microcontroller. **(5 marks)**

(c) Discuss in detail of I^2C - bus in PIC Microcontroller **(5 marks)**

(d) Explain briefly about keyboard interfacing with PIC microcontroller **(5 marks)**