

UGANDA MARTYRS UNIVERSITY

FACULTY OF SCIENCE

**DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION
SYSTEMS**

END OF SEMESTER TWO EXAMINATION

ACADEMIC YEAR 2022/2023

COURSE	:	BACHELOR OF SCIENCE IN COMPUTER SCIENCE
CLASS/YEAR	:	THREE
EXAM	:	EMBEDDED SYSTEMS
CODE	:	CSC 3107
SEMESTER	:	THREE
DATE	:	19TH MAY 2023
TIME	:	9:30 – 12:30 PM
DURATION	:	3 HOURS

Instructions

- 1. This exam consists of 7 questions, but you are only required to attempt 5 questions.*
 - 2. All questions carry equal marks.*
 - 3. You have a total of 3 hours to complete the exam.*
 - 4. Answer all questions in the answer booklet provided.*
 - 5. Write your answers clearly and legibly.*
 - 6. Ensure that you have written your name and student Registration number on the answer booklet.*
 - 7. You are not allowed to communicate with other students during the exam.*
- If you have any questions during the exam, please raise your hand and the invigilator will assist you.*
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Question One

- (a) Explain the classification of embedded systems based on their size. Clearly give real-world examples for each category. (10 marks)
- (b) With examples, give the applications of embedded systems. (10 marks)

Question Two

- (a) Explain in detail the differences between CISC and RISC architectures in embedded systems, including their design philosophies and performance characteristics. (10 marks)
- (b) With the aid of an illustration, describe the following
 - (i) Von-Neumann Architecture (5 marks)
 - (ii) Harvard architecture (5 marks)

Question Three

- (a) Discuss the different stages involved in the design process of an embedded system. (10 marks)
- (b) Name 4 tools used in programming embedded systems. (4 marks)
- (c) Briefly name six of the major components of an embedded system. (6 marks)

Question four

- (a) Describe the following as used in embedded systems (20 marks)
 - (i) Real time operating system (RTOS)
 - (ii) Actuator
 - (iii) Watchdog timer, give an application of the watchdog timer
 - (iv) Synchronous Data Transmission and Asynchronous Data Transmission
 - (v) ROM and EPROM

Question five

- (a) Write a program in C language to blink an LED connected to a microcontroller pin using a delay loop. Mention any assumptions for your program. (10 marks)
- (b) Briefly explain how the blinking led program can be modified for use with traffic lights. (6 marks)
- (c) Discuss any two number systems used in embedded systems. (4 marks)

Question Six

- (a) Explain the concept of a "producer-consumer problem" in embedded systems, including its importance in managing the communication between threads. (10 marks)
- (b) Discuss the implementation of a FIFO queue in embedded systems, including the use of circular buffers, linked lists, and other data structures. (10 marks)

Question Seven

- (a) Explain the concept of Analog-to-Digital Conversion (ADC) in embedded systems (5 marks)
- (b) Why is it important to convert Analog Signals to Digital Signals in embedded systems? (5 marks)
- (c) Discuss the challenges and limitations of ADCs in embedded systems. (10 marks)

END, GOOD LUCK