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University Examinations 2023/2024

THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF COMPUTER TECHNOLOLOGY

CIC 3350: EMBEDDED SYSTEMS DEVELOPMENT

DATE: APRIL 2024 **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Highlight the classification of embedded systems based on the following giving examples where possible
   i. Generation (3 Marks)
   ii. Complexity (3 Marks)
   iii. Triggering (3 Marks)

b) Define what an embedded system is and explain why it is considered application and domain specific (3 Marks)

c) Explain the concept of distributed embedded systems and describe how multiple embedded units work together to achieve a common goal (4 Marks)

d) Describe the different types of Random Access Memory (ROM) used in embedded systems, including their characteristics, applications, programmability and re-programmability ability (4 Marks)

e) Elaborate the concept of the Real Time Kernel in an RTOS and discuss the essential functions performed by the Real Time Kernel to ensure real-time responsiveness and reliability (4 Marks)

f) Describe three operational quality attributes of embedded systems and explain why they are important for ensuring the reliability and efficiency of embedded systems in various applications (6 Marks)

QUESTION TWO (20 MARKS)

a) Compare and contrast the features of flash memory with other types of non-volatile memory used in embedded systems (4 Marks)

b) Explore three significant aspects of memory selection in the design of embedded systems (6 Marks)

c) Discuss three typical non-functional requirements in embedded system design, providing examples for each requirement (6 Marks)

d) Explain why considering non-functional requirements is essential for designing embedded systems effectively (4 Marks)

QUESTION THREE (20 MARKS)

a) With help of a well labeled diagram, write short notes on the following

i. I^2C (3 Marks)

ii. SPI (3 Marks)

iii. 1-Wire interface (3 Marks)

b) Differentiate between wired and wireless communication interfaces, and offer examples of each (3 Marks)

c) Discuss two major privacy and security issues during design and implementation of embedded systems (4 Marks)

d) Explain how stepper motors function and compare their operation to that of DC motors. Then, explore common applications of stepper motors within embedded systems (4 Marks)

QUESTION FOUR (20 MARKS)

a) List four major characteristics of embedded systems that makes it different from other systems (4 Marks)

b) Using a suitable diagram, differentiate between von-Neumann and Harvard architectures (4 Marks)

c) Discuss three ways in which embedded systems have been used to improve the economy of enterprises worldwide (6 Marks)

d) Write a C program that would turn on a fun if temperature detected from a temperature sensor reaches 30^{o}c (6 Marks)

QUESTION FIVE (20 MARKS)

a) Differentiate between the following

i. Embedded systems and IoT (2 Marks)

ii. WSN and M2M (2 Marks)

iii. Stepper Motor and Servo Motor (2 Marks)

b) Briefly explain the perspectives in which communication interfaces can be viewed in embedded systems. (4 Marks)

a) Discuss the main difference that exist between Wireless Sensor Network (WSN) and Internet of Things (IoT) network (4 Marks)

b) Design a program using a microcontroller to regulate the speed and direction of a DC motor upon the press of a button. Explain the procedural steps required to accomplish this task effectively (6 Marks)