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University Examinations 2024/2025

FOURTH YEAR FIRST SEMESTER FOR THE DEGREE OF BACHELOR OF SCIENCE IN
INFORMATION TECHNOLOGY, BACHELOR OF SCIENCE IN COMPUTER SCIENCE

CCS 3401/CIC 3350: EMBEDDED SYSTEMS

DATE: JANUARY 2025

TIME: 2 HOURS

INSTRUCTIONS: Answer question **ONE** (Compulsory) and any other **TWO** questions

QUESTION ONE (30 MARKS)

- a) Using a simple diagram, explain the following terms
 - i. Integrated Circuit (IC) (2marks)
 - ii. Sensors (2marks)
 - iii. Actuators (2marks)
- b) List four factors to consider while selecting memory requirements for an embedded system while making a basic toy (4marks)
- c) Briefly explain, three types of buses used by embedded systems (3marks)
- d) Define the term embedded systems and give two reasons why they are dedicated to certain applications only (4marks)
- e) Define the term interrupt latency and explain how it can be reduced during embedded systems design (4marks)
- f) Explain three functions of I/O subsystems within an embedded system (3marks)
- g) Describe two basic approaches for the design and implementation of embedded systems firmware (4marks)
- h) State two languages used in embedded systems design (2marks)

QUESTION TWO (20 MARKS)

- a) Using a diagram, compare von-Neumann and Harvard architecture (6marks)
- b) Explain the following operational quality attributes in various embedded systems
 - i. Response (2marks)
 - ii. Throughput (2marks)
- c) Discuss Two application areas of embedded systems (4 marks)
- d) Using a well labelled diagram, discuss the key components that makes up a typical embedded system (6 Marks)

QUESTION THREE (20 MARKS)

- a) Differentiate the following as used in embedded systems
 - i. I/O subsystem and Microcontroller (2Marks)
 - ii. Verification and Validation (2Marks)
 - iii. RISC and CISC architecture (2 Marks)
- b) A micro controller forms part of the core of the embedded system, explain four important considerations that that you would make while choosing the right microcontroller for your final year project (8 marks)
- c) Differentiate between Interrupt and Direct Memory Access (DMA) in embedded systems. In addition, explain how latency in both interrupt and DMA can be reduced during embedded system design. (6Marks)

QUESTION FOUR (20 MARKS)

- a) Using a diagram, explain the following concepts
 - i. 1 Wire Interface (3 Marks)
 - ii. Havard Architecture (3 Marks)
 - iii. Von Neuman Architecture (3 Marks)

b) Explain how LoRa technology and the LoRaWAN protocol can be effectively applied in a smart agriculture application (5 Marks)

c) Define the term operational quality of a system and further, discuss two operational quality attributes commonly associated with embedded systems for real-world applications (6Marks)

QUESTION FIVE (20 MARKS)

a) Explain the codes as used in assembly language

- i. MOV A.#30 (1 mark)
- ii. LOAD RI, x (1 mark)
- iii. STORE R2, Y (1 mark)

b) Using a sketch diagram, discuss the two types of Endianness (4marks)

c) Explain the term Real Time Operating System(RTO) and discuss the two types of RTOs (5marks)

d) Explain four key units that makes up a Digital Signal Processor (DSP) (4marks)

e) Briefly discuss the reconfigurable logics as used in programmable logic devices (PLDs) (4marks)