



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

**FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE IN COMPUTER ENGINEERING**

SSE 310 : EMBEDDED SYSTEMS ANALYSIS AND DESIGN

DATE: THURSDAY 25TH NOVEMBER 2010 TIME: 8.00 A.M. - 10.00 A.M.

INSTRUCTIONS

Answer Question 1 and any other TWO.

QUESTION 1

- a. Define an Embedded Systems. 2 marks
- b. With an aid of a block diagram, describe the hardware components of embedded systems. 8 marks
- c. Define a microcontroller. 2 marks
- d. In order to be able to compare different embedded systems designs and approaches, there is need to be pre-defined, system independent metrics. Describe the technical metrics and or economical metrics that are normally used. 8 marks
- e. Define the following terms as they apply to embedded systems: 3 marks
 - i. Standard general purpose processors (SGPP)
 - ii. Standard Single Purpose Processors (SSPP)
 - iii. Custom Single Purpose Processors (CSPP)
 - iv. Application Specific Instruction Set Processors (ASIP) 4 marks

f. Explain the following design requirements of an embedded system, bringing out the design challenge posed by each.

- i. Real-time /reactive operation
- ii. Small size/ low weight
- iii. Safe and reliable

3 marks

QUESTION 2

a. Explain the use of the following features used in microcontrollers firmware development cycle:

- i. Assemblers
- ii. Linkers
- iii. Librarians
- iv. Debuggers

4 marks

b. What are the steps required for converting assembly language into a ROM image?

5 marks

c. Explain the following terms as they apply to embedded systems:

- i. Kernel
- ii. Real-time Operating System (RTOS)

4 marks

d. Describe the main features of DSP (Digital Signal Processor).

3 marks

e. Hardware/Software co-design methodology becomes popular for embedded systems. Discuss basic ideas behind this methodology and compare it to a traditional design methodologies.

4 marks

QUESTION 3

- a. Define a watchdog timer. 2 marks

- b. Give two examples for each of the following types of embedded systems:
 - i. Small scale embedded systems
 - ii. Medium scale embedded systems
 - iii. Sophisticated scale embedded systems. 3 marks

- c. Explain the basic characteristics of embedded systems and discuss their specific design process challenges. 9 marks

- d. Design process is often controlled by the time-to-market requirement. Explain this requirement and possible consequences on the design methodology. 6 marks

QUESTION FOUR

- a. Discuss differences and similarities between embedded systems and general purpose workstations, desktop computers and portable computers. 5 marks

- b. Describe a general idea of Petri nets? How they can be used to model parallel activities. 4 marks

- c. Draw simple graph representation of Petri nets and explain how it works. 5 marks

- d. Explain any three most common embedded software architectures that you know. 6 marks

QUESTION FIVE

- a. Write short notes on the following development methods:
 - i. (Hierarchical Object Oriented Design)HOOD
 - ii. Avionics Architecture Description Language(AADL)
 - iii. Unified Modeling Language (UML) 6 marks

- b. Input to a system design is usually defined as system specifications and a set of functional and non-functional requirements. Discuss system specification methods as well as different types of requirements. 4 marks

c. Explain the ideas behind the following design flow models:

- i. Waterfall model,
- ii. Spiral model,
- iii. Top-down model,
- iv. Bottom-up model.

10marks