

SULIT



Second Semester Examination
2017/2018 Academic Session

May/June 2018

EES 501 – EMBEDDED SYSTEMS DESIGN

Duration : 2 hours

Please check that this examination paper consists of **FOUR (4)** pages printed material before you begin the examination.

Instructions: This question paper consists **THREE (3)** questions. Answer **THREE (3)** questions. All questions carry the same marks.

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1. (a) Figure 1 shows a DMA controller a used in certain application. Answer the following questions:
 - (i) What is the function of the DMA controller? (10 marks)
 - (ii) Explain the operating sequence of the DMA controller. (10 marks)
 - (iii) What will happen if the DMA controller is not used in that application? (10 marks)
 - (iv) State one application of DMA controller. (10 marks)

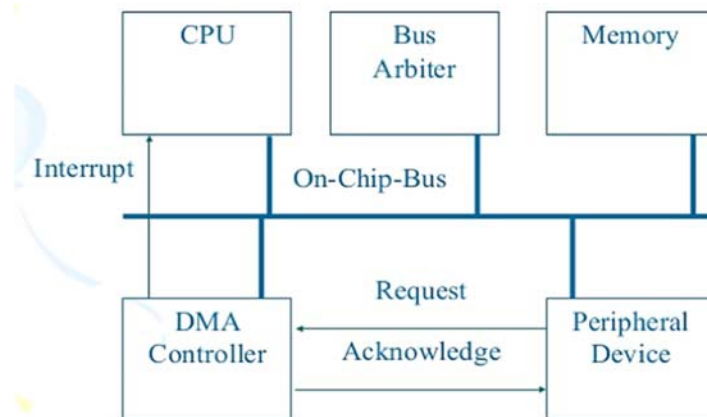


Figure 1

- (b) Figure 2 shows the general architecture of Zynq device. It comprises of two sections, which are Processing System (PS) and Programmable Logic (PL).
 - (i) What is advantage of each component, PS and PL? (10 marks)
 - (ii) How the PS and the PL is connected? (10 marks)

- (iii) What is the difference between interface and interconnect?
(10 marks)

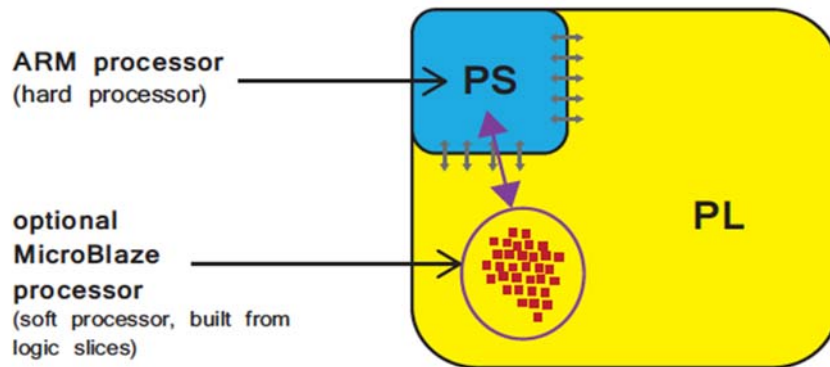


Figure 2

- (c) One cache memory can hold 64Kbytes. Data are transferred between main memory and the cache in blocks of 4 bytes each. The size of the main memory is 32Mbyte. The cache memory uses Direct Mapping technique.
- (i) How is the memory address divided into tag, line number and byte number?
(15 marks)
- (ii) Into what line would bytes of the following address
1111011101101100110001001 be stored?
(15 marks)
2. (a) Given that I/O events for a particular system is to be serviced via polling, explain the following:
- (i) Under what conditions is polling considered the best choice for I/O processing?
(8 marks)

- (ii) State two (2) limitations of Polling compared to Interrupt-based I/O handling
(16 marks)
- (b) The Linux operating system is increasingly used to control embedded systems and hardware I/O devices.
- (i) State two (2) different paradigms for accessing hardware I/O devices in the Linux environment, and explain three (3) characteristics of each approach.
(64 marks)
- (ii) Explain briefly the role of the Linux Device Tree in hardware platform configuration.
(12 marks)
3. Given that a Zynq 7000-based system has an I/O device in the FPGA which generates hardware interrupts that are managed by the Generic Interrupt Controller (SCUGIC).
- (a) What is the function of the SCUGIC? State three (3) tasks that the SCUGIC performs in the Zynq-7000 SoC.
(36 marks)
- (b) Draw a diagram to illustrate the interrupt service routine hierarchy connecting the ARM MCU with the SCUGIC and the I/O Block.
(32 marks)
- (c) Describe the sequence of steps taken by the various hardware blocks (I/O device block, SCUGIC, ARM core) when an event generated by the I/O block is being propagated from the I/O device to the CPU, explaining how the hardware block knows the appropriate routine to call.
(32 marks)

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