ADVANCED MICROCONTROLLERS (19EC4110) QUESTION BANK

UNIT –I

1. a) Define embedded system. **[CO1][L1][2M]**
   b) Explain the different classifications of embedded systems. Give an example for each. **[CO1][L2][10M]**
2. a) Mention the key components of a typical embedded system. **[CO3][L2][2M]**
   b) With the help of neat block diagram, explain architecture of embedded system. **[CO1][L1][10M]**
3. a) Describe the role of memory and interrupt controllers in an embedded system. **[CO5][L2][8M]**
   b) Mention various applications of embedded systems. **[CO1][L1][4M]**
4. a) With a neat sketch, explain the process involved in embedded system design and development life cycle. **[CO5][L2][9M]**
   b) Explain the importance of RTOS in an embedded system. **[CO1][L2][3M]**
5. a) Draw and explain about various core components of ARM-based embedded device. **[CO5][L2][9M]**
   b) Write a short note on ARM Bus technology. **[CO1][L1][3M]**
6. a) List out the four major design rules to implement the RISC philosophy. **[CO5][L1][2M]**
   b) Compare RISC and CISC design architectures with suitable block diagrams. **[CO1][L2][6M]**
   c) Explain in brief about the ARM design philosophy. **[CO1][L2][4M]**
7. a) Describe the memory characteristics related to embedded systems. **[CO5][L2][8M]**
   b) Explain in brief about the AMBA bus protocol. **[CO1][L2][4M]**
8. a) Analyze the structures of SRAM & DRAM and based on that mention their merits, demerits, and applications. **[CO5][L5][8M]**
   b) Explain in brief about the AMBA bus protocol. **[CO1][L2][4M]**
9. a) Justify how ARM instruction set is suitable for embedded applications. **[CO5][L5][6M]**
   b) Mention the need for embedded software. **[CO1][L1][2M]**
   c) Describe the operation of initialization (boot) code with an example **[CO1][L2][4M]**
10. a) Describe how the memory architecture effects the performance of cache and tightly coupled memory in ARM-based embedded systems. **[CO5][L2][6M]**
    b) Mention the need for memory management unit in embedded systems. **[CO1][L1][4M]**
    c) Write a short note on coprocessor. **[CO1][L1][2M]**
11. a) Explain the nomenclature of ARM processor family. **[CO5][L2][4M]**
    b) Compare various ARM processor families. **[CO1][L2][8M]**

UNIT-II

1. a) With the help of a neat diagram, explain the ARM core dataflow model. **[CO1][L2][6M]**
   b) Mention the need of a register in a processor or controller. **[CO2][L1][2M]**
   c) List and explain the registers available in user mode of a ARM device. **[CO2][L2][4M]**
2. a) Draw and explain current program status register of ARM processor. **[CO2][L2][5M]**
   b) Summarize the complete register set of ARM processor. **[CO1][L2][7M]**
3. a) Compare ARM and Thumb Instruction sets **[CO3][L2][4M]**
   b) List the features of Jazelle instruction set. **[CO3][L1][2M]**
   c) What is pipelining in a processor? Explain in brief about various stages of pipelining in ARM processors. **[CO3][L2][6M]**

4. a) Describe the pipeline executing characteristics in an ARM processor with necessary diagrams and examples. **[CO2][L2][6M]**
   b) Explain about exceptions, interrupts and the vector table in an ARM processor. **[CO1][L2][6M]**
5. Explain the following ARM instructions with an example **[CO2][L2][12M]**
   i) Move ii) Comparison iii) Multiply
6. a) Describe the operation of the Barrel shifter in ARM data processing instructions with an example **[CO2][L2][8M]**
   b) Explain ARM processor branch instructions with an example. **[CO1][L2][4M]**
   c) Mention various operating modes of ARM processor. **[CO1][L1][2M]**
7. Explain the following Thumb instructions with an example **[CO2][L2][12M]**
   i) Stack ii) Software interrupt iii) Single register load-store iv) Multiple register load-store
8. a) Justify how thumb instruction set has better performance than 16-bit ARM processor. **[CO2][L5][4M]**
   b) Explain in brief about ARM-THUMB Internetworking **[CO1][L2][4M]**
   c) Summarize various operating modes of ARM processor. **[CO1][L2][4M]**
9. a) Write a short note on thumb register usage **[CO2][L2][3M]**
   b) Explain Thumb instruction set based branch instructions of ARM processor with an example. **[CO1][L2][4M]**
   c) List various instructions present in Thumb instruction set. **[CO1][L1][5M]**
10. a) With an example each, explain the Thumb data processing instructions **[CO2][L2][9M]**
    b) With an example, explain stack instruction in ARM instruction set. **[CO1][L2][3M]**

UNIT-III

1. a) Demonstrate by writing a C program to check for errors in a data packet during the transmission of 64-bit data using TCP/IP protocol. **[CO3][L6][6M]**
   b) Describe how to use C data types efficiently for ARM processor programming. **[CO3][L5][6M]**
2. a) Explain the concept of loop unrolling in C language with an example. **[CO3][L2][7M]**
   b) Describe how to write loops efficiently in C language for ARM processor. **[CO3][L5][5M]**
3. Explain the following C looping structures with an example. **[CO3][L1][12M]**
   i) Loops with a fixed number of iterations ii) Loops with a variable number of iterations
4. a) With suitable examples, describe how ARM Thumb Procedure Call Standard(ATPCS) defines passing function arguments and return values in ARM registers **[CO3][L2][9M]**
   b) Describe how to call functions efficiently in C language for ARM processor. **[CO3][L5][3M]**
5. a) What is Pointer aliasing in C language? Explain the same with an example. **[CO3][L2][9M]**
   b) Mention the points to be considered to avoid pointer aliasing **[CO3][L1][3M]**
6. a) Describe how ARM processor registers are allocated by ARM C compilers. **[CO3][L2][9M]**
   b) Mention the points to be considered for efficient register allocation. **[CO3][L1][3M]**
7. a) Summarize the points on how to arrange the structures in ARM efficiently. **[CO3][L2][3M]**
   b) What are the issues concerning structures on the ARM? Explain how ARM compilers align structures with an example. **[CO3][L2][9M]**
8. a) Write a short note on floating-point arithmetic unit in ARM processor. **[CO3][L2][3M]**
   b) List the rules which summarizes the cycle timings for common instruction classes on the ARM processor and explain how ARM processor performs operations in parallel. **[CO3][L1][9M]**
9. a) Describe the conditional execution of instructions by ARM processor with an example **[CO3][L2][7M]**
   b) Explain with an example, how decrementing loops can be implemented efficiently on ARM processors. **[CO3][L1][5M]**
10. Explain the efficient implementation of the following loop structures on ARM processors with an example each
    (i) Unrolled counted loops **[CO3][L2][6M]**
    (ii) Multiple nested loops **[CO3][L2][6M]**

UNIT-IV

1. Explain the following registers of MSP430 μC:
   (i) Program Counter **[CO2][L2][3M]**
   (ii) Stack Pointer **[CO2][L2][4M]**
   (iii) Status Register **[CO2][L2][5M]**
2. a) Write a short note on general purpose registers of MSP430 μC. **[CO2][L2][2M]**
   b) Mention the purpose of constant generator in MSP430 μC. **[CO2][L1][2M]**
   c) Explain arithmetic and logic instructions of MSP430 μC with an example each. **[CO2][L2][8M]**
3. a) Define addressing mode. **[CO3][L2][2M]**
   b) Explain various addressing modes of MSP430 μC with an example **[CO5][L2][10M]**
4. Explain the following instructions of MSP430 μC with an example each
   (i)Movement Instructions **[CO5][L2][3M]**
   (ii)Shift and Rotate Instructions **[CO5][L2][4M]**
   (ii)Flow of control Instructions **[CO5][L2][5M]**
5. a) Mention the need of a reset in microprocessor or microcontroller. **[CO2][L5][2M]**
   b) Explain various types of resets associated with MSP430 μC. **[CO5][L2][10M]**
6. a) Mention the need of a clock in microprocessor or microcontroller. **[CO2][L5][2M]**
   b) With a neat sketch, elaborate the clock system of MSP430 μC. **[CO5][L2][10M]**
7. a) Explain how CPU will handle the interrupts and execution of ISR. **[CO2][L2][8M]**
   b) Summarize the issues associated with interrupts. **[CO2][L2][4M]**
8. a) Write a short note on instruction formats of MSP430 μC. **[CO5][L2][2M]**
   b) Describe how MSP430 μC can be operated in various low-power modes**.** **[CO5][L2][10M]**
9. a) Describe the switch problem associated with switches. **[CO2][L2][2M]**
   b) Explain various de-bouncing solutions to avoid the effects of switch bounce **[CO2][L2][10M]**
10. Describe the operation of the following peripherals of MSP430 μC.
    (i) Watchdog timer **[CO5][L2][6M]**
    (ii) Real-time clock **[CO5][L2][6M]**
11. a) Mention the need of pull-up/pull-down resistor in any processor or controller. **[CO2][L2][2M]**
    b) With a neat sketch explain the operation of timers in MSP430 μC. **[CO5][L2][10M]**

UNIT-V

1. Summarize the following communication mechanisms of MSP430 μC.
   (i) Universal Serial Interface **[CO5][L2][3M]**
   (ii) Universal Serial Communication Interface. **[CO5][L2][4M]**
   (iii) Universal Synchronous/Asynchronous Receiver/Transmitter **[CO5][L2][2M]**
   (ii) Bit-Banging **[CO5][L2][3M]**
2. a) Explain the serial peripheral interface in detail. **[CO6][L2][6M]**
   b) With a neat sketch describe how the serial peripheral interface can be implemented in the Universal Serial Interfaceof MSP430 μC. **[CO5][L2][6M]**
3. a) Explain the operation of Inter-integrated Circuit Bus in detail. **[CO6][L2][6M]**
   b) With a neat sketch describe how the serial peripheral interface can be implemented in the Universal Serial Communication Interface of MSP430 μC. **[CO5][L2][6M]**
4. With a neat sketch describe how the Inter-integrated Circuit Bus can be implemented in the following communication peripherals of MSP430 μC.
   (i) Universal Serial Interface **[CO5][L2][6M]**
   (ii) Universal Serial Communication Interface. **[CO5][L2][6M]**
5. Design a temperature measuring device by using the serial peripheral interface or Inter-Integrated circuit bus of MSP430μC and explain its operation. **[CO2][L6][12M]**
6. a) Mention the merits, demerits and applications of serial and parallel communications **[CO6][L2][6M]**

b) Explain the principle operation of asynchronous serial communication with necessary diagram **[CO6][L2][6M]**

7. With necessary diagrams, describe the implementation of asynchronous serial communication with USCI_A of MSP430μC. **[CO6][L2][12M]**
8. a) Mention the need of software UART in a system. **[CO6][L2][2M]**
   b) Describe the implementation of software UART using Timer A in MSP430 μC.**[CO5][L2][10M]**
9. Write an Embedded C programs for the following requirements using MSP430FR5969 development platform
   a) Blink the onboard RED LED (connected to P4.6) and GREEN LED(connected to P1.0) alternatively using GPIO. **[CO6][L6][6M]**
   b) Blink the onboard GREEN LED(connected to P1.0)whenever button (connected to P.1.1) is pressed and OFF when released using GPIO. **[CO6][L6][6M]**
10. a) Write an Embedded C program to blink onboard RED LED (connected to P4.6) with a delay of 1secusing MSP430FR5969 development platform. **[CO6][L6][5M]**
    b) By writing an Embedded C program, demonstrate how the interrupts are serviced in MSP430 based microcontrollers. **[CO6][L6][7M]**