M.Tech VLSI and Microelectronics

1st Year 2nd Semester Examination

Embedded and Real Time Systems

Session 2023-24

Time : 3 Hours **Full Marks: 100**

Part I

Use different answer scripts for different parts

Answer all questions in order. Marks 50

Answer any 5 questions. **Marks 10x5**

1. a) State the differences between GPOS & RTOS.
   b) What is the ISR or Interrupt Service Routine? State their importance in RTOS. 5+5
2. a) How is task scheduling achieved in RTOS?
   b) What is the Task Scheduling Block and what is its significance? 4+6
3. a) Represent the memory section division in a RAM of a microcontroller system?
   b) State the steps followed when a task is created in a FreeRTOS. Give a sample C code for this. 4+6
4. a) State the differences and similarity between MUTEX and Semaphore.
   b) How is a Race Condition avoided by using a MUTEX? Give an example. 5+5
5. a) What is a nested interrupt?
   b) Show how this routine works with an example. 2+8
6. a) Demonstrate the use of timers in RTOS with an example.
   b) Explain how software timers are different from hardware interrupts. 5+5
7. a) What are deadlock and starvation in an operating system?
   b) State the four conditions that have to be true for a deadlock to happen? 6+4
8. Illustrate the Superloop structure in RTOS with suitable diagram. 10

Part II

Answer question no. 1 & any four from the rest Marks 50

1. *Answer any five*
   5*2=10
   a) What is Watch Dog Timers?
   b) Why diagnostic tools are important in embedded system?
   c) What is status register of PIC microcontrollers? Explain each of the bits of the status register.
   d) Explain the following instruction of PIC:-
      i) decfsz f,d
      ii) SWAPF
   e) Why PIC microcontroller was designed using RISC?
   f) Justify how ARM instruction set is suitable for embedded applications.
   g) Describe an automated breaking system in a car with proper block diagram.

2. a) Explain briefly about typical characteristics of embedded system.
   b) Draw the architecture of an embedded system and explain each of the components.
   [5+5= 10]

3. a) With the help of neat block diagram explain architecture of PIC microcontrollers.
   b) Draw & explain the block diagram of ALU of PIC microcontrollers.
   [7+3= 10]

4. a) Describe the pipeline executing characteristics in an ARM processor with necessary diagrams and examples.
   b) Explain in brief about ARM-THUMB Internetworking.
   [7+3=10]

5. a) Draw and explain current program status register of ARM processor.
   b) Describe briefly about the ARM memory organization.
   [6+4=10]

6. a) How many PIC timers are present in the PIC processor? Explain each of them.
   b) Draw and explain the interrupt timing diagram of PIC.
   c) Write a short note about CCP module.
   [4+4+2=10]

7. a) Draw the block diagram of PWM generation. Discuss the different steps involved for setting up PWM.
   b) What is USART?
   [8+2=10]