Test2_ARM Processor Key Answers

1. **Write Embedded C statements to configure**

(i) Pin 19 of Port 0 as Output and want to drive it High(Logic 1)
(ii) Making output configured Pin 15 High of Port 0 and then Low
(iii) Configuring P0.13 and P0.19 as Output and Setting them High:
(iv) Configuring 1st 16 Pins of Port 0 (P0.0 to P0.15) as Output and Setting them High
(v) Select p0.0 pin TXD3 function among (GPIO/RD1/TXD3/SDA1)

Ans:

(i) LPC_GPIO0->FIODIR |=(1<<19); //P0.19 configured as O/P
LPC_GPIO0->FIOSET |=(1<<19); //P0.19 is HIGH

(ii) LPC_GPIO0->FIODIR |=(1<<15); //P0.15 configured as O/P
LPC_GPIO0->FIOSET |=(1<<15); //P0.19 is HIGH
LPC_GPIO0->FIOCLR |=(1<<15); //P0.19 is LOW

(iii) LPC_GPIO0->FIODIR |= (1<<13) | (1<<19); // P0.13 and P0.19 as O/Ps
LPC_GPIO0->FIOSET |=(1<<13) | (1<<19); //P0.13 and P0.19 are HIGH

(iv) LPC_GPIO0->FIODIR = 0xffff; //P0.0 to P0.15 as O/Ps
LPC_GPIO0->FIOSET = 0xffff; //P0.0 to P0.15 are HIGH

(v) LPC_PINCON->PINSEL0 |=(2<<0); //P0.0 function as TXD3

2. Calculate

(i) The PR value for timer resolution of 1ms on a timer with 25 MHz PCLK
(ii) The delay generated for MR0 value of 2^23 with 100MHz PCLK

Ans:

(i) PR = (PCLK/Timer resolution) – 1
= (25MHz/1ms) – 1
= (25000000/1000) - 1 = 25000 – 1 = 24999

(ii) Delay generated = MR0 (1/PCLK)
=2^23(1/100000000)
= 0.083 second

3. Explain the following

(i) Interrupts (ii) Interrupt latency

Ans: (i)

There are two types of interrupts available on the ARM processor. The first type of interrupt causes an exception raised by an external peripheral—namely, IRQ and FIQ. The second type is a specific instruction that causes an exception—the SWI instruction. Both types suspend the normal flow of a program.

(ii)

Interrupt-driven embedded systems have to fight a battle with *interrupt latency*—the interval of time from an external interrupt request signal being raised to the first fetch of an instruction of a specific interrupt service routine (ISR).

Interrupt latency depends on a combination of hardware and software. System architects must balance the system design to handle multiple simultaneous interrupt sources and minimize interrupt latency. If the interrupts are not handled in a timely manner, then the system will exhibit slow response times.

4. Write an embedded C program

(i) To GLOW LED connected to P0.30 pin when switch connected to P0.7 pin is Pressed

(ii) To LED dimming connected to P1.18 pin using PWM1.1 channel

Ans:

```
#include "lpc17xx.h"

int main(void)
 {
  LPC_GPIO0->FIODIR  |= (1<<30); //P0.30 as O/P
  LPC_GPIO0->FIODIR &=~(1<<7); //P0.7 as I/P

while(1)
   {
     if(!(LPC_GPIO0->FIOPIN & (1<<7));

    {
       LPC_GPIO0->FIOSET |=(1<<30); // if switch is closed, LED ON
   }
        }
```

(iii) #include<stdio.h>

```
#include <lpc17xx.h>
 uint32_t x;
 void delay(uint32_t);
  void PWM_init(void)
          {
          LPC_PINCON->PINSEL3 |= (2<<4);// pwm1.1 , p1.18
          LPC_PWM1->TCR=(1<<0);// enable counter and PWM
          LPC_PWM1->PR=0;//to fix the period of pwm
          LPC_PWM1->MCR=(1<<1);//reset the timer on match
          LPC_PWM1->MR0=500;//24999;//ton+toff = 1ms
          LPC_PWM1->PCR=(1<<9);//PWM enable
 }

          int main (void)
          {
            PWM_init();
            while(1)
            {
            for(x=0;x<=500;x=x+10)
             {
           LPC_PWM1->MR1=x;  //ton,duty cycle = 24999/6250=25%
                                  //ton=12500,duty cycle = 24999/12500=50%
                                 //ton=18750,duty cycle = 24999/18750=75%
           LPC_PWM1->LER=(1<<1);//Enable the bits in LER register to load and latch the new
                                       //match values
                    delay(300000);
             }
            }
          }

          void delay(uint32_t i)
          {
                    uint32_t   a;
                    for(a=0;a<=i;a++);
          }
```