

III SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2019

SUBJECT: MICROCONTROLLER BASED SYSTEM DESIGN [MTE 2153] Time: 3 Hours MAX. MARKS: 50

	Instructions to Candidates:		
	Answer ALL the questions.		
	 Data not provided may be suitably assumed 		
1A	State the various operations performed by the registers in any microcomputers with neat flow diagram.	2	CO1
18	 Develop an ARM assembly language program to perform the following. i. Write a function to compute the square of an unsigned 16 bit number stored in the register R1 and save the result in the register R5. ii. Utilize this function to compute the square of 5 unsigned 16 bit numbers stored in the memory location 0x2000000 onwards. iii. Store the squared number in the memory location 0x20001000 onwards. 	6	CO2
1C	List the ARM Cortex M4 features.	2	CO1
2A	 State the operation of following ARM assembly instruction. a. BLX b. BPL label c. SMULL. 	3	CO2
2B	Differentiate the following with an example. a. CMN and ADDS. b. ROR and RRX. c. ADD and ADDS. d. CMP and SUBS.	4	CO2
2C	Illustrate at least two-bit field instructions available in ARM Cortex M4 Processor.	3	CO2
3A	 Explain the role of following registers in ARM Cortex M4 processor. a. LINK register (LR) or R14 b. STACK POINTER (SP) register or R13 	3	CO2

c. PROGRAM COUNTER (PC) or R15 register.

3B	Write the steps required for baud rate generation in UART communication for a) 115200 using 3MHz clock b) 9600 using 12MHz clock.	5	CO3
3C	Explain memory mapping in ARM Cortex M4 processor and mention the use of code, data, and stack memory.	2	CO2
4A	Develop an embedded C program for MSP432 microcontroller using Timer A to generate a pulse width modulated signal (PWM) with the frequency of 50 Hz and duty cycle set to 40%. Use up mode for timer block and output mode 7 for output block of Timer A0 module. Consider P2.5 (TA0, CCR2) for connecting PWM signal to external device. Use default SMCLK clock settings.	6	CO3
4B	Compare the interrupt generation procedure using timer overflow and capture/compare overflow in a Timer A module.	2	CO3
4 C	Write the importance of OUTMOD bits in Timer-A output block	2	CO3
5A	Develop an embedded C code using MSP432 launch pad for the following application. For an automatic water tank filling system using water level sensors, the valve is opened if the water level decreases by a pre-fixed threshold (25% of the tank) and valve is closed if the water level increases above 90% of the tank. Consider, the sensor connected to P1.1 provides logic low if the water level decreases below 25% of the tank and P1.4 provides logic low when the tank is filled above 90% of the tank. The relay for valve control is connected to pin P2.7. Use interrupts for the port pins P1.1 and P1.4.	6	CO4
5B	State the working of Post and Pre increment with examples in assembly language.	2	CO2
5C	List out the registers available in systick and also show how a delay is generated in systick.	2	CO3