Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2017

SUBJECT: MECHATRONICS SYSTEM DESIGN [MTE 4101]

Time: 3 Hours

MAX. MARKS: 50

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Instructions to Candidates:

- ✤ Answer ALL questions.
- ✤ Missing data may be suitable assumed.
- 1A. Air quality parameter values for five consecutive days this week in Delhi, are stored in the 4 memory locations of an ARM controller. Identify the parameter value for which Delhi was most polluted and store this in R5. Also, store the pollution parameter value in R6.
- **1B.** Elaborate the 5-stage pipeline feature of an ARM processor with a suitable diagram. **4**
- Illustrate the concept of branch speculation with respect to pipelining in an ARM Cortex 2 controller.
- 2A. Construct an ARM assembly level program for following C code C = [(x << 14)/2] + yAssume x and y are stored in registers R1 & R2 respectively. Store result C in memory.
- 2B. What is the challenge faced with market entry for a newly designed embedded system 3 product? Describe the design metric related to this with a neat diagram.
- 2C. Identify the instruction that will perform a reverse subtraction on two numbers. Also, with 4 a neat diagram, describe in detail the data path activity taking place during execution this particular data processing instruction.
- **3A.** A keyboard is interfaced to LPC1768 via USB protocol. Write a high level program to use **4** the 'u' and 'd' keys to make an on-board LED (LED1) brighter or dimmer .
- **3B.** With a neat diagram, list and describe the sequence of operations taking place when **4** implementing an SPI protocol. When is SPI preferred over I2C protocol?
- **3C.** Summarize any four characteristics of Thumb Instruction set.
- 4A. Write an mbed C program to do the following: Consider 4 switches interfaced to 3 LPC1768 controller p5, p7, p15 and p17 Condition 1: if p5 = 1; p7 = 1; p15 = 0; p17 = 0 Onboard LED4 & LED2 will glow

Condition 2: if p5 = 0; p7 = 0; p15 = 0 ; p17 = 1 Onboard LED1 & LED3 will glow

- **4B.** With respect to LPC1768, explain the functions of following registers with examples
 - (i) FIOSET
 - (ii) FIODIR
 - (iii) PINSEL
 - (iv) FIOCLR
- 4C Write an mbed program to do the following: If a switch connected to p5 is high then flash 3 an on-board LED (LED2) with a duty cycle of 66%; Else flash it with a duty cycle of 50%.
- 5A. Illustrate the concept of banked registers using a neat diagram. Describe this process when 4 the processor is forced into an interrupt mode.
- **5B.** Describe the reasons for Hardware software co-simulation also explain the advantages **3** of co-simulation.
- **5C.** With suitable examples, describe following arm instructions.
 - (i) BIC R1, R0, R2
 - (ii) ADD R2, R2, R1, LSL #02
 - (iii) BNE xyz

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