M.Tech. IN ADVANCED INFORMATION TECHNOLOGY –MICROELECTRONICS AND VLSI DESIGN (MTECHVD)

Term-End Examination

00239

December, 2014

MINE-054 : CIRCUITS AND SYSTEMS DESIGN

Time : 3 hours   *Maximum Marks : 100*

Note :

(i)   *Section I is* **compulsory**.

(ii)   *In Section II, attempt any* **five** *questions.*

(iii) *Assume suitable data wherever required.*

(iv)   *Draw suitable circuits wherever required.*

(v)   *Italicized figures to the right indicate maximum marks.*

(vi)   *Use of calculator is allowed.*

(vii) *See the end of the question paper for reference data.*

SECTION I

1. An assistance robot is to be designed to help electronic engineers in research labs. It should have the following characteristics :   *30*

(a) Take voice commands from a researcher.

(b) Find the way to the store room and reach there without hitting any obstacle.

(c) From a rack with equipments, properly labelled, it should find what the researcher ordered. In case of clarification it should contact the researcher via wireless communication.

(d) It has to come back to the researcher with exact number of equipments from the store.

Give a detailed design description with pseudo-codes, schematic, important considerations, desired sensor characteristics and assumptions, if any.

SECTION II

2. (a) WinAVR is used in Windows for compiling and programming AVR controllers. Describe the steps for compiling and programming. 7

    (b) A system needs positioning around 360 degrees. Which motor should be used ? Explain its working. 7

3. Write short notes on the following : 2×7=14

    (a) Pulse Width Modulation

    (b) FPGA v/s Microcontrollers

4. (a) What are the different ways to pull up a pin on the controller ? 6

    (b) Describe an application where pull up is used in controllers. Draw the circuit diagram and explain the working. 8

5. An embedded system takes an analog sine wave input of 5Vp-p with a +2.5V DC shift. It has to sample the signal at 2,000 samples/second. Convert the samples values into integer and display it on the terminal. Write the embedded C code for the system. 14

6. (a) What is an interrupt ? Explain any one interrupt available in AVR microcontroller. 7

    (b) Write a function in embedded C for initializing and starting the 8-bit timer of the Mega 8., which toggles an LED with a duration of 0.5 sec. 7

7. Explain the working of the following ADCs with schematic or circuit diagram : *2×7=14*

   (a) Successive approximation ADC

   (b) Flash ADC

8. From the controller's point of view, justify the following statements. Draw proper circuit diagrams as and when needed. *2×7=14*

   (a) Use of MAX232 in a USART communication circuit.

   (b) Filter capacitors near power supply and with microcontrollers.

Following data is available for reference :

Register UCSRB has bits RXEN, TXEN

Register UCSRC has bits URSEL, UCSZ0, UCSZ1

Other Registers Available : UBRRL UBRRH

Conditions applicable :

while ((UCSRA & (1 << UDRE)) == 0)

while ((UCSRA & (1 << RXC)) == 0)

Register ADCSRA has bits ADPS2, ADPS1, ADPS0 for setting prescaler (assume 111 as the required prescaler)

Register ADMUX has bit REFS0 which when **SET**, makes ADC reference to AVCC

Register ADMUX has bit ADLAR which when **SET,** Left adjust ADC result to allow easy 8 bit reading

Register ADCSRA has bit ADFR, which when **SET**, puts ADC to Free-Running Mode

Register ADCSRA has bit ADEN, To enable ADC when **SET**

Register ADCSRA has bit ADSC, To start ADC conversions when **SET**

Register ADMUX (Lower 3 Bits) are used to select ADC channel

Conditions applicable :

while(bit_is_set (ADCSRA,ADSC));

Register TIMSK has bit TOIE0, when **SET,** enable timer overflow interrupt for Timer0

Register TCNT0, for setting timer 0 initial 1 value

Register TCCRO has bits CS01 and CS00, when SET, starts the timer with 64-bit prescaler

TIMER0_OVF_vect, is the timer0 overflow vector