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20-11-2022

International Institute of Information Technology, Hyderabad

Communication and Controls in IoT – Monsoon 2022-23

Quiz 1

Max. Time: 45 min **Max. Marks:20**

MCQ section has +1 for correct answer, -0.25 for incorrect
Answer to be written on the question paper. Subjective 3 marks each.

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1. Change in output of sensor with change in input is _____
   a) Threshold b) Slew rate c) Sensitivity d) Precision

2. Which of the following is not an example of a transducer?
   a) Human eyes b) Amplifier c) DC Motor d) None of these

3. A MEMS comb-drive structure with a known spring constant can be used measure:
   a) Acceleration b) Speed c) Mass d) Pressure

4. A pressure sensor has a zero offset of -0.5 V and zero drift of +0.1 V per month. After four months, the output for no applied pressure is
   a) -0.1 V b) -0.9 V c) +0.1 V d) +0.9 V

5. For a PWM output, the duty cycle needed to obtain $V_{RMS} = V_{cc}/2$ is:
   a) 25% b) 33.33% c) 50% d) 75%

6. Which of these interrupts has the highest priority in ATMEGA328:
   a) INT1 b) INT0 c) Analog_vect d) ADC_vect

7. What is the maximum time that can be counted using the internal timers in ATMEGA328 using a 1.024 MHz clock?
   a) 256 ms b) 4.096 sec c) 64 ms d) 65.536 sec

8. What is the value of OCR1 if we need to count 500 µs using a 16 MHz clock with a prescalar of 8?
   a) 0x3E7 b) 0x999 c) 0x1000 d) 0x9F

9. DP is a commonly used protocol at
   a) Application layer b) Transport layer c) Network layer d) None of the above

10. Which one of the following is not fixed assignment protocol?
    a) TDMA b) SDMA c) CSMA d) CDMA

11. Which of the things cannot be connected to internet
    a) Chair b) Water bottle c) Shoes d) None of the above

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Q1. Write a pseudo-code for setting up timer0 to make an LED toggle every 200 ms, assuming a 16 MHz clock. If a human presses a button connected to INT0 (say falling edge), the blinking should stop. The blinking should resume if the button is pressed again.

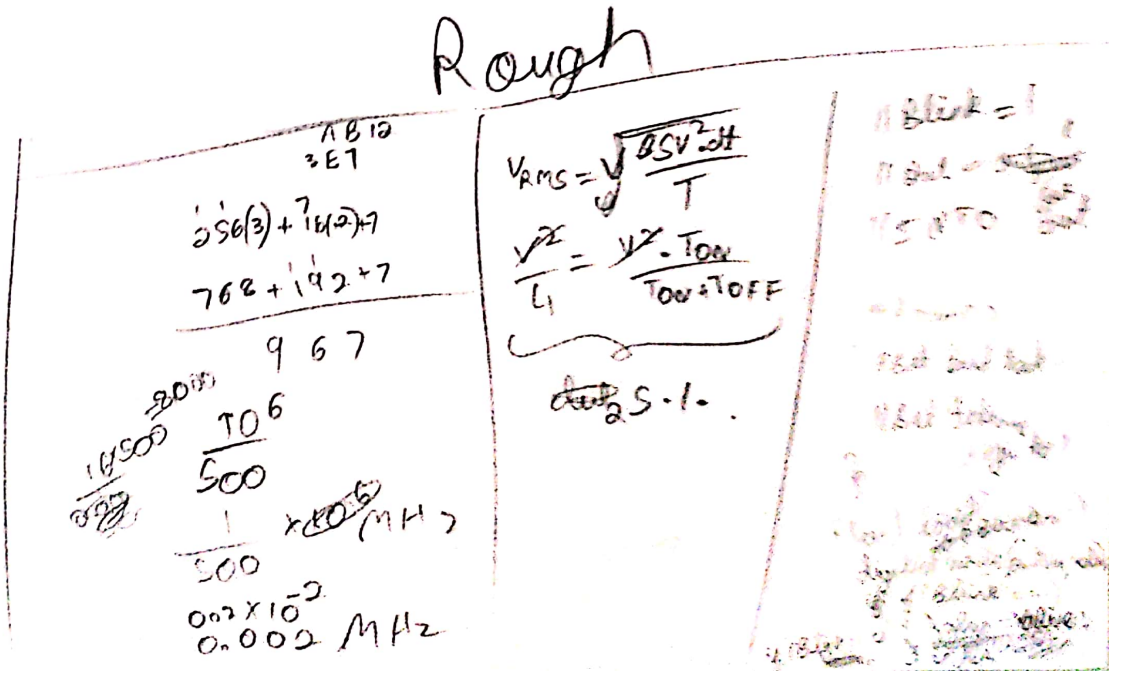
[3 marks]

```
int value = High;
int Blink = High;
// Output = <Bulb pin>;
// INT0 = Bulb pin;

void main ( )
{  // Set Interrupt Enable to 1
   // Set baud rate
}
void loop ( )
{  digitalWrite (Output, value);
   if (Blink == 1)
      { value = !value ; }
   interrupt (function to call (bulb), INT0, FALLING);
   delay (200);
}
void bulb ( )
{  Blink = ! Blink;
}
```

1.5

Rough



Q2. Say we have a 4-bit R-2R ladder DAC with reference voltage 8 V. What is the smallest value of R which will limit the current drawn from the input to 10 mA [1]? If $R_f = R$, what is the resolution of the DAC for this value of resistance [2]?

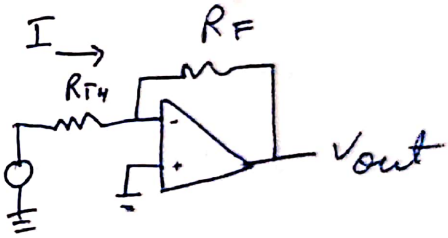
[1+2 = 3 marks]

$$I = \frac{V_{ref}}{2^n R}\left[2^{n-1}A_{n-1} \ldots + A_0\right]$$

$$10mA = \frac{8}{16R}\left[8(1)+4(1)+2(1)+1(1)\right]$$

$$R = \frac{8 \times 4}{16 \times 10 \times 10^{-3}}\left[\frac{3}{15}\right] \Rightarrow R = \frac{3000}{4} = 750\Omega$$

$$\boxed{R = 750\Omega}$$



$$V_{out} = -I \cdot R_F$$

$$|V_{out}| = |I \cdot R_F|$$

$$= \frac{V_{ref}}{2^n \cdot R}\left[2^{n-1}A_{n-1} \ldots A_0\right] \cdot R_F \Rightarrow V_{out} = \frac{V_{ref}\left[2^{n-1}A_{n-1} \ldots A_0\right]}{2^n}$$

$\therefore$ resolution = change in output for unit change in input

$$\therefore \Rightarrow \text{resolution} = \frac{V_{ref}}{2^n} = \frac{8}{16} = 0.5V$$

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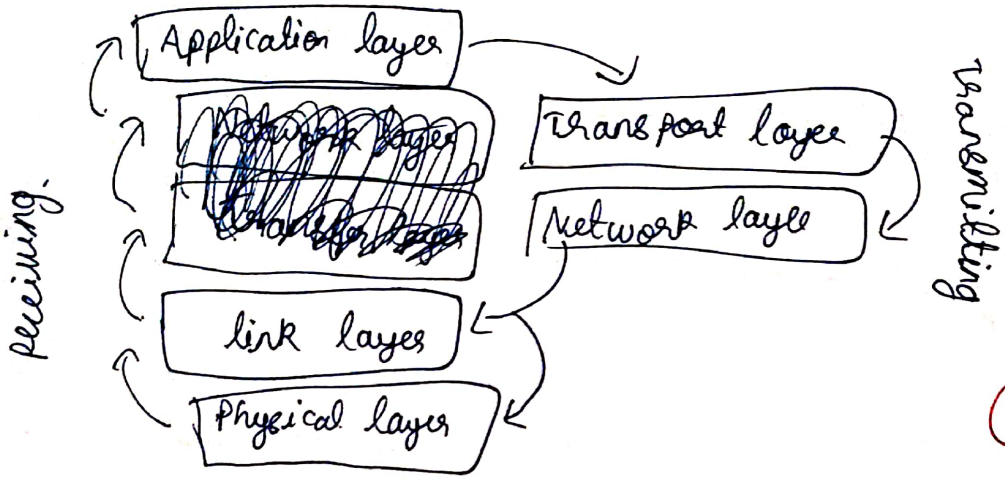
Q3. Explain the functions of different layers of TCP/IP Internet protocol stack.

[3 marks]

Internet Protocol Stack



3

* Application layer :- It provides protocols through which Applications can communicate

  Applications like, www, texting, etc.

  Application Protocols like, HTTP, HTTPS, SMTP, etc.

* Transport layer :- Segments the data and adds port number to know the application it can from. It also ensures that no data is missing

  Ex:- TCP, UDP

* Network layer :- It takes the segmented data adds IP address and sends this packet to next layer

* Linking layer :- It takes the packet and adds MAC addresses of source & destination and sends this Dataframe to the Physical layer

* Physical layer :- This layer converts the data into bits and sends it into the medium

⇒ On the receiving end each of these layers work in the exact vice-versa mode.