

**M.Sc. Physics Examination** Nov-2014

Semester III

Paper No: E-301 Microcontrollers

Paper Code - 4706

Time: 2 Hours 30 Min

Max Marks 70

Note: Attempt all questions. Numbers to the right indicate marks

1.	a.	What is arduino? List 3 different arduino boards available. What can be done from within arduino IDE? List the steps involved in developing an arduino sketch.	[5]
	b.	Which are the different data types available in arduino. Write the data ranges for any four types. How many bytes of memory are required by each of these?	[5]
	c.	Write program segment to declare digital pins d2 to d6 as an array and set them as input. Also activate internal pull-ups in all of these.	[4]
		OR	
	a.	What output will the following code generate? <pre>int text1 = 12; text1 += 1; String text2="12"; text2 += "1";</pre>	[2]
	b.	Define text1 as a String variable. Assign it a value of "I am OK". Using which function can we find the length of string variable text1.	[2]
	c.	What will be differences in outputs from following : (i) <pre>while (analogRead(sensorPin) &gt;100) { blink(); }</pre> (ii) <pre>do {blink(); } while(analogRead(sensorPin()) &gt; 100;</pre>	[2]
	d.	What is achieved by the modulus operator. Explain with an example.	[2]
	e.	Explain the rounding methods used with floating-point numbers. Explain the functions ceil and floor.	[4]
	f.	How are random numbers generated in arduino. Write statements to generate and store random number in variable of appropriate type.	[2]
2.	a.	Which operators and functions can be used to handle Bits in arduino. Explain each with an example.	[8]
	b.	Explain the concept of software serial ports. Why is this needed? Write a sketch to define and use a software serial port for sending sequence of numbers from 1 to 100 with a delay of 1 sec.	[6]
		OR	
	a.	Create a sketch to read a switch connected to d2 pin in a reliable manner. Take care to handle permanent switch closure and long press.	[7]
	b.	How many analog pins are available on standard arduino and arduino mega? Which function is used to read the analog voltage values on the pin? What are the minimum and maximum values of analog voltages and	[7]

	the output from reading these values. Write program segment to read two analog input pins and put the LED (pin d13) on if val1 is equal or larger than val2.	
3.	a. Explain the functioning of an LDR. Draw the schematic showing connection of an LDR to arduino. Write a sketch to vary the intensity of LED on D13, in proportion to the light intensity detected by LDR.	[7]
	b. Showing the connections of the ultrasonic distance measuring sensor, write a sketch to measure the distance of an object.	[7]
	OR	
	a. What is PWM? Show the expected PWM outputs for three different values. Write a program to control the brightness of an LED using PWM.	[7]
	b. Which digital sensor is used to detect and measure rotary movement. Show its schematic and write program to measure the angular rotation.	[7]
4.	a. Draw the schematic of a 3X4 matrix keyboard connected to arduino. Write sketch to read the key pressed and send it to serial terminal. Put the LED on whenever 9 key is pressed, and put it off when 1 key is pressed.	[7]
	b. How are high power LED's driven from outputs of the arduino? Show the connections of 1 digit seven segment display with arduino. Write sketch to display numerals on it.	[7]
	OR	
	a. Show schematic of two servo motors connected to arduino and write a sketch to move both as per following sequence. Servo1 : 30 deg Servo3 : 45 deg Servo1: - 25 deg Servo2: 05 deg both back to zero position and repeat again.	[9]
	b. Write a sketch for simulating a clock in arduino. The time may be displayed on serial terminal.	[5]
5.	a. show the circuit for connecting a speaker to arduino. Which pins are selected and used for this. Write a sketch to generate audio tones of selected frequencies in sequence to create a melody. (chose audio frequencies randomly).	[7]
	b. Compare SPI and I2C protocols. What are the advantages and disadvantages of each of these.	[7]
	OR	
	a. Schematically show connections of a temperature sensor with arduino. Write sketch to measure temperature periodically and send the measured data to serial terminal.	[7]
	b. Explain any three serial related functions. Use examples to clarify. How ASCII is interpreted by write and print methods?	[7]

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