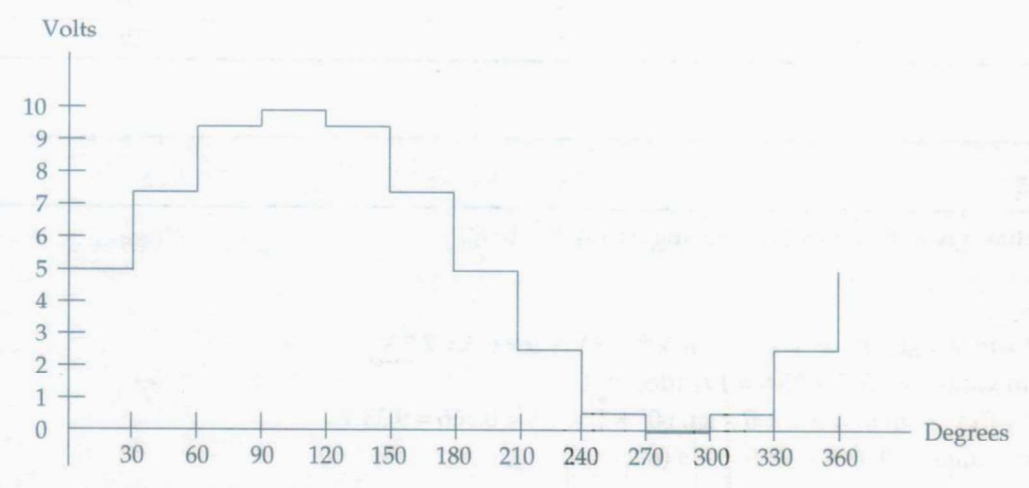


LIST OF QUESTIONS

PART A

1. List the types of serial communication.

Serial data communication uses two methods,

- Synchronous and
- Asynchronous.

Synchronous:

The synchronous method transfers a block of data (characters) at a time.

Asynchronous:

Asynchronous data communication is widely used for character-oriented transmissions i.e, transfers a single byte at a time

The data coming in at the receiving end of the data line in a serial data transfer is all 0s and 1s; it is difficult to make sense of the data unless the sender and receiver agree on a set of rules, a protocol, on how the data is packed, how many bits constitute a character, and when the data begins and ends.

2. Write down the different operating modes for serial communication of 8051.

SM0	SM1	Mode	Baud Rate
0	0	Serial mode 0 (8 data bits)	$1/12^{th}$ of the oscillator frequency
0	1	Serial mode 1(1 bit for start, 8 bits of data, 1 bit for stop)	Baud rate is variable, depends on timer 1 overflow rate.

1	0	Serial mode 3(1 bit for start, 8 bits of data, 1 bit can be programmed, 1 bit for stop)	1/32 or 1/64th of the oscillator frequency.
1	1	Serial mode 3(1 bit for start, 8 bits of data, 1 bit can be programmed, 1 bit for stop)	Baud rate is variable, depends on timer 1 overflow rate.

3. Explain the interrupts of 8051 with their vector address and priorities.

Interrupt	ROM Location(Hex)
Reset	0000
External hardware interrupt 0(INT0)	0003
Timer 0 interrupt(TF0)	000B
External hardware interrupt 1(INT1)	0013
Timer 1 interrupt(TF1)	001B
Serial COM interrupt (R1 and T1)	0023

Highest to lowest priority

External interrupt 0(INT0)
Timer interrupt 0(TF0)
External interrupt 1(INT1)
Timer interrupt 1(TF1)
Serial communication (RI+TI)
Timer 2(8052 only) TF2

4. Write the importance of TI flag.

1. The byte character to be transmitted is written into the SBUF register.
2. The start bit is transferred.
3. The 8-bit character is transferred one bit at a time.
4. The stop bit is transferred. It is during the transfer of the stop bit that the 8051 raises the TI flag (TI =1), indicating that the last character was transmitted and it is ready to transfer the next character.
5. By monitoring the TI flag, we make sure that we are not overloading the SBUF register. If we write another byte into the SBUF register before TI is raised, the un transmitted portion of the previous byte will be lost. In other words, when the 8051 finishes transferring a byte, it raises the TI flag to indicate it is ready for the next character.
6. After SBUF is loaded with a new byte, the TI flag bit must be forced to 0 by the "CLR TI" instruction in order for this new byte to be transferred.

5. Draw the format of IE and IP registers.

Interrupt Priority (IP) Register

D7 D0

-	-	-	PS	PT1	PX1	PT0	PX0

PS Serial Port Interrupt Priority level
PT1 Timer 1 Interrupt Priority level
PX1 External Interrupt 1 Priority level
PT0 Timer 0 Interrupt Priority level
PX0 External Interrupt 0 Priority level
Priority bit=1 assigns high priority: priority bit =0 assigns low priority

IE (interrupt enable) Register:

D7 D0

EA	X	X	ES	ET1	EX0	ET0	EX0

EA (enable all):

If EA=0, no interrupt will be acknowledged. If EA=1, each interrupt source is individually enabled or disabled by setting or clearing the enable bit.

ES Enables or disables Serial port interrupt:

If ES=0, serial port interrupt is disabled.

ET1 Enables or disables the Timer 1 overflow interrupt:

If ET1 = 0 Timer 1 overflow interrupt is disabled

EX1 Enables or disables the external interrupt 1

If EX1 =0 external interrupt 1 is disabled

ET0 Enables or disables Timer 0 overflow interrupt

If ET0 = 0 Timer 0 overflow interrupt is disabled

EX0 Enables or disables the external interrupt 0

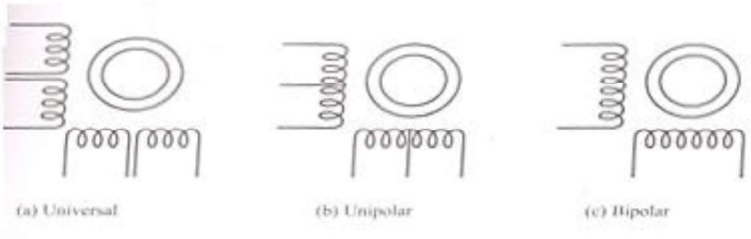
If ET0 = 0 external interrupt 0 is disabled

6. What are the functions of diode and transistor used in stepper motor?

Diodes are used to reduce the back EMF spike created when the coils are energized and de-energized. TIP transistors can be used to supply higher current to the motor.

7. Explain the difference between universal, unipolar and bipolar stepper motor interface.

A universal stepper motor has eight, while the unipolar has six and the bipolar has four. The universal stepper motor can be configured for all three modes, while the unipolar can be either unipolar or bipolar. Obviously the bipolar cannot be configured for universal nor unipolar mode. Table shows selected stepper motor characteristics.



8. *Define Step angle.*

The step angle is the minimum degree of rotation associated with a single step. Various motors have different step angles.

9. *What is the relation between steps per second and rpm relation*

The relation between rpm (revolutions per minute), steps per revolution, and steps per second is as follows.

$$\text{Steps per second} = \frac{\text{rpm x Steps per revolution}}{60}$$

10. What are the ways in which memory block selector can be generated?

There are three ways to generate a memory block selector:

(a) using simple logic gates

(b) using the 74LS138

(c) using programmable logics

11.What are the ways in which a microcontroller can serve devices?

A single microcontroller can serve several devices. There are two ways to do that:

- Interrupts
- Polling.

Interrupts:

In the interrupt method, whenever any device needs its service, the device notifies the microcontroller by sending it an interrupt signal. Upon receiving an interrupt signal, the microcontroller interrupts whatever it is doing and serves the device.

Polling:

In polling, the microcontroller continuously monitors the status of a given device; when the status condition is met, it performs the service. After that, it moves on to monitor the next device until each one is serviced. Although polling can monitor the status of several devices and serve each of them as certain conditions are met, it is not an efficient use of the microcontroller.

12. What are the advantages of interrupts?

The advantage of interrupts is that the microcontroller can serve many devices (not all at the same time, of course); each device can get the attention of the microcontroller based on the priority assigned to it. The polling method cannot assign priority since it checks all devices in a round-robin fashion. In the interrupt method the microcontroller can also ignore (mask) a device request for service. This is again not possible with the polling method.

13. What are the disadvantages of polling?

Polling method wastes much of the microcontroller's time by polling devices that do not need service. So in order to avoid tying down the microcontroller, interrupts are used.

14. What do you mean by Interrupt service routine?

For every interrupt, there must be an interrupt service routine (ISR), or interrupt handler. When an interrupt is invoked, the microcontroller runs the interrupt service routine. For every interrupt, there is a fixed location in memory that holds the address of its ISR.

15. Define interrupt vector table.

The group of memory locations set aside to hold the addresses of ISRs is called the interrupt vector table

16. What are the advantages of LCD compared to LED?

1. The declining prices of LCDs.
2. The ability to display numbers, characters, and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving theCPU of the task of refreshing the LCD. In contrast, the LED must be refreshedby the CPU (or in some other way) to keep displaying the data.
4. Ease of programming for characters and graphics.

17. What is UART?

There are special 1C chips made by many manufacturers for serial data communications. These chips are commonly referred to as UART (universal asynchronous receiver-transmitter) and USART (universal synchronous-asynchronous receiver-transmitter).

PART B

1. Describe the different modes of operation of timers/counters in 8051 with its associated registers? (16)
2. Explain in detail about the serial communication modes with their SFRs in 8051? (16)
3. Explain in detail about interrupts in 8051? (16)
4. Discuss in detail the interfacing of stepper motor with 8051 microcontroller?(16)
5. Explain how 8051 is interfaced with external memory in detail. (16)