lecture 11

USART Control and Status Register B – UCSRB

Bit	7	6	5	4	3	2	1	0	
	RXCIE	TXCIE	UDRIE	RXEN	TXEN	UCSZ2	RXB8	TXB8	UCSRB
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R	R/W	
Initial Value	0	0	0	0	0	0	0	0	

Bit 7 – RXCIE: RX Complete Interrupt Enable
when reception is completed, then set 1
default 0.

Bit 6 – TXCIE: TX Complete Interrupt Enable
when transmission is completed, then set 1
default 0.

Bit 5 – UDRIE: USART Data Register Empty Interrupt Enable
Writing this bit to 1 enables interrupt on the UDRE Flag
default 0

Bit 4 – RXEN: Receiver Enable
Writing this bit to 1 enables the USART Receiver {default}
if put here 0, then it will turn off reciever and will not check of any reception

Bit 3 – TXEN: Transmitter Enable
Writing this bit to 1 enables the USART transmitter {default}
if put here 0, then it will turn off transmitter and will not check of any reception

Bit 2 – UCSZ2: Character Size

Bit 1 – RXB8: Receive Data Bit 8
RXB8 is the ninth data bit of the received character, and we use 8 bit system so we dont need it!
put 0 here to disable this pin.

Bit 0 – TXB8: Transmit Data Bit 8
TXB8 is the ninth data bit in the character to be transmitted, but again we dont use 9th bit, put always 0.

USART Control and Status Register C – UCSRC

Bit	7	6	5	4	3	2	1	0	
	URSEL	UMSEL	UPM1	UPM0	USBS	UCSZ1	UCSZ0	UCPOL	UCSRC
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	1	0	0	0	0	1	1	0	

Bit 7 – URSEL: Register Select
It is read as 1 when reading UCSRC

Bit 6 – UMSEL: USART Mode Select
This bit selects between Asynchronous and Synchronous mode of operation.
and we are doing async. so put 1!

Bit 5:4 – UPM1:0: Parity Mode
These bits enable and set type of parity generation and check.
But we don't use parity, hense always put 0

Bit 3 – USBS: Stop Bit Select
This bit selects the number of Stop Bits to be inserted by the Transmitter,
So put 0 to use STOP BIT as 1st bit.

Bit 2:1 – UCSZ1:0: Character Size
choose 011 as we use 8 bit as char size { look at data sheet for corresponding table pg. no. 165 }

Bit 0 – UCPOL: Clock Polarity
This bit is used for Synchronous mode only. and we use async. simply put it as 0.

USART Baud Rate Registers – UBRRL and UBRRH

Bit	15	14	13	12	11	10	9	8	
	URSEL	–	–	–	UBRR[11:8]				UBRRH
	UBRR[7:0]								UBRRL
	7	6	5	4	3	2	1	0	
Read/Write	R/W	R	R	R	R/W	R/W	R/W	R/W	
	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
Initial Value	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	

Bit 15 – URSEL: Register Select
It is read as 0 when reading UBRRH.
see 2nd resistor and second-last pin.

Bit 14:12 – Reserved Bits
we dont use it, no purpose!

Bit 11:0 – UBRR11:0: USART Baud Rate Register
This is a 12-bit register which contains the USART baud rate

$$Error[\%] = \left(\frac{BaudRate_{Closest\ Match}}{BaudRate} - 1\right) \bullet 100\%$$

$$\text{baud rate} = \frac{\text{frequency}}{16\,(1 + \text{UBRR})}$$

read that highlighted line above for better understanding

async double speed mode -> 16 to 8
sync mode -> 16 to 4

Q
BAUD RATE = 9600
F = 8 Mhz = 8 * 10 ^ 6 Hz
UBRR = ?
=> UBRR = 51.88 → UBRRH = 0, UBRRL = 51

UBRRL = 0b00110011;
UBRRH = 0b00000000;
← UBRR = 0b0000000000110011

USART I/O Data — UDR

reciever ~~~ transmitter

if we transmit from 1 side, we will recieve in same side.

~ By K.S.