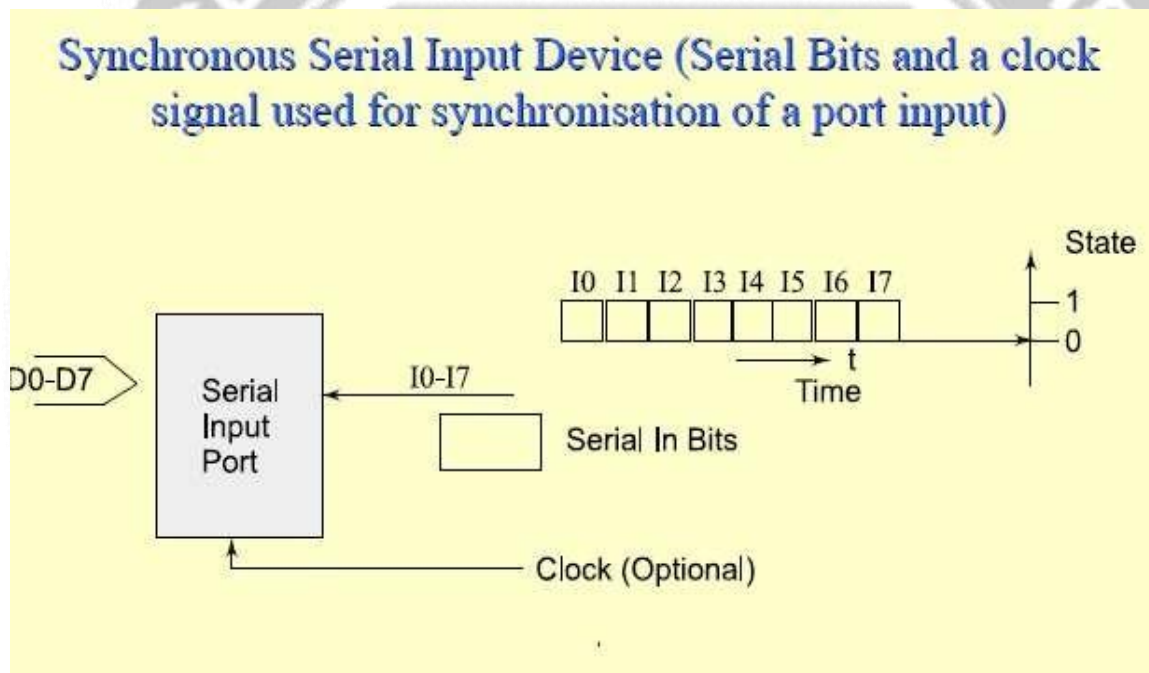## UNIT 11
EMBEDDED NETWORKING

2.1 Synchronous   Serial Input Example

Inter-processor data transfer, reading from CD or hard disk, audio input, video input, dial tone, network input, transceiver input, scanner input, remote controller input, serial I/O bus input ,writing to flash memory using SDIO (Secure Data Association IO based card).

Synchronous Serial Input

- The sender along with the serial bits also sends the clock pulses SCLK (serial clock) to the receiver port pin. The port synchronizes the serial data input bits with clock bits. Each bit in each byte as well as each byte in synchronization

- Synchronization means separation by a constant interval or phase difference. If clock period=T, then each byte   at the port is received at input in period =8T.

- The bytes are received at constant rates. Each byte at input port separates by 8T and data transfer rate or the serial line bits is(1/T)bps. [1bps =1 bit per s]

- Serial data and clock pulse-inputs

- On same input line − when clock pulses either encode or modulate serial data input bits suitably. Receiver detects the clock pulses and receives data bits after decoding or demodulating.

- On separate input line − When a separate SCLK input is sent, the receiver detects at the middle or + ve   edge or − ve   edge of the clock pulses that   whether the data-input is 1 or 0 and

saves the bits in an 8-bit shift register. The processing element at the port (peripheral) saves the byte at a port register from where the microprocessor reads the byte.

Master output slave input (MOSI) and Master input slave output (MISO)

MOSI when the SCLK is sent from the sender to the receiver and slave is forced to synchronize sent inputs from the master as per the inputs from master clock.

- MISO when the SCLK is sent to the sender (slave) from the receiver (master) and slave is forced synchronize for sending the inputs to master as per the master clock outputs.
- Synchronous serial input is used for inter processor transfers, audio inputs and streaming data inputs.
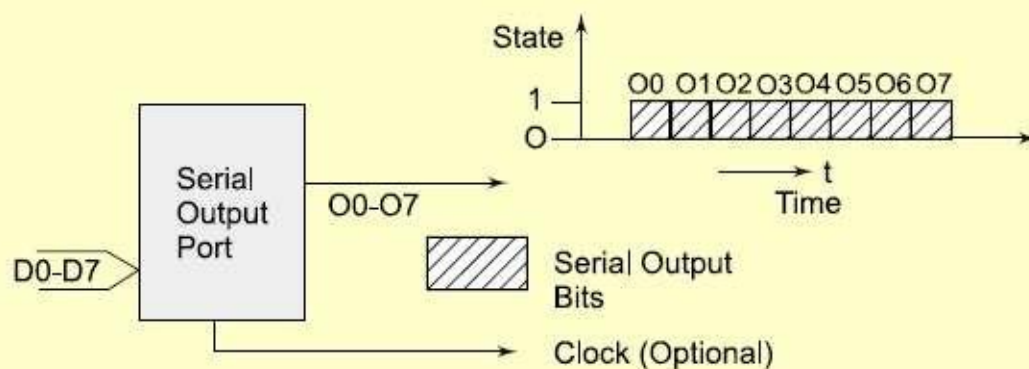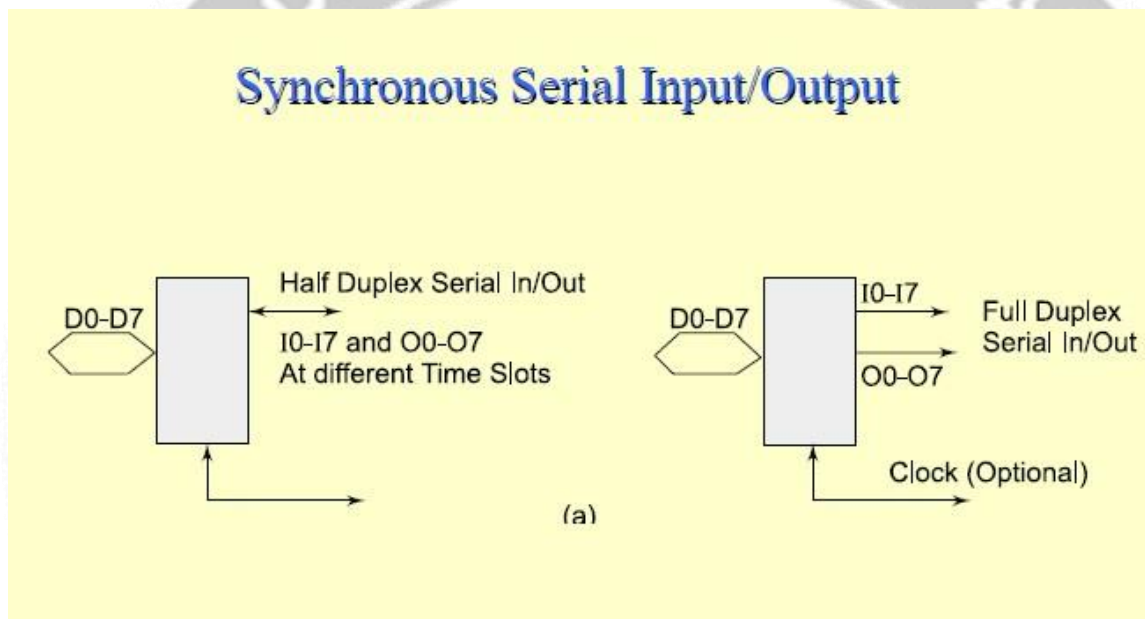

Example Synchronous Serial Output

Inter-processor data transfer, multiprocessor communication, writing to CD or hard disk ,audio Input/output, video Input/output, dialer output, network device output, remote TV Control ,transceiver output, and serial I/O bus output or writing to flash memory using SDIO

Synchronous Serial Output

- Each bit in each byte sent in synchronization with a clock.
- Bytes sent at constant rates. If clock period $=T$ then data transfer rate is $(1/T)$ bps.
- Sender either sends the clock pulses at SCLK pin or sends the serial data output and clock pulse -input through same output line with clock pulses either suitably modulate or encode the serial output bits.

**Synchronous serial output using shift register**

- The processing element at the port (peripheral) sends the byte through a shift register at the port to where the microprocessor writes the byte.
- Synchronous serial output is used for inter processor transfers, audio outputs and streaming data outputs.

Synchronous   Serial Input/output

- Each bit in each byte is in synchronization at input and each bit in each byte is in synchronization at output with the master clock output.
- The bytes are sent or received at constant rates. The I/Os can also be on same I/O line when input/output clock pulses either suitably modulate or encode the serial input/output, respectively. If clock period =T, then data transfer rate is (1/T) bps.
- The processing element at the port (peripheral)sends and receives the byte at a port register to or from where the microprocessor writes or reads the byte

Asynchronous Serial input RxD at UART COM Port
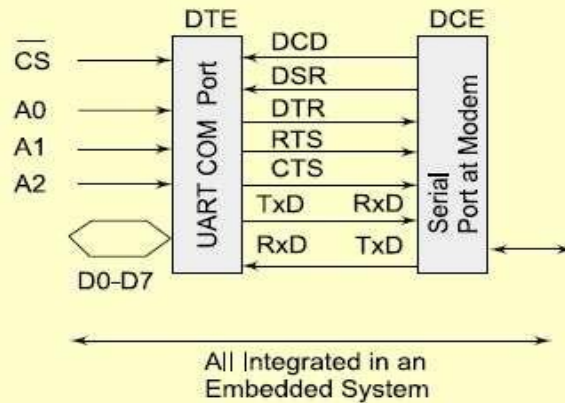
A synchronous Serial port line R x D (receive data).

- Does not receive the clock pulses or clock information along with the bits.
- Each bit is received in each byte at fixed intervals but each received byte is not in synchronization.
- Bytes separate by the variable intervals or phase differences.
- A synchronous serial input also called UART input if serial input is according to UART protocol

Example Serial Asynchronous Input

- Asynchronous serial input is used for keypad inputs and modem inputs in computers
- Keypad controller serial data-in, mice, keyboard controller, modem input, character send inputs on serial line [also called UART (universal receiver and
- transmitter) input when according to UART mode]