**B.Sc. (HONS.) IN ECE, PART-III, SIXTH SEMESTER EXAMINATION, 2020**  
**COMPUTER PERIPHERALS AND INTERFACING**  
**Subject Code - ECE-315**  
**Time - 3 hours**  
**Full marks - 80**

[N.B. The figures in the right margin indicate full marks. Answer any five questions.]

**1.(a) What is computer highway? Describe with diagram computer Highway. (1+4+5 = 10 marks)**

A **computer highway** is a communication path inside the computer through which data, control signals, and addresses are transferred between CPU, memory, and input-output devices. It is generally referred to as the **system bus**.

The system bus has three main parts:

1. **Data Bus** – carries actual data between CPU, memory, and I/O devices.
2. **Address Bus** – carries the address of the location in memory or I/O port where data is to be read/written.
3. **Control Bus** – carries control signals like Read, Write, Interrupt, Clock, etc.

**Diagram 8 no**.page

**Explanation:** #The CPU communicates with memory and I/O devices through the **system bus**.

* The **address bus** specifies the location, the **data bus** carries the value, and the **control bus** manages the operation (Read/Write).
* This is called a “highway” because all components share the same path for communication.

**(b) Types of interfacing techniques? Describe the asynchronous interfacing technique with diagram. (1+5+6 = 12 marks)**

**Types of interfacing techniques:**

1. **Synchronous Interfacing** – data transfer is synchronized with a common clock signal.
2. **Asynchronous Interfacing** – data transfer does not require a common clock; uses handshaking signals.
3. **Interrupt-driven Interfacing** – CPU responds when an I/O device sends an interrupt.
4. **Direct Memory Access (DMA) Interfacing** – I/O devices directly access memory bypassing CPU.

**Asynchronous Interfacing:**

* In asynchronous mode, **no common clock** is shared between CPU and device.
* Instead, **handshake signals** (READY, STROBE, ACKNOWLEDGE) are exchanged to ensure proper timing.
* This technique is useful when CPU is faster than I/O devices.

Diagram 8 No. page

**Working:**

1. CPU places data on data bus and asserts **STROBE**.
2. The I/O device responds with **ACK** when it has received the data.
3. CPU waits until ACK is received, ensuring synchronization without a clock.

**(c) Difference between Serial and Parallel Interfacing. (6 marks)**

| **Aspect** | **Serial Interfacing** | **Parallel Interfacing** |
| --- | --- | --- |
| **Data Transfer** | One bit at a time | Multiple bits simultaneously |
| **Speed** | Slower | Faster |
| **Cost** | Low (fewer wires) | High (many wires required) |
| **Distance** | Suitable for long distance | Suitable for short distance |
| **Examples** | USB, RS-232, UART | Printer port, System bus |

**2.(a) What is DMA? Show the basic block diagram of DMA and describe it. (1+5+6 = 12 marks)DMA (Direct Memory Access):**

* DMA is a technique that allows an **I/O device to transfer data directly to/from memory** without continuous involvement of the CPU.
* It improves speed and efficiency because CPU is free during the transfer.

Diagram 8 no.page

**Explanation:**

1. CPU initializes DMA controller with starting address, size of block, and operation type (read/write).
2. DMA controller takes control of system bus.
3. Data is transferred directly between memory and I/O device.
4. After completion, DMA sends an **interrupt** to CPU to notify.

**Advantages:**

* High-speed data transfer.
* CPU is free to perform other tasks.
* Reduces CPU overhead.

**(b) Draw the block diagram showing 8259 Priority Interrupt Controller (PIC). (6 marks)**

**Answer:**

**8259 PIC:**

* The Intel 8259 PIC manages **hardware interrupts** from multiple I/O devices.
* It allows priority handling and sends the highest priority interrupt to CPU.

Diagram 8 NO page

**Explanation:**

* **IRR (Interrupt Request Register):** Stores incoming interrupts.
* **Priority Resolver:** Decides which interrupt has highest priority.
* **IMR (Interrupt Mask Register):** Masks (disables) specific interrupts.
* **ISR (In-Service Register):** Holds the currently executing interrupt.
* PIC communicates with CPU through control logic and data bus buffer.

**(c) What is transducer? Write down about active and passive transducer. (1+5 = 6 marks)**

**Answer:**

**Transducer:**  
A transducer is a device that converts one form of energy (physical quantity) into another, usually into an **electrical signal**. Example: microphone (sound → electrical signal).

**Types:**

1. **Active Transducer:**
   * Generates its own electrical output without external power.
   * Example: Thermocouple, Piezoelectric crystal.
2. **Passive Transducer:**
   * Requires external power source.
   * Changes resistance, inductance, or capacitance in response to stimulus.
   * Example: LDR (Light Dependent Resistor), Strain Gauge.

**3.(a) Explain with neat diagram the construction of inkjet printer. (4 marks)**

**Answer:**

**Inkjet Printer:**

* An inkjet printer sprays very fine droplets of liquid ink directly onto the paper to form an image or text.
* It provides high resolution (up to 1200 dpi or more).

Diagram \* 8 No page

**Main parts:**

1. **Print Head:** Contains nozzles that spray ink.
2. **Ink Cartridges:** Hold liquid ink (black/color).
3. **Stepper Motor & Belt:** Move print head across the paper.
4. **Paper Feed Mechanism:** Rolls paper forward.

**Working:**

* Nozzles eject ink droplets as per signals.
* Print head moves horizontally, paper moves vertically.
* Image/text is formed line by line.

**(b) Explain with diagram the working principle of laser printer. (6 marks)**

**Laser Printer Principle:**

* Works on the principle of **electro-photography**.
* A laser beam and a rotating drum coated with photoconductive material are used.

Diagram 8 no page

**Steps:**

1. **Charging:** Drum is given uniform electrostatic charge.
2. **Exposure:** Laser beam scans drum; discharges selected areas → forms latent image.
3. **Developing:** Toner particles stick to charged areas.
4. **Transferring:** Toner image is transferred to paper.
5. **Fusing:** Heat + pressure fuse toner permanently.
6. **Cleaning:** Drum is cleaned for next cycle.

**Advantages:**

* High speed, high-quality printing. \*Silent operation.

**(c) Explain RS-232-C serial communication with diagram. (6 marks)**

**RS-232-C:**

* A standard protocol for **serial communication** between DTE (Data Terminal Equipment, e.g., computer) and DCE (Data Communication Equipment, e.g., modem).
* Uses voltage levels:
  + Logic 1 = –3V to –25V
  + Logic 0 = +3V to +25V

**RS-232-C Connection Diagram: 8 no page**

**Signals:**

* **TxD:** Transmit Data
* **RxD:** Receive Data
* **RTS/CTS:** Request to Send / Clear to Send (handshaking)
* **DTR/DSR:** Data Terminal Ready / Data Set Ready
* **GND:** Ground reference

**Features:**

* Asynchronous transmission.
* Supports baud rates up to 20 kbps.
* Commonly used in serial ports.

**4.(a) What is keyboard encoder? Describe working principle of keyboard encoder. (4 marks)**

**Keyboard Encoder:**A keyboard encoder is a circuit (IC) inside the keyboard that converts the **key press (row-column code)** into a **binary code** (usually ASCII or scan code) which the computer understands.

* Example: IC 8279 (Keyboard/Display Controller).

**Working Principle:**

1. The keys are arranged in a **matrix of rows and columns**.
2. When a key is pressed, it creates a connection between a row and column.
3. The encoder detects the pressed key by scanning the rows and columns.
4. It generates the corresponding binary code (scan code).
5. This code is sent to CPU through data bus.

**Diagram of Keyboard Encoder (Matrix):**

Columns → C1 C2 C3 C4

Rows

↓

R1 [1] [2] [3] [4]

R2 [5] [6] [7] [8]

R3 [9] [0] [A] [B]

R4 [C] [D] [E] [F]

**(b) Explain with neat diagram working principle of optical encoder. (6 marks)**

**Optical Encoder:**

* An optical encoder is a device that converts angular or linear motion into a digital signal using light.
* It is used in robotics, CNC machines, printers, etc.

**Working Principle**

1. An **LED light source** passes through a **slotted (transparent-opaque) disk** attached to a rotating shaft.
2. On the other side, a **photo-detector** senses the light.
3. As the disk rotates, the light is interrupted → pulses are generated.
4. The number of pulses corresponds to the angular displacement.
5. Direction can also be detected using two phase-shifted detectors.

**Diagram of Optical Encoder:**

LED ---> | | | | | | | | (Slotted disk) ---> Photodetector ---> Pulses

* As the shaft rotates, slots pass light → photo detector produces digital output.

**(c) Write a note on decoding. Show the decoding of 3-to-8 decoder. (6 marks)**

**Decoding:**Decoding is the process of **converting binary information into a specific output line**.

* A **decoder** is a combinational circuit that activates one output line depending on the input code.

**3-to-8 Decoder:**

* Has 3 inputs (A, B, C) and 8 outputs (Y0–Y7).
* Only one output becomes active (logic 1) for a given input combination.

**Truth Table of 3-to-8 Decoder:**

| **A** | **B** | **C** | **Output Active** |
| --- | --- | --- | --- |
| 0 | 0 | 0 | Y0 |
| 0 | 0 | 1 | Y1 |
| 0 | 1 | 0 | Y2 |
| 0 | 1 | 1 | Y3 |
| 1 | 0 | 0 | Y4 |
| 1 | 0 | 1 | Y5 |
| 1 | 1 | 0 | Y6 |
| 1 | 1 | 1 | Y7 |

**Diagram of 3-to-8 Decoder (Simplified):**

A ----\

>---- Logic Circuit ---- Y0

B ----/

C ---------------------------- Y1

...

(up to Y7)

* In practice, IC **74LS138** is used as a 3-to-8 decoder.

**5(a) Explain RS-232-C standard. Write the method of asynchronous data transmission using 8251A in mode 0 and RS-232C block diagram with diagram. (6+4+6 = 16 marks)RS-232-C Standard:**

* RS-232-C is a **serial communication standard** used between a computer (DTE – Data Terminal Equipment) and a modem (DCE – Data Communication Equipment).
* It defines **voltage levels, signal names, and connector pinouts**.

**Voltage levels:**

* Logic 1 → –3V to –25V
* Logic 0 → +3V to +25V

**Important Signals:**

* **TxD**: Transmit Data
* **RxD**: Receive Data
* **RTS/CTS**: Request to Send / Clear to Send
* **DTR/DSR**: Data Terminal Ready / Data Set Ready
* **GND**: Ground

**Asynchronous Data Transmission using 8251A (Mode 0):**

* **8251A USART (Universal Synchronous/Asynchronous Receiver Transmitter)** can be used in **asynchronous mode** for RS-232-C communication.
* In asynchronous mode:
  1. Data is framed with **start bit, data bits, parity bit (optional), and stop bit(s)**.
  2. 8251A transmits serial data via **TxD** pin and receives via **RxD** pin.
  3. Baud rate is controlled by an external clock.

**Frame Format (Asynchronous):**

| Start (0) | D0 | D1 | D2 | ... | D7 | Parity | Stop (1) |

RS-232C with 8251A Block Diagram:

CPU <----> 8251A USART <----> RS-232 Driver (MAX232) <----> MODEM/Device

* **CPU:** Loads data into 8251A.
* **8251A:** Converts parallel data to serial data (and vice versa).
* **RS-232 Driver (e.g., MAX232):** Converts TTL voltage levels to RS-232 voltage levels.
* **Device/Modem:** Communicates with remote system.

**(b) What is USART? What are the advantages of USART? (10 marks)**

**USART (Universal Synchronous/Asynchronous Receiver Transmitter):**

* It is a device that converts parallel data from CPU into serial data for transmission, and serial data into parallel data for reception.
* Example: Intel 8251A.
* It supports **both synchronous and asynchronous** communication.

**Advantages of USART:**

1. **Flexibility:** Can handle both synchronous and asynchronous data.
2. **Reliable:** Provides error detection through parity.
3. **Efficient:** Reduces CPU workload in serial communication.
4. **Compatibility:** Widely used with RS-232-C standard.
5. **Speed Control:** Baud rate can be selected as per requirement.
6. **Data Integrity:** Start/stop bits ensure proper synchronization.

**6.(a) Describe IEEE-488 bus structure briefly. (6 marks)**

**IEEE-488 Bus (also called GPIB – General Purpose Interface Bus):**

* It is a **parallel communication bus** standard used to connect instruments like oscilloscopes, signal generators, printers, etc.
* Developed by Hewlett-Packard and standardized as IEEE-488.

**Main Features:**

* Up to **15 devices** can be connected.
* Transmission speed: up to **1 MB/s**.
* Devices connected in **daisy-chain or star topology**.
* One controller (usually computer) and multiple instruments (talkers/listeners).

**Bus Lines in IEEE-488:**

1. **Data Lines (8):** Carry data/instructions.
2. **Control Lines (5):** Control handshaking and communication.
   * ATN (Attention), REN (Remote Enable), IFC (Interface Clear), SRQ (Service Request), EOI (End or Identify).
3. **Handshake Lines (3):** Manage data transfer (DAV, NRFD, NDAC).

**Diagram of IEEE-488 Bus:**

[ Controller ]

[Device1] [Device2] [Device3] ... ..[Device15]

(Talker/Listener devices on common bus)

**(b) Describe the structure of Compact Disk (CD). (5 marks)**

**Compact Disk (CD):**

* A CD is an **optical storage medium** used to store digital data (up to 700 MB).
* Data is stored as **tiny pits and lands** on the surface, which are read by a laser beam.

**Structure of CD (Layer-wise):**

1. **Polycarbonate Layer:** Provides mechanical support.
2. **Data Layer:** Contains pits and lands (representing binary 0 and 1).
3. **Reflective Layer (Aluminum):** Reflects the laser light.
4. **Protective Layer (Acrylic):** Protects reflective layer.
5. **Label Layer:** Printed on top for identification.

**Diagram of CD Structure (Cross-section):**

[ Label Layer ]

[ Protective Acrylic ]

[ Reflective Aluminum ]

[ Data Layer (Pits & Lands) ]

[ Polycarbonate Base ]

**(c) Describe with diagram the working principle of LCD monitor. (5 marks)**

**LCD Monitor (Liquid Crystal Display):**

* LCD uses the property of **liquid crystals** to control light passage.
* It is widely used in computer monitors, TVs, smartphones, etc.

**Working Principle:**

1. LCD panel is made of **two glass plates** with liquid crystal material between them.
2. A **backlight** passes light through the liquid crystals.
3. When voltage is applied, the orientation of crystals changes, controlling the amount of light passing through.
4. Color filters (RGB) produce colored images.

**Diagram of LCD Monitor (Simplified):**

[ Backlight ] ---> [ Polarizer ] ---> [ Liquid Crystals ] ---> [ RGB Filters ] ---> [ Display Screen]

**Advantages of LCD:**

* Thin, lightweight, low power consumption.
* High resolution and sharp image quality.

**7.(a) What is interfacing memory? Give a brief description. (6 marks)**

**Memory Interfacing:**

* Memory interfacing is the process of **connecting memory devices (RAM, ROM, etc.) with the CPU** so that the CPU can read from and write to them.
* Since CPU and memory may have different speed, size, and control requirements, interfacing logic is needed.

**Key Steps in Memory Interfacing:**

1. **Address Decoding:** CPU generates address → Decoder selects specific memory chip/location.
2. **Control Signals:** CPU provides Read/Write signals → Memory responds accordingly.
3. **Data Bus Connection:** CPU and memory exchange data through data bus.

**Diagram of Memory Interfacing (Simplified):**

CPU

----------------

| Adder Bus ---> |----> Decoder ----> Memory Chip Select

| Data Bus <--> |-----------------> Memory (RAM/ROM)

| Control ------|----> Read/Write signals

----------------

**Explanation:**

* Decoder activates only the selected memory chip.
* Control lines ensure correct operation (read or write).
* Data is exchanged over the data bus.

**(b) Explain different types of parallel transmission techniques. (5 marks)**

**Answer:**

**Parallel Transmission:**

* In parallel transmission, **multiple bits are transferred simultaneously** using multiple wires.

**Types:**

1. **Simple Parallel Transmission:**
   * Data transferred directly over N lines (for N-bit data).
   * Fast but costly due to more wires.
2. **Strobe Method:**
   * A **strobe signal** is sent along with data.
   * Receiver reads data when strobe is active.
3. **Handshake Method:**
   * Uses **Request (REQ)** and **Acknowledge (ACK)** signals.
   * Ensures reliable transfer.

**Diagram (Handshake in Parallel Transmission):**

Sender ---- Data ----> Receiver

Sender ---- REQ ----> Receiver

Receiver -- ACK -----> Sender

**Advantages:**

* High-speed communication.
* Suitable for short distance (like computer buses).

**Disadvantages:**

* Expensive (requires many wires).
* Not suitable for long distance (signal skew problem).

**(c) Explain different types of serial transmission techniques. (5 marks)**

**Serial Transmission:**

* In serial transmission, data bits are sent **one after another** using a single communication line.
* Cheaper but slower compared to parallel.

**Types:**

1. **Synchronous Serial Transmission:**
   * A clock signal is shared between sender and receiver.
   * Data is sent in continuous stream without start/stop bits.
   * Examples: SPI, I²C.
2. **Asynchronous Serial Transmission:**
   * No common clock.
   * Each character is framed with **start bit, data bits, parity, stop bits**.
   * Example: RS-232.
3. **Isochronous Transmission:**
   * Data is sent at fixed time intervals.
   * Used in real-time communication (e.g., video/audio streaming).

**Diagram (Asynchronous Serial Frame):**

| Start (0) | D0 | D1 | D2 | ... | D7 | Parity | Stop (1) |

**Comparison (Parallel vs Serial):**

* Parallel: Fast, short distance.
* Serial: Economical, long distance.

**(d) LED Monitor**

* **LED (Light Emitting Diode) monitor** is a type of **LCD monitor** that uses **LED backlighting** instead of CCFL (Cold Cathode Fluorescent Lamp).
* It is thin, lightweight, and energy efficient.
* Provides better brightness, contrast, and color quality.

**Diagram (Simplified):**

[ LED Backlight ] → [ LCD Panel ] → [ RGB Filters ] → [ Screen ]

**Advantages:**

* Lower power consumption.
* Long lifespan.
* Slim design and high resolution

**(e) Stepper Motor**

* A **stepper motor** is a digital motor that rotates in **discrete steps** according to input pulses.
* Each pulse moves the shaft by a fixed angle (called step angle).
* Widely used in **printers, robotics, CNC machines**.

**Working Principle:**

* Rotor moves step by step as stator windings are energized in sequence.

**Diagram (Simplified):**

[ Stator Coils ] → Magnetic Field → Rotor moves in steps

**Features:**

* Accurate position control without feedback.
* Speed proportional to pulse frequency.

**(f) Digitizer**

* A **digitizer** is an input device that converts **hand-drawn images, sketches, or handwriting** into digital form.
* It consists of a **flat tablet** and a **stylus or puck**.
* Commonly used in **CAD (Computer-Aided Design)**, graphic design, and drawing applications.

**Diagram (Simplified):**

[ Stylus/Puck ] → [ Tablet Surface ] → [ Computer (Digital Image) ]

**Advantages:**

* High precision input.
* Useful for designers and engineers.

1(b)

A black screen with white text

AI-generated content may be incorrect.

1(a)

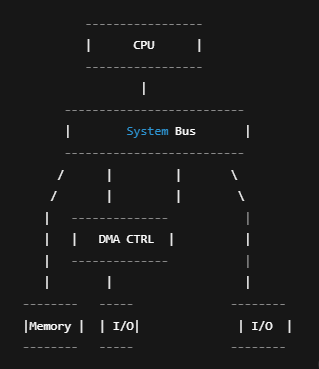
A screen shot of a computer

AI-generated content may be incorrect.

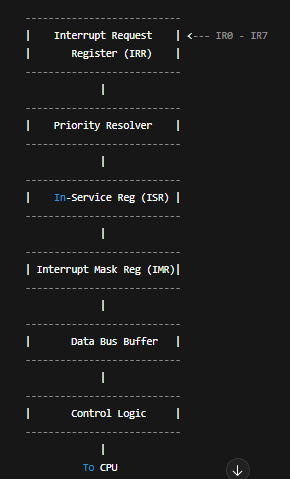
3(b) A computer screen shot of text

AI-generated content may be incorrect.

2(a)



2(b)

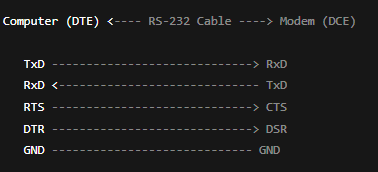


3(a)

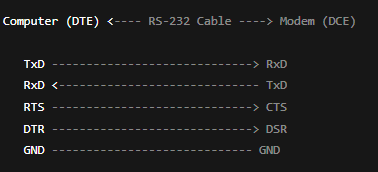
A screen shot of a computer

AI-generated content may be incorrect.

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3(a)

A screen shot of a computer

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