

Microcontroller Unit Fundamentals

Assignment Solution

Question no. 1(a)

i. Micro-Processor →

- General Purpose Processor, Capable of arithmetic & logical operations

It consists of CPU, memory (cache) & I/O interfaces

To be able to communicate

ii. Microcontroller →

- Single Specific Purpose Chip, Consists of microprocessor, RAM, ROM, I/O Ports, System Peripherals and Interrupt Controller, Used to control Embedded Systems

iii. Embedded Systems →

- Single Purpose Computer Systems, that operate under constraints such as Time, Size & Power Consumption

iv. Mechatronic System →

- System in which mechanical hardware is driven by Embedded Systems

* v. N-bit Processor →

- It's any Processor that can process data and instructions in chunks of n-bits

- The number of bits in a processor determines the size of the registers, the width of the data bus and maximum size of address space

→ Question no.(2) :

Micro-Processor

General Purpose

Consists of CPU, memory
(usually cache) & I/O interfaces

Systems are bulkier as RAM,
ROM & I/O parts are added
externally, also expensive

Ideal for versatile systems
Enabling designer to select
suitable components as needed

→ Question no.(3) :

Von-Neuman Arch

Single Common memory
Space for both data
& instructions

Single data bus that
fetches both instructions
& data

Bottle neck & no Pipelining

Micro-Controller

• Specific Purpose & includes
microprocessor inside it

Consists of Micro Processor, RAM,
ROM, System Peripherals, I/O
Ports & Interrupt Controller

• Designer can't add any external
memory, I/O ports or timers

• Ideal in systems where space
& cost are critical & pre-defined

- Harvard Arch

- Separate memory area for
data and another one for
instructions

- One bus for instructions
(CPU with ROM) & another
bus for data (CPU with RAM)

- No bottle neck & Pipelining

Question No. (4) :

i. Mask ROM

- This type of ROM is not user programmable, otherwise its content is programmed by the IC manufacturer.

ii. PROM

- This type of ROM can be programmed only once.
- Each bit is a fuse, where user burns the information to it. It's manufactured as blanks and then user programs it.

iii. EEPROM

- Can be programmed and erased many times.
- It can be programmed electrically while erasing.
- It needs ultra violet rays to erase it, and it's erased totally as there is no option to erase certain regions.

iv. EEPROM

- Similar to EEPROM but it can be erased electrically.
- On erasing you can select bytes or memory blocks to be erased and not all the memory.

v. Flash

- The most recent technology in memory.
- They are low cost, fast in comparison with EEPROM.

→ Question No.(5) :

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i. SRAM →

- Storage cells are made of Flip Flops So it doesn't need Refreshing To keep their values so less power consumption
- Each cell requires 6 Transistors making it more expensive
- offers higher performance, more complex design & less used in cache manufacturing

ii. DRAM →

- Storage cells are made of 1 Transistor and 1 Capacitor
- So it needs refreshing To keep its value
- lower in Price so it's used in main memory, simpler design, less performance & more power consumption

iii. NVRAM →

- Basically it's a SRAM with a battery
- other design is a RAM Combines SRAM with EEPROM where content is written to EEPROM and on Power off after Power returns a backup is taken from the EEPROM

→ Question No.(6) :

Because in the normal operation the CPU can't write to it, it's written to by an external device or there may be a special configuration that gives the CPU access to write to it (access granted)

→ Question no. (7) s

i. SRAM →

Yes, Yes, Byte, Un-limited, expensive, fast

ii. DRAM →

Yes, Yes, Byte, Limited, cheap, Slow

iii. MRAM →

No, Yes, Byte, unlimited, expensive, fast

iv. Masked ROM →

No, No, --, --, cheap, fast

v. PROM →

No, once, --, --, cheap, fast

vi. EEPROM →

No, Yes, Entire chip, limited, cheap

vii. EEPROM →

No, Yes, Byte, limited, expensive, fast read slow write

viii. Flash →

No, Yes, Sectors, limited, cheap, fast read slow write