ET & IOT(CAT 1) QUESTIOBN BANK SOLUTION

1. What is UART?

: UART stand for universal asynchronous receiver-transmitter

It is one of the most used device-to-device communication protocols. It is a computer hardware (***ic***) or peripheral device serial port.

2. What is the difference between Von Neumann architecture and Harvard architecture ?

**: Difference between Von Neumann and Harvard Architecture :**

| VON NEUMANN ARCHITECTURE | HARVARD ARCHITECTURE |
| --- | --- |
| It is ancient computer architecture based on stored program computer concept. | It is modern computer architecture based on Harvard Mark I relay based model. |
| Same physical memory address is used for instructions and data. | Separate physical memory address is used for instructions and data. |
| There is common bus for data and instruction transfer. | Separate buses are used for transferring data and instruction. |
| It is cheaper in cost. | It is costly than Von Neumann Architecture. |
| CPU can not access instructions and read/write at the same time. | CPU can access instructions and read/write at the same time. |
| It is used in personal computers and small computers. | It is used in micro controllers and signal processing. |

4. What is large scale embedded systems ?

**:The embedded systems have highly complex hardware and software, built around 32-bit or 64-bit processors/controllers, RISC processors, SoC, scalable and configurable processors**.

5. Architecture of Microcontroller used in Arduino UNO.

 :**ATmega328- a 28 pin microcontroller**.

6. Explain about the details of other hardware units available in embedded system

SOL:-

POWER SUPPLY:

The power supply is an essential part of any embedded systems circuits. An embedded system may need a supply of 5 volts or if it is low power then maybe 3.3 or 1.8v. The supply may be provided with the help of battery or we can use any wall adapter. It will depend on the application need.

PROCESSOR:

 processor is the main brain inside any embedded systems. This is a major factor that affects the performance of the system. There are different processors available in the market. An embedded system may use microprocessor or microcontroller.

MEMORY:-

RAM memory is volatile memory and used for temporary storage of the data. And the selection of it depends on the user need and the application.

The ROM memory or Code Memory. This is used for the storage of the program. Once system powered, the system fetches the code from the ROM memory.

The EEPROM is a unique memory. The content can be erased and reprogrammed by a high voltage pulse input. This is used to store the data by the program itself. Suppose we have a temperature data logger

**Communication Ports**

Embedded systems hardware has different types of communication ports to communicate with the other embedded devices

7. Describe in detail about embedded system on-chip with necessary sketch

:A **system on a chip**, also known as an **SoC**, is essentially an integrated circuit or an IC that takes a single platform and integrates an entire electronic or computer system onto it. It is, exactly as its name suggests, an entire system on a single chip.

8. Discuss about the factors to be considered for selection of processor in embedded system.

::The most important factor to consider when choosing a processor for an embedded system is its performance. A processor's speed is primarily determined by its architecture and silicon design.

9. Illustrate with example the techniques used for memory devices

10. Write the need for software in embedded systems.

11. What is flash memory and EEPROM ?

: Flash memory is **a non-volatile memory chip used for storage and for transfering data between a personal computer (PC) and digital devices**. It has the ability to be electronically reprogrammed and erased.

EEPROM (electrically erasable programmable read-only memory) is **user-modifiable read-only memory (ROM) that can be erased and reprogrammed (written to) repeatedly through the application of higher than normal electrical voltage**. Unlike EPROM chips, EEPROMs do not need to be removed from the computer to be modified.

12. What do you mean by system-on-chip (SOC)? Mention one example

: SoC, is simply **a merged circuit or an integrated circuit (IC) that uses one platform and joins the whole electronic or the entire computer system on it**.

One common example of tech that uses an SoC is **video game consoles**,

13. What are the different memory devices used in embedded systems?

* Volatile Memory Module-RAM.
* Internal Data storage circuit for RAM memory chip.
* Non volatile memory-ROM Memory.
* Static random Access memory (SRAM)
* Dynamic Access Random Memory (DRAM)
* Programmable Read Only Memory.

14. Explain input output devices used in embedded systems.

**An input device is something you connect to a computer that sends information into the computer.** **An output device is something you connect to a computer that has information sent to it**.

15. Distinguish between microprocessor and microcontroller ?

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| --- | --- |
| **Microprocessor** | **Microcontroller** |
| Microprocessor is the heart of Computer system. | Micro Controller is the heart of an embedded system. |
| It is only a processor, so memory and I/O components need to be connected externally | Micro Controller has a processor along with internal memory and I/O components. |
| Memory and I/O has to be connected externally, so the circuit becomes large. | Memory and I/O are already present, and the internal circuit is small. |
| Most of the microprocessors do not have power saving features. | Most of the microcontrollers offer power-saving mode. |
| It is mainly used in personal computers. | It is used mainly in a washing machine, MP3 players, and embedded systems. |
| Microprocessors are based on Von Neumann model | Micro controllers are based on Harvard architecture |

16. What is system on chip? Explain embedded systems change with system on chip.

A system on a chip, also known as an SoC, is essentially **an integrated circuit or an IC that takes a single platform and integrates an entire electronic or computer system onto it**.

17. What is processor architecture? What are the different processor architectures available for processor design?

Processor Architecture is **a fluid term that is basically useful only in comparisons to something else**. A processor is made of transistors. The transistors are arranged in a sort of hardware-based computer program that is designed to accept inputs and process them into outputs. The inputs are machine code.

the different processor architectures available for processor design ARE:

 (1) Von-Neumann (or stored program computer) architecture ·

(2) Harvard architecture ·

(3) Harvard Architecture Derivatives ·

(4) CISC ( ...

18. Explain the design process of embedded systems.

An embedded system design process is **how a manufacturer determines the requirements for a small computerized system embedded within a product**. Then, they decide the best way to build that system and test that it works. In an embedded system, hardware and software work together.

19. What are the programming languages used in embedded systems?

 The most used languages include **C, C++, Python, MicroPython, and Java**.

20. Explain about significance of embedded system and classification of the Embedded systems.

THE significance ofEmbedded systems is **to control a specific function within a device**. They are usually designed to only perform this function repeatedly, but more developed embedded systems can control entire operating systems.

Embedded Systems are classified into three types based on the performance of the microcontroller such as

**Small scale embedded systems**.

**Medium scale embedded systems**.

**Sophisticated embedded systems**.

\*21. Explain about the components used as core of an embedded system. Also mention their commonly used application.

The component used as Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch etc.

22. Explain the classification of embedded systems.

Embedded systems are classified into four categories based on their performance and functional requirements:

**1..Real-Time Embedded Systems :**  
A Real-Time Embedded System is strictly time specific which means these embedded systems provides output in a particular/defined time interval. These type of embedded systems provide quick response in critical situations which gives most priority to time based task performance and generation of output.

2.. **Stand Alone Embedded Systems :**  
Stand Alone Embedded Systems are independent systems which can work by themselves they don’t depend on a host system. It takes input in digital or analog form and provides the output.

3.. **Networked Embedded Systems :**  
Networked Embedded Systems are connected to a network which may be wired or wireless to provide output to the attached device. They communicate with embedded web server through network.

4.. **Mobile Embedded Systems :**  
Mobile embedded systems are small and easy to use and requires less resources. They are the most preferred embedded systems.

23. Explain the input and output devices used in embedded systems.

input devices are the **mouse, trackballs, light pens, graphical tablets, scanners of several designs, speech recognition devices, optical character recognition hardware and software**, while

**monitors and printers** are output devices

.

24. What is an embedded system? List out its applications. Explain why the processors play a vital role in embedded system

An Embedded system is **a combination of computer hardware and software**. As with any electronic system, this system requires a hardware platform and that is built with a microprocessor or microcontroller.

Applications are:-

**Embedded Systems in Automobiles and in telecommunications**

**Embedded Systems in Smart Cards, Missiles and Satellites**

**Embedded Systems in Peripherals  & Computer Networking**

**Embedded Systems in Consumer Electronics**

25. What is the difference between RISC and CISC ?

## Difference between the RISC and CISC Processors

|  |  |
| --- | --- |
| **RISC** | **CISC** |
| It is a Reduced Instruction Set Computer. | It is a Complex Instruction Set Computer. |
| It emphasizes on software to optimize the instruction set. | It emphasizes on hardware to optimize the instruction set. |
| It is a hard wired unit of programming in the RISC Processor. | Microprogramming unit in CISC Processor. |
| It requires multiple register sets to store the instruction. | It requires a single register set to store the instruction. |
| RISC has simple decoding of instruction. | CISC has complex decoding of instruction. |
| Uses of the pipeline are simple in RISC. | Uses of the pipeline are difficult in CISC. |
| It uses a limited number of instruction that requires less time to execute the instructions. | It uses a large number of instruction that requires more time to execute the instructions. |
| It uses LOAD and STORE that are independent instructions in the register-to-register a program's interaction. | It uses LOAD and STORE instruction in the memory-to-memory interaction of a program. |
|  |  |
| The execution time of RISC is very short. | The execution time of CISC is longer. |

26. How the software is embedded on to the system? Explain.

Embedded software is **specialized programming in a chip or on firmware in an embedded device to controls its functions**. Hardware makers use embedded software to control the functions of various hardware devices and systems.

27. Explain the techniques used for selection of memory in embedded systems.

Selection of suitable memory is very much essential step in high performance applications, because the challenges and limitations of the system performance are often decided upon the type of memory architecture.

Systems memory requirement depend primarily on the nature of the application that is planned to run on the system. Memory performance and capacity requirement for low cost systems are small, whereas memory throughput can be the most critical requirement in a complex, high performance system.

Following are the factors that are to be considered while selecting the memory devices,

* Speed
* Data storage size and capacity
* Bus width
* Latency
* Power consumption
* Cost