

Q.1 a. Explain any four characteristics of embedded systems.

Answer:

a. Characteristics of embedded systems.

1. Suitable for real-time and multi-rate operations which may take place at distinct rates.
2. Performs complex algorithms.
3. Suitable for complex graphic user interfaces (GUI)s and other user interfaces.
4. Performs the dedicated functions.

b. Describe the functioning of microcontroller.

Answer:

- b. The design approach of the microcontroller is: make a single design that can be used in as many applications as many as possible. The microprocessor design accomplishes this goal by having a very flexible and extensive repertoire of multi-byte instructions. These instructions work in a hardware configuration that enables large amounts of memory and I/O to be connected to address and data bus pins on the integrated circuit package. Much of the activity in the microprocessor has to do with moving code and data words to and from *external* memory to the CPU. The architecture features working registers that can be programmed to take part in the memory access process, and the instruction set is aimed at expediting this activity in order to improve throughput. The pins that connect the microprocessor to external memory are unique, each having a single function.

c. Discuss the features of write ability and storage performance of memory.

Answer: Page Number 111-112, Embedded Systems Design, Frank Vahid

d. Explain the process of A/D and D/A converters.

Answer: Page Number 102-103, Embedded Systems Design, Frank Vahid

e. Explain concurrent process model. Give an example with illustration.

Answer: Page Number 222-223, Embedded Systems Design, Frank Vahid

f. Explain the role of debuggers and emulators in embedded systems.

Answer: Page Number 73, Embedded Systems Design, Frank Vahid

g. Give the advantages of networked embedded systems.

Answer: Page Number 159-160, Embedded Systems 2nd Edition, Raj Kamal

Q.2 a. Discuss the functioning of Application-Specific Instruction-Set Processors (ASIPs) and Digital Signal Processors (DSPs) in embedded systems.

Answer: Page Number 74-75, Embedded Systems Design, Frank Vahid

- b. Describe the basic architecture of general-purpose processor. Explain the features of data sub-system and control sub-system.

Answer: Page Number 55-57, Embedded Systems Design, Frank Vahid

- c. Explain the features of System-on-Chip (SoC) and give the relevant block diagram.

Answer: Page Number 29-30, Embedded Systems 2nd Edition, Rajkamal

- Q.3** a. Compare the characteristic features of ROM, Mask-Programmed ROM and One-Time Programmable ROM.

Answer: Page Number 112-115, Embedded Systems Design, Frank Vahid

- b. Explain the features of the following:

- (i) Memory hierarchy
- (ii) Cache-Replacement Policy
- (iii) Processor and memory interface

Answer: Page Number 125-126 & 128, Embedded Systems Design, Frank Vahid

- c. Draw the architecture of DRAM. Mention various types of DRAMs and give their respective features.

Answer: Page Number 144-145, Embedded Systems Design, Frank Vahid

- Q.4** a. Compare the strobe and handshake control protocols used in interfacing. Draw the respective waveforms.

Answer: Page Number 140-142, Embedded Systems Design, Frank Vahid

- b. Explain interrupt driven I/O for the following:

- (i) Fixed ISR location
- (ii) Vectored interrupt

Answer: Page Number 149-152, Embedded Systems Design, Frank Vahid

- c. Explain briefly the process of parallel communication and serial communication in embedded systems.

Answer: Page Number 166-167, Embedded Systems Design, Frank Vahid

Q.5 a. Explain how the program optimization improves the performance of an embedded system.

Answer: Page Number 262-264, Embedded Systems, 2nd Edition, RajKamal

b. Explain the features of Real-Time Operating Systems (RTOS) in detail.

Answer: Page Number 370-373, Embedded Systems, 2nd Edition, RajKamal

c. Explain any three interprocess communication methods used in embedded system design.

Answer: Page Number 330-337, Embedded Systems, 2nd Edition, RajKamal

Q.6 a. Describe the features of the following wired protocols used in embedded systems:

(i) I²C

(ii) Controller Area Network (CAN)

(iii) PCI bus protocols

Answer: Page Number 169-172, Embedded Systems Design, Frank Vahid

b. Describe the features of the following wireless protocols used in embedded systems:

(i) IrDA

(ii) Bluetooth

(iii) IEEE 802.11

Answer: Page Number 174-175, Embedded Systems Design, Frank Vahid

Q.7 a. Explain the design development tools used in embedded systems.

Answer: Page Number 618-622, Embedded Systems, 2nd Edition, RajKamal

b. Write short notes from any FOUR of the following.

(i) Performance design metrics in embedded system

Answer: Page Number 8-9, Embedded Systems Design, Frank Vahid

(ii) Power management in embedded system

Answer:

(ii) A power management policy is a strategy for determining when to perform certain power management operations. A power management policy in general examines the state of the system to determine when to take actions. However, the overall strategy embodied in the policy should be designed based on the characteristics of the static and dynamic power management mechanisms.

- Avoiding a power-down mode can cost unnecessary power.
- Powering down too soon can cause severe performance penalties.

(iii) Fault tolerance in embedded system**Answer:**

- (iii) Fault tolerance: Despite all the efforts for robustness, faults may occur. Embedded systems should be operational even after such faults. Restarts, like the ones found in personal computers, cannot be accepted. This means that retries may be required after attempts to communicate failed. A conflict exists with the first requirement: If we allow retries, then it is difficult to meet strict real-time requirements. Fault tolerance mechanisms must be designed such that they do not create any additional difficulty in explaining the behavior of the system. Fault tolerance mechanisms should be decoupled from the regular function.

(iv) Process control applications of embedded system**Answer:**

- (iv) Embedded systems are used in process controlled industrial applications.

(v) Multimedia applications of embedded system**Answer:**

- (v) Embedded are used in CCTV and surveillance monitoring for real-time applications.