Q.1 a. Explain various types of DRAM. Mention their respective data and control signals.

Answer: Page No.130-133 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

b. Mention various I/O devices that can be interfaced in embedded systems. Explain their features.

Answer: Timers and Counters - Timers and counters are distinguished from one another largely by their use, not their logic.

A watchdog timer is an I/O device that is used for internal operation of a system.

Analog/digital (A/D) and digital/analog (D/A) converters (typically known as ADCs and DACs, respectively) are often used to interface non digital devices to embedded systems.

A keyboard is basically an array of switches, but it may include some internal logic to help simplify the interface to the microprocessor.

Light-emitting diodes (LEDs) are often used as simple displays by themselves, and arrays of LEDs may form the basis of more complex displays.

Display - display device may be either directly driven or driven from a frame buffer. Typically, displays with a small number of elements are driven directly by logic, while large displays use a RAM frame buffer.

Touchscreen - A touchscreen is an input device overlaid on an output device. The touchscreen registers the position of a touch to its surface.

c. Differentiate the functioning of port-based I/O and bus-based I/O.

Answer: Page No.144-145 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

d. Explain the issues and challenges in embedded system design.

Answer:

ISSUES

Energy

Security

Time-sensitive applications

CHALLENGES AND UNCERTAINTIES

Open Systems, Internet Access, and Neutrality Privacy

e. Explain program optimization features in embedded system design.

Answer: PROGRAM OPTIMIZATION

(i) Expression Simplification
(ii) Dead Code Elimination
(iii) Procedure Inlining
(iv) Loop Transformations
(v) Register Allocation and scheduling

f. Distinguish between CAN, IrDA and PCI protocols.

Answer:

g. Write short notes on testing and debugging process in embedded system design. **(7×4)**

Answer: Page No. 71-74 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

Q.2 a. Compare microcontrollers and microprocessors. Also explain feature of system on chip (SoC). **(6)**

Answer: Microcontroller

Microcontrollers can be considered as self-contained systems with a processor, memory and peripherals so that in many cases all that is needed to use them within an embedded system is to add software. The processors are usually based on 8 bit stack based architectures such as the MC6800 family. There are 4 bit versions available such as the National COP series which further reduce the processing power and reduce cost even further. These are limited in their functionality but their low cost has meant that they are used in many obscure applications.

Microprocessor based

Microprocessor-based embedded systems originally took existing general-purpose processors such as the MC6800 and 8080 devices and constructed systems around them using external peripherals and memory. The use of processors in the PC market continued to provide a series of faster and faster processors such as the MC68020, MC68030 and MC68040 devices from Motorola and the 80286, 80386, 80486 and Pentium devices from Intel. These CISC architectures have been complemented with RISC processors such as the PowerPC, MIPS and others. These systems offer more performance than is usually available from a traditional microcontroller.

b. Explain the features of Digital signal processors. **(6)**

Answer: Page No. 76-83 of Computers as Components, Principles of Embedded Computing System Design, Second Edition by Wayne Wolf.

c. Explain the single purpose processors and general purpose processors in detail. Give an illustration. **(6)**

Answer: Page No.9-13 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid

Q.3 a. Explain various cache mapping techniques. Give an illustration for each. **(9)**

Answer: Page No.126-129 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

b. Explain how the program optimization improves the performance of embedded system. **(5)**

Answer: Page No. 398-399 of Computers as Components, Principles of Embedded Computing System Design, Second Edition by Wayne Wolf.

c. Explain the features of real-time operating system. **(4)**

Answer: Many multitasking operating systems available today are also described as 'real-time'. These operating systems provide additional facilities allowing applications that would normally interface directly with the microprocessor architecture to use interrupts and drive peripherals to do so without the operating system blocking such activities. Many multitasking operating systems prevent the user from accessing such sensitive resources. This overzealous caring can prevent many operating systems from being used in applications such as industrial control. A characteristic of a real-time operating system is its defined response time to external stimuli. If a peripheral generates an interrupt, a real-time system will acknowledge and start to service it within a maximum defined time. Such response times vary from system to system, but the maximum time specified is a worst case figure, and will not be exceeded due to changes in factors such as system workload.

Q.4 a. Compare the features of parallel communication and wireless communication. Give their applications. **(6)**

Answer: Page No. 166-168 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

b. Describe the functioning of strobe and handshake control methods. Explain briefly with an illustration. **(6)**

Answer: Page No.140-144 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

c. What is the significance of arbitration technique in direct memory access (DMA)? Explain briefly. **(6)**

Answer: Page No.159-163 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid

Q.5 a. Write the application of embedded system for the following: **(5+4)**
(i) Multimedia (ii) Telecommunication

b. What is the significance of hardware/software design methodology? Define the term 'concurrent engineering' and explain the features of concurrent engineering. **(9)**

Answer: Page No. 441-444 of Computers as Components, Principles of Embedded Computing System Design, Second Edition by Wayne Wolf.

Q.6 a. Compare the functioning of program state machine model and concurrent process model. **(6)**

Answer: Page No.220-224of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

b. What is the significance of shared memory in process communication? How message passing improves the data exchange? Explain briefly. **(6)**

Answer: Page No.229-232 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid.

c. Write brief notes on the power saving techniques used in processor models. Explain various modes. (6)

Answer: Page No. 256-259 of Programming Embedded Systems by Michael Barr & Anthony Massa, O' REILLY.

Q.7 Write short notes from any <u>THREE</u> of the following: (3×6)

(i) Networking Protocols
(ii) Fault tolerance in embedded system
(iii) RT-Level Combinational and sequential components
(iv) Power Management in embedded system

Answer:

Answer (i) Page No.169-173 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid

Answer (iii) Page No.169-173 of Embedded System Design A Unified Hardware/Software Introduction by Frank Vahid

TEXT BOOKS

1. **Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, second edition, Morgan Kaufmann Publishers 2008**
2. **Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/software Introduction, Hony Wiley & Sons 2002**

3. M.Barr, Anthony Massa, Programming Embedded Systems, second edition, O'Reilly 2006