1. Introduction to Embedded Systems

1. **What is an embedded system?**
   a) A general-purpose computer system
   b) A combination of hardware and software dedicated to specific tasks
   c) A standalone server
   d) A cloud computing device
   Answer: b) A combination of hardware and software dedicated to specific tasks

2. **Which of the following is NOT a characteristic of embedded systems?**
   a) Task-specific
   b) Low cost
   c) High power consumption
   d) High efficiency
   Answer: c) High power consumption

3. **What is the primary controller in an embedded system?**
   a) Microcontroller
   b) Hard disk
   c) Graphics card
   d) BIOS
   Answer: a) Microcontroller

4. **Which of these components is NOT part of embedded system hardware?**
   a) Peripherals
   b) Device drivers
   c) Memory
   d) Input/Output interfaces
   Answer: b) Device drivers

5. **Embedded systems are designed for which purpose?**
   a) General computing
   b) Application-specific tasks
   c) Cloud data processing
   d) Entertainment applications only
   Answer: b) Application-specific tasks

---

2. Characteristics of Embedded Systems

6. **Which feature ensures that embedded systems perform within a specific time frame?**
   a) High efficiency
   b) Task-specific design
   c) Time specificity
   d) Minimal user interface
   Answer: c) Time specificity

7. **What does "low power consumption" in embedded systems indicate?**
   a) Reduced energy needs
   b) Increased power supply
   c) Enhanced speed

d) Improved functionality
Answer: a) Reduced energy needs

8. **Which of these is a reliability feature of embedded systems?**
   a) Task specificity
   b) Minimal user interface
   c) High stability
   d) Cost-effectiveness
   Answer: c) High stability

9. **Why are embedded systems designed to have minimal user interfaces?**
   a) To reduce design costs
   b) To simplify user interactions
   c) To ensure autonomous operation
   d) All of the above
   Answer: d) All of the above

---

3. Types of Embedded Systems

10. **Which of these is an example of a standalone embedded system?**
    a) Washing machine
    b) Smartphone
    c) Smart thermostat
    d) Web server
    Answer: a) Washing machine

11. **Network embedded systems are used for...**
    a) Isolated operations
    b) Communication with other systems
    c) Simple household tasks
    d) Single-user operations
    Answer: b) Communication with other systems

12. **What is a key feature of real-time embedded systems?**
    a) Meeting strict deadlines
    b) High resource consumption
    c) Unlimited storage
    d) Complex user interfaces
    Answer: a) Meeting strict deadlines

13. **Mobile embedded systems are characterized by...**
    a) High speed and low mobility
    b) Small size and portability
    c) Robust networking
    d) Expensive components
    Answer: b) Small size and portability

---

4. Hardware Components

14. **Which memory type is used for storing firmware?**
    a) RAM
    b) ROM
    c) Cache memory
    d) SRAM
    Answer: b) ROM

15. **What is the purpose of an ADC in embedded systems?**
    a) To convert analog signals to digital
    b) To store data
    c) To power the system
    d) To act as a clock
    Answer: a) To convert analog signals to digital

16. **Microcontrollers are preferred in embedded systems because...**
    a) They are cost-effective
    b) They integrate CPU, memory, and peripherals
    c) They are faster than microprocessors
    d) All of the above
    Answer: d) All of the above

17. **What is the role of power management in embedded systems?**
    a) Enhances system design
    b) Reduces energy consumption
    c) Ensures data accuracy
    d) Provides data storage
    Answer: b) Reduces energy consumption

---

5. Software Components

18. **What is a device driver in embedded systems?**
    a) A software component enabling hardware communication
    b) A power management tool
    c) A user interface component
    d) A memory manager
    Answer: a) A software component enabling hardware communication

19. **What type of software directly interacts with hardware in simpler systems?**
    a) RTOS
    b) Bare-metal software
    c) Device drivers
    d) Middleware
    Answer: b) Bare-metal software

20. **Which type of software layer is responsible for specific system functionality?**
    a) Middleware
    b) Operating system
    c) Application software

d) Device drivers
Answer: c) Application software

---

6. Communication Protocols

21. **Which communication interface is commonly used for onboard data transfer?**
    a) Ethernet
    b) SPI
    c) Bluetooth
    d) Wi-Fi
    Answer: b) SPI

22. **Which protocol supports multi-master communication?**
    a) RS232
    b) I2C
    c) USB
    d) SPI
    Answer: b) I2C

23. **Which interface is suitable for long-distance communication with noise resistance?**
    a) RS232
    b) RS485
    c) USB
    d) SPI
    Answer: b) RS485

24. **How many wires are used in RS232 communication?**
    a) 1
    b) 2
    c) 4
    d) 6
    Answer: b) 2

---

7. Real-Time Embedded Systems (RTES)

25. **Which RTES type strictly meets all deadlines?**
    a) Hard real-time systems
    b) Soft real-time systems
    c) Firm real-time systems
    d) None of the above
    Answer: a) Hard real-time systems

26. **What does a task scheduler in RTOS manage?**
    a) Data storage
    b) Resource allocation and task deadlines
    c) Hardware interfacing
    d) User interaction
    Answer: b) Resource allocation and task deadlines

27. **Which scheduling algorithm is optimal for preemptive tasks?**
    a) RMS
    b) EDF
    c) LLF
    d) Priority Scheduling
    Answer: b) EDF

---

8. Networking and IoT Standards

28. **What is a Bluetooth piconet?**
    a) A single-master network
    b) A mesh network
    c) A satellite-based system
    d) A high-speed LAN network
    Answer: a) A single-master network

29. **Which Zigbee topology is known for self-healing?**
    a) Star
    b) Mesh
    c) Tree
    d) Ring
    Answer: b) Mesh

30. **Which frequency band is used by Zigbee globally?**
    a) 915 MHz
    b) 2.4 GHz
    c) 868 MHz
    d) 5 GHz
    Answer: b) 2.4 GHz

---

9. USB Standards

31. **What is the maximum speed of USB 2.0?**
    a) 12 Mbps
    b) 480 Mbps
    c) 5 Gbps
    d) 20 Gbps
    Answer: b) 480 Mbps

32. **Which USB standard offers a maximum speed of 20 Gbps?**
    a) USB 3.1
    b) USB 3.2 (Gen 2×2)
    c) USB 2.0
    d) USB 4
    Answer: b) USB 3.2 (Gen 2×2)

33. **What is the main advantage of USB over older communication standards?**
    a) Higher cost

b) Plug-and-play functionality
c) Limited device support
d) Larger size connectors
Answer: b) Plug-and-play functionality

10. Applications of Embedded Systems

34. **Which of the following is NOT a consumer electronics application of embedded systems?**
    a) Digital camera
    b) Airbag control
    c) Washing machine
    d) Television
    Answer: b) Airbag control

35. **What role do embedded systems play in the automotive industry?**
    a) Engine management
    b) Communication protocol testing
    c) Satellite navigation systems
    d) Cloud computing
    Answer: a) Engine management

36. **Which field utilizes embedded systems for flight control and navigation?**
    a) Consumer electronics
    b) Aerospace
    c) Medical devices
    d) Defense
    Answer: b) Aerospace

37. **Pacemakers and MRI machines are examples of embedded systems in...**
    a) Automotive industry
    b) Medical devices
    c) Industrial automation
    d) Security systems
    Answer: b) Medical devices

38. **Home automation systems like smart thermostats rely on...**
    a) Networked embedded systems
    b) Real-time embedded systems
    c) Mobile embedded systems
    d) Stand-alone embedded systems
    Answer: a) Networked embedded systems

---

11. Real-Time Operating System (RTOS)

39. **Which feature is essential in RTOS for managing task priorities?**
    a) Scheduler
    b) Memory allocation
    c) Error handling
    d) Signal processing
    Answer: a) Scheduler

40. **Hard real-time systems are primarily used in...**
    a) Multimedia systems
    b) Safety-critical applications
    c) General computing tasks
    d) Cloud-based IoT devices
    Answer: b) Safety-critical applications

41. **What distinguishes firm real-time systems from soft real-time systems?**
    a) Occasional deadline misses are tolerable
    b) All deadlines are strict
    c) No tolerance for errors
    d) Exclusive use of RTOS
    Answer: a) Occasional deadline misses are tolerable

42. **In soft real-time systems, missing deadlines results in...**
    a) Catastrophic failure
    b) Degraded performance
    c) Increased speed
    d) None of the above
    Answer: b) Degraded performance

43. **Which of the following scheduling algorithms is suitable for periodic tasks?**
    a) Rate Monotonic Scheduling (RMS)
    b) Earliest Deadline First (EDF)
    c) Priority Scheduling
    d) Least Laxity First (LLF)
    Answer: a) Rate Monotonic Scheduling (RMS)

---

12. Communication Interfaces

44. **What is the primary difference between RS232 and RS485?**
    a) RS232 is single-ended, RS485 is differential
    b) RS232 supports multi-master, RS485 does not
    c) RS485 has lower noise resistance than RS232
    d) RS485 uses fewer wires than RS232
    Answer: a) RS232 is single-ended, RS485 is differential

45. **SPI is characterized by...**
    a) Multi-master capability
    b) Four-wire full-duplex communication
    c) Slow data transfer rates
    d) Limited number of slave devices
    Answer: b) Four-wire full-duplex communication

46. **In I2C communication, the master device...**
    a) Generates clock pulses
    b) Receives data only
    c) Acts as a passive component

d) Provides power to the slaves
Answer: a) Generates clock pulses

47. **Which feature of USB enhances its usability for multiple devices?**
    a) Differential signal pins
    b) Plug-and-play functionality
    c) Long-distance communication
    d) Multi-master support
    Answer: b) Plug-and-play functionality

48. **The polling principle in USB indicates...**
    a) Continuous checking of device readiness by the processor
    b) Master-slave communication structure
    c) Parallel data transmission
    d) Automatic data synchronization
    Answer: a) Continuous checking of device readiness by the processor

---

13. Advanced Embedded System Architectures

49. **Which architecture uses a single bus for instructions and data?**
    a) Harvard
    b) Von Neumann
    c) RISC
    d) ASIC
    Answer: b) Von Neumann

50. **What distinguishes the Harvard architecture from Von Neumann?**
    a) Shared memory for instructions and data
    b) Separate buses for instructions and data
    c) Single-thread processing
    d) Use of RTOS exclusively
    Answer: b) Separate buses for instructions and data

---

14. Bluetooth and Wireless Protocols

51. **What is the maximum number of active nodes in a Bluetooth piconet?**
    a) 4
    b) 8
    c) 16
    d) 32
    Answer: b) 8

52. **Which Bluetooth feature allows devices to connect and form larger networks?**
    a) Piconet
    b) Scatternet
    c) Mesh topology
    d) Tree topology
    Answer: b) Scatternet

53. **The frequency range of Bluetooth is...**
    a) 915 MHz
    b) 2.4 GHz
    c) 5 GHz
    d) 868 MHz
    Answer: b) 2.4 GHz

54. **What is the typical data transfer rate of Bluetooth?**
    a) 1 Mbps
    b) 2 Mbps
    c) 3 Mbps
    d) 5 Mbps
    Answer: c) 3 Mbps

---

15. Zigbee

55. **What is Zigbee primarily designed for?**
    a) Long-distance communication
    b) Low-power, short-range communication
    c) High-speed data transfer
    d) Video streaming
    Answer: b) Low-power, short-range communication

56. **Which Zigbee topology supports self-healing?**
    a) Star
    b) Mesh
    c) Tree
    d) Line
    Answer: b) Mesh

57. **How many devices can theoretically connect in a Zigbee network?**
    a) 240
    b) 65,000
    c) 1,024
    d) Unlimited
    Answer: b) 65,000

58. **What is the primary role of a Zigbee router?**
    a) Coordinate the network
    b) Extend the network range
    c) Process data
    d) Control end devices
    Answer: b) Extend the network range

59. **Zigbee applications include...**
    a) Industrial control systems
    b) Voice communication systems
    c) Cloud computing devices

d) Real-time navigation systems
Answer: a) Industrial control systems

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16. Embedded System Applications

60. **Which industry heavily relies on real-time embedded systems for safety?**
    a) Automotive
    b) Fashion
    c) Retail
    d) Marketing
    Answer: a) Automotive

61. **Embedded systems in medical devices are critical for...**
    a) Image processing
    b) Real-time monitoring and control
    c) High-speed computing
    d) Data warehousing
    Answer: b) Real-time monitoring and control

62. **What type of embedded system is used in smart homes?**
    a) Networked embedded systems
    b) Mobile embedded systems
    c) Standalone systems
    d) Cloud-based systems
    Answer: a) Networked embedded systems

63. **Which of these is NOT a defense application of embedded systems?**
    a) Missile guidance
    b) Biometric systems
    c) Surveillance drones
    d) Gaming consoles
    Answer: d) Gaming consoles

---

17. Summary MCQs

64. **Which design consideration ensures that embedded systems can handle future upgrades?**
    a) Scalability
    b) Real-time responsiveness
    c) Power management
    d) Application specificity
    Answer: a) Scalability

65. **What is the primary advantage of embedded systems in cost-sensitive applications?**
    a) High power consumption
    b) Customizability
    c) Cost-effectiveness
    d) Universal adaptability
    Answer: c) Cost-effectiveness

18. Types of Embedded Processors

66. **What is an embedded processor?**
    a) A type of microprocessor designed for specific tasks
    b) A general-purpose CPU
    c) A processor used only for gaming devices
    d) A memory storage unit
    Answer: a) A type of microprocessor designed for specific tasks

67. **Which of the following is NOT a characteristic of embedded processors?**
    a) Low power consumption
    b) Large size
    c) Real-time processing capabilities
    d) High reliability
    Answer: b) Large size

68. **Where are embedded processors commonly used?**
    a) Desktop computers
    b) Industrial control systems
    c) Data centers
    d) Cloud storage systems
    Answer: b) Industrial control systems

69. **What is the primary difference between microcontrollers and microprocessors?**
    a) Microcontrollers include integrated peripherals
    b) Microprocessors are smaller in size
    c) Microcontrollers are used in servers
    d) Microprocessors have embedded memory
    Answer: a) Microcontrollers include integrated peripherals

70. **Which component ensures real-time responsiveness in embedded systems?**
    a) Memory
    b) Timer
    c) Display
    d) Input interface
    Answer: b) Timer

---

19. Hardware Architecture

71. **Which of the following is NOT a hardware component of embedded systems?**
    a) Memory
    b) Input/Output interfaces
    c) Application software
    d) Power management
    Answer: c) Application software

72. **What type of memory is used for volatile data storage?**
    a) ROM
    b) Flash memory
    c) RAM

d) EEPROM
Answer: c) RAM

73. **Which hardware interface connects the system to sensors and actuators?**
    a) Communication modules
    b) Input and Output interfaces
    c) Power supply
    d) Timers
    Answer: b) Input and Output interfaces

74. **Which of the following is NOT an example of a peripheral in embedded systems?**
    a) ADC
    b) UART
    c) Operating system
    d) Timer
    Answer: c) Operating system

75. **What is the primary purpose of power management in embedded systems?**
    a) Increase processing speed
    b) Minimize power consumption
    c) Enhance user interface
    d) Maximize memory usage
    Answer: b) Minimize power consumption

---

20. Software Architecture

76. **What is the primary function of a real-time operating system (RTOS)?**
    a) Providing a graphical user interface
    b) Managing tasks and deadlines
    c) Storing firmware
    d) Managing internet connectivity
    Answer: b) Managing tasks and deadlines

77. **Which layer of software is customized for specific functionality in embedded systems?**
    a) Operating system
    b) Middleware
    c) Application software
    d) Device drivers
    Answer: c) Application software

78. **What is the purpose of device drivers in embedded systems?**
    a) To control hardware components
    b) To enhance system speed
    c) To reduce system complexity
    d) To allocate memory dynamically
    Answer: a) To control hardware components

79. **Which software component provides low-level hardware control?**
    a) Application software
    b) Middleware

c) Device drivers
d) Task scheduler
Answer: c) Device drivers

80. **Which approach directly interacts with hardware in simple embedded systems?**
    a) Bare-metal programming
    b) RTOS-based programming
    c) Middleware abstraction
    d) Cloud-based architecture
    Answer: a) Bare-metal programming

---

21. Serial Communication Protocols

81. **What type of transmission is used in RS232 communication?**
    a) Serial
    b) Parallel
    c) Optical
    d) Wireless
    Answer: a) Serial

82. **Which pin in RS232 is used for receiving data?**
    a) RX
    b) TX
    c) RTS
    d) CTS
    Answer: a) RX

83. **RS485 communication is ideal for...**
    a) Short-distance high-speed data transfer
    b) Long-distance data transfer with noise resistance
    c) Wireless networking
    d) Peer-to-peer communication
    Answer: b) Long-distance data transfer with noise resistance

84. **What type of communication does SPI use?**
    a) Half-duplex
    b) Full-duplex
    c) Single-ended
    d) Differential
    Answer: b) Full-duplex

85. **Which communication protocol uses a two-wire bus with clock and data lines?**
    a) SPI
    b) I2C
    c) RS232
    d) USB
    Answer: b) I2C

---

22. USB Standards and Specifications

86. **What is the maximum speed of USB 3.0?**
    a) 480 Mbps
    b) 5 Gbps
    c) 10 Gbps
    d) 20 Gbps
    Answer: b) 5 Gbps

87. **Which USB connector is most commonly used in modern smartphones?**
    a) Type-A
    b) Type-B
    c) Micro-USB
    d) USB-C
    Answer: d) USB-C

88. **What feature of USB supports hot swapping?**
    a) Polling principle
    b) Plug-and-play
    c) Differential signaling
    d) Sleep mode
    Answer: b) Plug-and-play

89. **USB devices can draw power up to...**
    a) 500 mA at 5V
    b) 1A at 3.3V
    c) 2A at 12V
    d) 100W at 20V
    Answer: d) 100W at 20V

90. **What is the primary difference between USB 2.0 and USB 3.0?**
    a) Cable length
    b) Maximum data transfer speed
    c) Connector type
    d) Power supply method
    Answer: b) Maximum data transfer speed

---

23. Zigbee and IoT Applications

91. **Which Zigbee topology is the simplest?**
    a) Mesh
    b) Tree
    c) Star
    d) Ring
    Answer: c) Star

92. **What is the maximum data rate for Zigbee communication?**
    a) 100 kbps
    b) 250 kbps
    c) 1 Mbps

d) 10 Mbps
Answer: b) 250 kbps

93. **Which Zigbee device type connects end devices to the network?**
    a) Coordinator
    b) Router
    c) Gateway
    d) Bridge
    Answer: b) Router

94. **What is the range of Zigbee communication in open environments?**
    a) 10 meters
    b) 100 meters
    c) 1 kilometer
    d) 10 kilometers
    Answer: b) 100 meters

95. **Which of these is NOT a common application of Zigbee?**
    a) Home automation
    b) Industrial automation
    c) Video streaming
    d) Smart metering
    Answer: c) Video streaming

24. Bluetooth Communication

96. **Bluetooth operates over which unlicensed frequency band?**
    a) 868 MHz
    b) 915 MHz
    c) 2.4 GHz
    d) 5 GHz
    Answer: c) 2.4 GHz

97. **A Bluetooth network with one master and up to seven slaves is called a...**
    a) Piconet
    b) Scatternet
    c) Mesh network
    d) Ring network
    Answer: a) Piconet

98. **What is the term for interconnected Bluetooth piconets?**
    a) Ad hoc network
    b) Scatternet
    c) Full-duplex network
    d) Peer-to-peer network
    Answer: b) Scatternet

99. **What is the theoretical maximum data transfer rate of Bluetooth 5.0?**
    a) 1 Mbps
    b) 2 Mbps
    c) 3 Mbps

d) 5 Mbps
Answer: b) 2 Mbps

100. **Which Bluetooth version supports mesh networking?**
a) Bluetooth 3.0
b) Bluetooth 4.0
c) Bluetooth 5.0
d) Bluetooth 2.0
Answer: c) Bluetooth 5.0

---

25. RTOS and Scheduling Algorithms

101. **What does a task scheduler do in RTOS?**
a) Allocates memory for applications
b) Manages task execution based on priority
c) Provides a graphical interface
d) Sends network data
Answer: b) Manages task execution based on priority

102. **Which scheduling algorithm assigns priority based on deadlines?**
a) RMS
b) EDF
c) LLF
d) Priority-based scheduling
Answer: b) EDF

103. **What is the main limitation of RMS (Rate Monotonic Scheduling)?**
a) Non-preemptive scheduling
b) Lower processor utilization for higher priority tasks
c) Requires tasks to be periodic
d) Limited to a single task
Answer: c) Requires tasks to be periodic

104. **Which scheduling algorithm uses task laxity to prioritize execution?**
a) RMS
b) EDF
c) LLF
d) Priority scheduling
Answer: c) LLF

105. **In hard real-time systems, missing a deadline results in...**
a) Degraded performance
b) Increased efficiency
c) Catastrophic failure
d) Graceful recovery
Answer: c) Catastrophic failure

---

26. Characteristics of RTES (Real-Time Embedded Systems)

106. **What is a key characteristic of soft real-time embedded systems?**
a) Hard deadlines
b) Tolerance for occasional deadline misses
c) No reliance on operating systems
d) High resource redundancy
Answer: b) Tolerance for occasional deadline misses

107. **Firm real-time systems are suitable for which scenario?**
a) Non-critical multimedia applications
b) Life-critical medical devices
c) Automated assembly lines
d) Financial market trading systems
Answer: c) Automated assembly lines

108. **Which of these is a characteristic of hard real-time systems?**
a) Flexible deadline scheduling
b) High reliance on user interaction
c) Deterministic system behavior
d) Long response times
Answer: c) Deterministic system behavior

109. **Which of the following is NOT a type of event triggering in RTES?**
a) Periodic
b) Aperiodic
c) Sporadic
d) Static
Answer: d) Static

110. **What is an example of a typical real-time embedded system?**
a) Smartwatch
b) Airbag deployment system
c) Gaming console
d) Weather monitoring system
Answer: b) Airbag deployment system

---

27. Communication Interfaces

111. **Which communication interface is commonly used for connecting microcontrollers to sensors?**
a) I2C
b) Ethernet
c) RS232
d) Zigbee
Answer: a) I2C

112. **RS485 is better than RS232 because it...**
a) Uses less power
b) Offers better noise immunity
c) Provides higher speeds

d) Is a wireless protocol
Answer: b) Offers better noise immunity

113. **Which communication protocol is most suitable for connecting microcontrollers with multiple peripherals?**
a) USB
b) SPI
c) RS232
d) UART
Answer: b) SPI

114. **What is the role of the clock signal in synchronous communication?**
a) Ensures data security
b) Synchronizes data transfer timing
c) Identifies the sender
d) Acts as a voltage reference
Answer: b) Synchronizes data transfer timing

115. **What is the maximum data transfer rate for RS485?**
a) 10 Mbps
b) 1 Mbps
c) 20 kbps
d) 480 Mbps
Answer: a) 10 Mbps

---

28. Embedded System Design Considerations

116. **What is scalability in embedded system design?**
a) Ability to handle increasing complexity or workloads
b) Capability to reduce system costs
c) Using minimal hardware components
d) Simplifying the user interface
Answer: a) Ability to handle increasing complexity or workloads

117. **Which design consideration is crucial for safety-critical applications?**
a) High flexibility
b) Reliability
c) Aesthetic design
d) Minimal interface
Answer: b) Reliability

118. **What is fault tolerance in embedded systems?**
a) Ability to operate despite hardware or software failures
b) A feature to reduce power consumption
c) A mechanism for debugging code
d) A way to enhance communication speeds
Answer: a) Ability to operate despite hardware or software failures

119. **Which of the following ensures system security?**
a) Encryption

b) Fault tolerance
c) Low-cost components
d) Redundancy
Answer: a) Encryption

120. **Testing in embedded systems includes...**
a) Environmental variations and real-time behavior
b) Network speed testing
c) Manual user interface validation
d) All of the above
Answer: a) Environmental variations and real-time behavior

---

29. Von Neumann vs. Harvard Architecture

121. **What is a key limitation of Von Neumann architecture?**
a) Separate memory for data and instructions
b) Sequential processing due to shared bus
c) Inability to execute complex instructions
d) Lack of scalability
Answer: b) Sequential processing due to shared bus

122. **Harvard architecture is most commonly used in...**
a) General-purpose computers
b) Embedded systems
c) Mainframes
d) Cloud servers
Answer: b) Embedded systems

123. **What is an advantage of Harvard architecture over Von Neumann?**
a) Reduced complexity
b) Faster data and instruction access
c) Single bus design
d) Larger size components
Answer: b) Faster data and instruction access

124. **Which memory design allows simultaneous access to instructions and data?**
a) Von Neumann
b) Harvard
c) RISC
d) CISC
Answer: b) Harvard

125. **Von Neumann architecture supports...**
a) Parallel processing of instructions
b) Shared memory for data and instructions
c) Separate buses for instructions and data
d) High-speed real-time operation
Answer: b) Shared memory for data and instructions

This brings the total to **125 MCQs**. I'll continue with 26 more to complete **150 MCQs**!

30. IoT and Embedded Networking Standards

126. **Which of the following is an IoT communication protocol?**
a) MQTT
b) USB
c) RS232
d) Harvard Architecture
Answer: a) MQTT

127. **Which IoT protocol uses a lightweight messaging system for resource-constrained devices?**
a) MQTT
b) HTTP
c) Zigbee
d) Ethernet
Answer: a) MQTT

128. **Which type of interface is used for onboard communication in embedded systems?**
a) External Communication Interface
b) Device/Board Level Communication Interface
c) Cloud Interface
d) User Interface
Answer: b) Device/Board Level Communication Interface

129. **What is the purpose of an external communication interface?**
a) Interconnect internal system components
b) Transfer data between the system and external devices
c) Reduce system power consumption
d) Perform input/output operations
Answer: b) Transfer data between the system and external devices

130. **Which wireless communication interface is widely used in IoT devices?**
a) RS485
b) SPI
c) Wi-Fi
d) USB
Answer: c) Wi-Fi

---

31. Applications of Real-Time Embedded Systems (RTES)

131. **What type of real-time system is used in airbag deployment?**
a) Firm real-time
b) Hard real-time
c) Soft real-time
d) Hybrid real-time
Answer: b) Hard real-time

132. **A fully automated assembly line is an example of which RTES type?**
a) Firm real-time
b) Soft real-time
c) Hard real-time
d) Dynamic real-time
Answer: a) Firm real-time

133. **Which RTES is commonly used in multimedia applications?**
a) Hard real-time
b) Firm real-time
c) Soft real-time
d) Static real-time
Answer: c) Soft real-time

134. **What is a typical industrial application of RTES?**
a) Cloud-based storage
b) Process control systems
c) Online gaming
d) Multimedia playback
Answer: b) Process control systems

135. **Which characteristic is most critical in a medical RTES like a pacemaker?**
a) High-speed internet connectivity
b) Deterministic behavior and accuracy
c) User-friendly interface
d) Multimedia support
Answer: b) Deterministic behavior and accuracy

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32. Advanced Embedded Communication Standards

136. **Which communication interface is synchronous and multi-master capable?**
a) I2C
b) SPI
c) RS232
d) RS485
Answer: a) I2C

137. **Which standard offers high-speed serial communication for peripherals?**
a) USB 3.2
b) RS232
c) SPI
d) Zigbee
Answer: a) USB 3.2

138. **Zigbee is suitable for...**
a) High-bandwidth applications
b) Long-range communication
c) Low-power and short-range communication

d) Real-time video streaming
Answer: c) Low-power and short-range communication

139. **Which type of interface supports full-duplex communication?**
a) SPI
b) RS232
c) I2C
d) RS485
Answer: a) SPI

140. **What is the key advantage of RS485 over RS232?**
a) Better noise immunity and longer transmission range
b) Simpler protocol design
c) Higher data transfer speed
d) Lower power consumption
Answer: a) Better noise immunity and longer transmission range

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33. General Characteristics of Embedded Systems

141. **Which characteristic is vital for battery-powered embedded systems?**
a) High processing speed
b) Low power consumption
c) Real-time multitasking
d) Parallel processing
Answer: b) Low power consumption

142. **Task-specific embedded systems are optimized for...**
a) Multi-user applications
b) Specific functionalities
c) Cloud-based operations
d) Gaming and entertainment
Answer: b) Specific functionalities

143. **Embedded systems without complex user interfaces often rely on...**
a) Autonomous operation
b) Real-time decision-making
c) High-speed internet
d) Dynamic user input
Answer: a) Autonomous operation

144. **What is the purpose of testing and validation in embedded systems?**
a) To reduce costs
b) To improve aesthetic design
c) To ensure reliability and performance
d) To enhance user interactivity
Answer: c) To ensure reliability and performance

145. **In embedded systems, fault tolerance refers to...**
a) Operating despite failures
b) Optimizing system power usage

c) Increasing device speed
d) Simplifying system design
Answer: a) Operating despite failures

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34. Miscellaneous Embedded Systems Questions

146. **Which is NOT a characteristic of an RTOS?**
a) Real-time scheduling
b) Deterministic behavior
c) High-latency response
d) Predictable task execution
Answer: c) High-latency response

147. **ASICs are used in embedded systems because they...**
a) Reduce system cost for specific applications
b) Support generic applications
c) Provide universal hardware design
d) Offer low processing speeds
Answer: a) Reduce system cost for specific applications

148. **A key feature of embedded networking is...**
a) Local and remote communication capabilities
b) High processing speed
c) Complex debugging features
d) User-dependent operation
Answer: a) Local and remote communication capabilities

149. **What is the role of a task scheduler in RTOS?**
a) Manage application software
b) Allocate tasks based on priority
c) Handle hardware drivers
d) Store data
Answer: b) Allocate tasks based on priority

150. **Which of the following is NOT a real-time system?**
a) Elevator control system
b) Traffic signal control
c) Email server
d) Pacemaker
Answer: c) Email server