19ECT312– EMBEDDED SYSTEMS DESIGN
Question Bank
Unit-1

1. What is an embedded system? What are the components of embedded system?

An embedded system employs a combination of hardware & software (a "computational engine") to perform a specific function; is part of a larger system that may not be a "computer"; works in a reactive and time-constrained environment.

The three main components of an embedded system are

- Hardware
- Main application software
- RTOS

System:

A way of doing one or more tasks according to a program.

2. What are the applications of an embedded system?

Embedded Systems: Applications:

- Consumer electronics, e.g., cameras, camcorders, etc.,
- Consumer products, e.g., washers, microwave ovens, etc.,
- Automobiles (anti-lock braking, engine control, etc.,)
- Industrial process controllers & avionics/defense applications
- Computer/Communication products, e.g., printers, FAX machines, etc.,

3. What are the main components of an embedded system?

Three main components of embedded systems:

1. The Hardware
2. Application Software
3. RTOS

4. Define embedded microcontroller.

An embedded microcontroller is particularly suited for embedded applications to perform dedicated task or operation.

Example: 68HC11xx, 8051, PIC, 16F877, etc.,

5. What are the various classifications of embedded systems?

1. Small scale embedded systems
2. Medium scale embedded systems
3. Sophisticated embedded systems

6. What are the two essential units of a processor on an embedded system?

1. Program flow control unit (CU)
2. Execution unit (EU)

7. Classify the processors in embedded system?

1. General purpose processor
   - Microprocessor
   - Microcontroller
   - Embedded processor
   - Digital signal processor
   - Media processor
2. Application specific system processor
3. Multiprocessor system using GPP and ASSP GPP core

8. Draw the simple view of organization of processor and memory in a system.
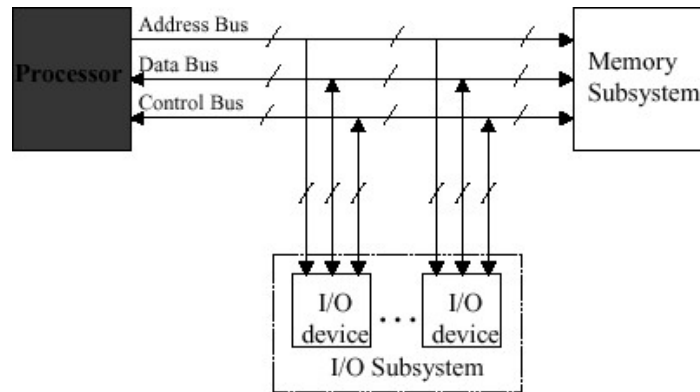
In what ways CISC and RISC processors differ?

CISC	RISC
1. It provides number of addressing modes	It provides very few number of addressing modes
2. It has a micro programmed unit with a control memory	It has a hard wired unit without a control memory
3. An easy compiler design	Complex compiler design
4. Provides precise and intensive calculations slower than a RISC	Provides precise and intensive calculations faster than a RISC

9. Differentiate between timers and counters.

Timer	Counter
The register incremented for every machine cycle.	The register is incremented considering 1 to 0 transition at its corresponding to an external input pin (T0, T1).
Maximum count rate is 1/12 of the oscillator frequency.	Maximum count rate is 1/24 of the oscillator frequency.
A timer uses the frequency of the internal clock, and generates delay.	A counter uses an external signal to count pulses.

10. Draw and compare von-Neumann and Harvard architecture.

von Neumann Architecture   **Harvard Architecture**
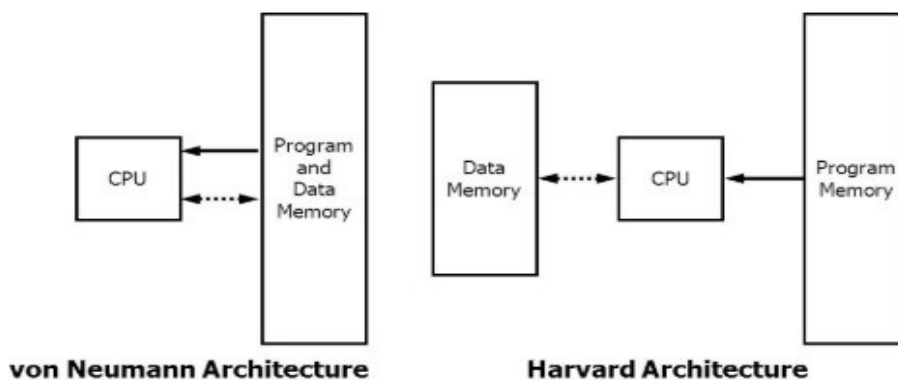
11. **Define interrupt latency? How to avoid it.**

   The interrupt latency refers to the amount of time taken by a system to respond to an interrupt.
   Following factors causes interrupt latency:
   - Interrupt disabling
   - Longer time taken by higher priority interrupts
   - Time taken by processor for bookkeeping
   - Time taken by processor for context saving

   Methods for avoiding it:
   Using multiple arrays for critical data's. , Using circular queues

12. **List the important considerations when selecting a processor.**
   - Instruction set
   - Maximum bits in an operand
   - Clock frequency
   - Processor ability

13. **Name some of the hardware parts of embedded systems?**
   - Power source
   - Clock oscillator circuit
   - Timers
   - Memory units
   - DAC and ADC
   - LCD and LED displays
   - Keyboard/Keypad

14. **What are the various types of memory in embedded systems?**
   - RAM internal External
   - ROM/PROM/EEPROM/Flash
   - Cache memory

15. **What are the important embedded processor chips?**
   - ARM 7 and ARM 9
   - i 960
   - AMD 29050

16. **Name some DSP used in embedded systems?**
   - TMS320Cxx
   - SHARC
   - 5600xx

17. **What are the points to be considered while connecting power supply rails with embedded system?**
   - A processor may have more than two pins of Vdd and Vss supply should separately power the external I/O driving ports, timers, and clock and
   - From the supply there should be separate interconnections for pairs of Vdd and Vss pins analog ground analog reference and analog input voltage lines.

18. What is watch dog timer?
Watch dog timer is a timing device that resets after a predefined timeout.
19. What are the two essential units of a processor on a embedded system?
*   Program Flow control Unit
*   Execution Unit
20. What does the execution unit of a processor in an embedded system do?
The EU includes the ALU and also the circuits that execute instructions for a program control task. The EU has circuits that implement the instructions pertaining to data transfer operations and data conversion from one form to another.
21. Define device driver.
A device driver is software for controlling, receiving and sending byte or a stream of bytes from or to a device.
22. Give some examples for small scale embedded systems.
*   ACVM
*   Stepper motor controllers for a robotic system
*   Washing or cooking system
*   Multitasking toys
23. Give some examples for medium scale embedded systems
*   Router, a hub and a gateway
*   Entertainment systems
*   Banking systems
*   Signal tracking systems
24. Give some examples for sophisticated embedded systems
*   Embedded system for wireless LAN
*   Embedded systems for real time video
*   Security products
*   ES for space lifeboat.
25. **What are the requirements of embedded system?**
*   Reliability
*   Low power consumption
*   Cost effectiveness
*   Efficient use of processing power
26. **Give the characteristics of embedded system?**
*   Single-functioned
*   Tightly constrained
*   Reactive and real time
27. What are the design metrics?
*   Power
*   Size
*   NRE cost
*   Performance
28. What are the challenges of embedded systems?
*   Hardware needed
*   Meeting the deadlines
*   Minimizing the power consumption

- Design for upgradeability

29. Give the steps in embedded system design?
- Requirements
- Specifications
- Architecture
- Components
- System integration

30. What are the functions of memory?
The memory functions are
- To provide storage for the software that it will run.
- To store program variables and the intermediate results
- Used for storage of information

31. Define RAM?
RAM refers Random Access Memory. It is a memory location that can be accessed without touching the other locations.

32. What is data memory?
When the program is executing, to save the variable and program stack, this type of memory is used

33. What is code memory?
The program code can be stored by using this area. The ROM is used for this purpose.

34. What are the uses of timers?
The time intervals can be completed Precise hardware delays can be calculated The timeout facilities are generated

35. Give short notes on RAM processor?
It is said to be the family of RISC architecture. The ARM instructions are written one per line, starting after the first column.

36. What are the data types supported by RAM?
- Standard ARM word is 32 bit long
- Word is splitted into 4 8 bit bytes

37. What are the 3 types of operating modes?
- Normal mode
- Idle mode
- Power down mode

38. Define machine cycle.
Machine cycle is defined as the time required to complete one operation of accessing memory, I/O, or acknowledging an external request. This cycle may consist of three to six T-states.

Part-B

1. Describe in detail about the data transfer mechanism using DMA in Embedded System.
2. Explain in detail about device driver and Interrupt servicing Mechanism in an embedded device.
3. Write the types of timers and explain any two types of timers.
4. Explain the basic processors and hardware units in the embedded system.

5. How to select the processor based upon its architecture and applications?
6. Explain in brief about various memories used in embedded systems.
7. Explain in detail about interrupt latency and their solutions.

Unit-2

1. Explain the electrical specifications of RS232.
- The electrical characteristics of RS232 define the specifications related to voltage levels, line impedance and rate of change of signal levels.
- The logic '1' in RS232 is described as being in the voltage range of -15V to -3V and logic '0' is described as the voltage range of +3V to +15V i.e. low level voltage is logic '1' and high level voltage is logic '0'.
- The line impedance i.e. impedance of the wire between the DTE and DCE devices is specified to be around 3Ω to 7Ω.

2. List the two major states in the operation of Bluetooth.

The major states in the operation of Bluetooth are
- Standby state
- Connection state

3. What is a CAN bus? Where is it used?
CAN is a serial bus for interconnecting a central Control network. It is mostly used in automobiles. It has fields for bus arbitration bits, control bits for address and data length data bits, CRC check bits, acknowledgement bits and ending bits.

4. I2C bus frame format:

With I2C, data is transferred in *messages.* Messages are broken up into *frames* of data. Each message has an address frame that contains the binary address of the slave, and one or more data frames that contain the data being transmitted. The message also includes start and stop conditions, read/write bits, and ACK/NACK bits between each data frame:
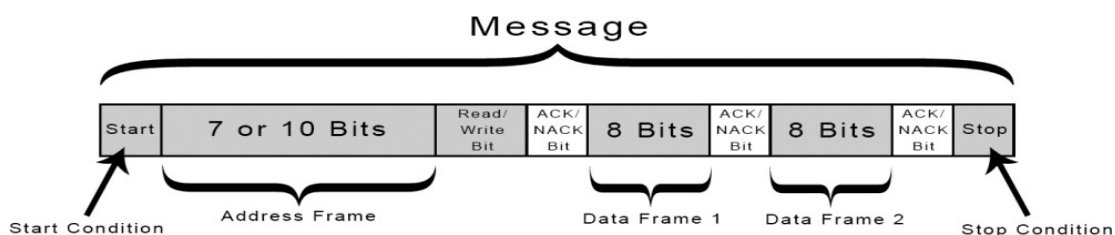
5. **Define the term carrier sense in CSMA/CD?**

Carrier Sense Multiple Access/Collision Detect (CSMA/CD) is the protocol for carrier transmission access in Ethernet networks. On Ethernet, any device can try to send a frame at any time. Each device senses whether the line is idle and therefore available to be used. If it is, the device begins to transmit its first frame. If another device has tried to send at the same time, a collision is said to occur and the frames are discarded. Each device then waits a random amount of time and retries until successful in getting its transmission sent.

6. What are the features of the USB protocol?
A device can be attached, configured and used, reset, reconfigured and used, share the bandwidth with other devices, detached and reattached.

7. What is I2C?

I2C is a serial bus for interconnecting ICs .It has a start bit and a stop bit like an UART. It has seven fields for start,7 bit address, defining a read or a write, defining byte as acknowledging byte, data byte, NACK and end.

8. What is a CAN bus? Where is it used?

CAN is a serial bus for interconnecting a central Control network. It is mostly used in automobiles. It has fields for bus arbitration bits, control bits for address and data length data bits, CRC check bits, acknowledgement bits and ending bits.

9. State the special features on I2C?

- Low cost
- Easy implementation
- Moderate speed (upto 100 kbps).

10. What are disadvantages of I2C?

- Slave hardware does not provide much support
- Open collector drivers at the master leads to be confused

11. What is USB? Where is it used?

USB is a serial bus for interconnecting a system. It attaches and detaches a device from the network. It uses a root hub. Nodes containing the devices can be organized like a tree structure. It is mostly used in networking the IO devices like scanner in a computer system.

12. What are the features of the USB protocol?

A device can be attached, configured and used, reset, reconfigured and used, share the bandwidth with other devices, detached and reattached.

13. List the functions performed by the physical layer of 802.3 standard?

Ans. Functions of physical layer are:

i) Data encoding/decoding (To facilitate synchronization and efficient transfer of signal through the medium).

ii) Collision detection (It detects at the transmit side)

iii) Carrier sensing (Channel access senses a carrier on the channel at both the transmit and receive sides)

iv) Transmit/receive the packets (Frame transmitted to all stations connected to the channel)

v) Topology and medium used (Mediums are co-axial cable, twisted pair and fiber optic cable)

14. Why do you require a limit on the minimum size of Ethernet frame?

Ans. To detect collision, it is essential that a sender continue sending a frame and at the same time receives another frame sent by another station. Considering maximum delay with five Ethernet segments in cascade, the size of frame has been found to be 64 bytes such that the above condition is satisfied.

15. What are the different types of cabling supported by Ethernet standard?

Ans. Types of cabling are:

i) 10 BASE 5 - Maximum cable length is 500 meters using 4" diameter coaxial cable.

ii) 10 BASE 2 - Maximum cable length is 185 meters using 0.25" diameter CATV cable.

iii) 10 BASE T - Maximum cable length is 100 meters using twisted-pair cable (CAT-3 UTP).

iv) 10 BASE FL - Maximum cable length is 2 Km using multimode fiber optic cable (125/62.5 micrometer).

16. Define the term carrier sense in CSMA/CD?

All the nodes can distinguish between idle and a busy-link and "collision detect" means that a node listens as it transmits and can therefore detect when a frame it is transmitting has interfered (collided) with a frame transmitted by another node.

17. Define Bluetooth?

Bluetooth fills the niche of very short-range communication between mobile phones, PDAs, notebook computers, and other personal or peripheral devices. For example, Bluetooth can be used to connect mobile phones to a headset, or a notebook computer to a printer.

18. What are the features of SPI?
- SPI has programmable clock rates
- Full-duplex mode
- Crystal clock frequency is 8MHz
- Open drain or totempole output from master to slave

19. What are the four types of data transfer used in USB?
- Controlled transfer
- Bulk transfer
- Interrupt driven data transfer
- Iso-synchronous transfer

Part-B

1. Explain the various features in USB communication protocol
2. With neat sketches explain about Bluetooth technology.
3. Describe the frame format and working of I2C Protocol with features.
4. Describe the CAN protocol bringing out the architecture, message formats and error detection on detail.
5. Explain the encoding method, frame format, network access protocol used by Ethernet standard

Unit-3

1. What is Computational Model?

A computational Model which describes the system behaviour by providing set of objects, rules for composing those objects and execution semantics of the composed object.

2. List out the different Real time models or Computational Model.
- Sequential Programming Model
- Concurrent process model
- Data flow model
- State machine model
- Object oriented model

3. What is the difference between Model and languages?

Model: i. describes the behaviour of the system

ii. A model is a Conceptual Notation

Eg: Sequential Programming Model

Language: i. Language captures the Models

ii. Language captures that concept in a concrete form

Ex: C language captures the sequential programming language.

4. **Define State Machine Model**
   a. Describe the system behaviour based on the states and states function
   b. Mostly consist of Monitoring Control Inputs and reaching by setting control inputs
   c. Used for control dominated system

5. **Define sequential Programming Model:**

   Sequential programming model which describes the system behaviour by providing a set of statements, rules for putting statement one after another and semantics stating how the statements are executed one at a time.

6. **Define concurrent process Model?**
   - Concurrent Process Model which supports description of Multiple Sequential Programming running concurrently
   - It describes the functionality of the system in two or more concurrent executing subtasks
   - Applicable for multiple tasking system

7. **Define Dataflow model**
   - Used commonly for data dominated system
   - Here the Model describes the system behaviour consists mostly of transforming streams of Input data into streams of output data

8. **Define Object oriented Model**

Provides elegant means for breaking complex software into simpler well defined pieces.

9. **What is Finite State Machine Model?**

   It is a Computational Model which describes the system behaviour based on the finite no of possible states in the system.System can exits only one of the state at an instance.

10. **What are the steps involved in describing a system's behaviour as a state Machine?**
- List all the possible states, giving each descriptive name
- Declare all the variables
- For each state, list all the possible transitions, with associated conditions to other state
- For each state, and/or transition, list the associated actions
- For each state, ensure that existing transition conditions are exclusive, meaning that two conditions could be true simultaneously, and complete, meaning that one of the conditions is true at any time.

11. **What were the types of Finite state Machine Model?**
   - Hierarchial/ Concurrent state machine model
   - Program state machine model
   - Finite state machine model with data path model(FSMD)

23. What is FSMD?
- It is an execution of finite state machine model
- It describes the system behaviour by supporting more complex data types and variables with data path

24. What is HCSM?
- HCSM- Hierarchial/Concurrent State Machine Model
- It is an extension to the state machine model
- It supports Hierarchial and currency process
- It is a decomposition of a state into much concurrent state or to group many concurrent states into a new hierarchial state.

25. What are the operations defined by the concurrent process?
- Processes create
- Processes terminate
- Process suspend
- Process resume

26. What do you mean by Process suspend and resume :
Process suspend suspends the execution of an already created process
i.e Once a process has started to execute, another process need to to stop it without terminating
Process Resume allowing executing the suspended process

27. What do you mean by process create and terminate?
Process Create creates a new process, initializes any association data and starts execution of that process.
Process terminate terminates an already executing process and destroy all the data associated with the process.

28. Define deadlock?
Deadlock is the name given to the condition where two or more processes are blocked waiting for each other to unlock critical section of codes.

29. How the processes communicate through message passing?
a. Data is exchanged between two process by mean of Explicit fashion
b. Process wants to send data to another process by means of "Send" operation.
c. Process wants to receive the data from another process by means f receive operation

30. What is busy waiting?
The waiting processes is simply executing loops, instead of being blocked until the condition is met, hence making CPU available for computation is called busy waiting.

20. What is condition variable?
A condition variable is a object that permits two kind of operation called signal and wait to achieve synchronization among process.

21. What is data flow graph?
A Diagram which graphically represents the data flow are called as Data flow graph.

22 What is control data flow graph?
Control data flow graph is a diagram which graphically represents the condition and the program along a condition dependent path.

23. What are the advantages of data flow model?

Main advantage of this model is that rather than translating to a concurrent process. Model for implementation, we can instead statically schedule the nodes to produce a sequential program model.

24. State the difference between FSM and FSMD models.

• An FSMD is a digital system composed of a finite-state machine, which controls the program flow, and a datapath, which performs data processing operations.

• FSMDs are essentially sequential programs in which statements have been scheduled into states, thus resulting in more complex state diagrams.

• FSMs do not use variables or arithmetic operations/conditions, thus FSMDs are more powerful than FSMs.

• The FSMD level of abstraction is often referred to as the register-transfer level.

25. What are the advantages of data flow model?

Main advantage of this model is that rather than translating to a concurrent process. Model for implementation, we can instead statically schedule the nodes to produce a sequential program model.

PART-B

1. Explain the design concept of an Elevator control mechanism using a sequential model.

2. Write the steps involved in describing a system's behavior as a state Machine.

3. Write a brief note on concurrent process model and communication among the process.

4. Explain the HCFSM model in a elevator control system.

5. Explain the Synchronization among process with examples.

6. Explain in brief about the following.

    a) FSM

    b) FSMD

    c) HCFSM and state charts

7. Explain in brief about the following

    a) PSM

    b) Concurrent process model.

    d) Data flow model

8. Explain in detail about Concurrent process and its implementation.

Unit-4

1. **Define multitasking**.

Multitasking is the process of scheduling and switching the CPU between several tasks. A single CPU switches its attention between several sequential tasks.

It maximizes the utilization of the CPU and also provides modular construction of application.

2. **What is RTOS**?

A Real time operating system is a multitasking operating system for response time controlled and event controlled process which has real time programming constrains to solve

3. **When RTOS necessary and when it is not necessary in the Embedded system?**
➢ An RTOS is necessary when scheduling of Multilpe processors
➢ An RTOS is must to monitor the processors that are response controlled and event controlled processors.
➢ RTOS may not necessary in small scale Embedded system.

4. **Compare OS and RTOS.**

OS	RTOS
1. It is an OS for systems do not have any time and deadline constrains.	1. it is a OS for systems which has time deadlines and real time dead lines
2. control is given first to OS	2. Application programs take control first.
3. Protects themselves from application	3. RTOS can't protect themselves from application programs.
4. it needs large memory space	4. it needs less memory space
EX: Windows, Linux, etc..,	EX:µC/OS-II, PSOS,VRTx, Vx works

5. **Describe in brief about types of RTOS.**

Preemptive RTOS→in this type of RTOS, new higher priority task will gain control of the CPU only when the current task gives up the CPU.

Non Preemptive RTOS→ In this type of RTOS, if any higher priority task or ISR is ready to run, the current task is preempted (suspended) and higher task is immediately given the control of CPU.

6. **What is Task scheduler?**

A part of the RTOS called the scheduler keeps the track the state of which one task should go into the running state.

7. How does the scheduler know when a task has become blocked or unblocked?

The RTOS provides a collection of functions that track can call to tell the scheduler what events they wait for and to signals that event has happened.

9. **Define task and Task state.**

A task is a set of computations or actions that processes on a CPU under the control of a scheduling kernel. It also has a process control structure called a task control block that saves at the memory. It has a unique ID. It has states in the system as follows: idle, ready, running, blocked and finished.

10. Define Task Control Block (TCB)

A memory block that holds information of program counter, memory map, the signal dispatch table, signal mask, task ID, CPU state and a kernel stack.

11. Define Inter process communication.

An output from one task passed to another task through the scheduler and use of signals, exception, semaphore, queues, mailbox, pipes, sockets, and RPC.

12. What is shared data problem?

If a variable is used in two different processes and another task if interrupts before the operation on that data is completed then the value of the variable may differ from the one expected if the earlier operation had been completed .This ids known as shared data problem.

13. Define Semaphore.

Semaphore provides a mechanism to let a task wait till another finishes. It is a way of synchronizing concurrent processing operations. When a semaphore is taken by a task then that task has access to the necessary resources. When given the resources unlock. Semaphore can be used as an event flag or as a resource key.

14. Define Mutex.

A phenomenon for solving the shared data problem is known as semaphore. Mutex is a semaphore that gives at an instance two tasks mutually exclusive access to resources.

15. What is Priority inversion?

A problem in which a low priority task inadvertently does not release the process for a higher priority task.

16. Define Message Queue.

A task sending the multiple FIFO or priority messages into a queue for use by another task using queue messages as an input.

17. Define Mailbox and Pipe.

A message or message pointer from a task that is addressed to another task.

18. Define Socket.

It provides the logical link using a protocol between the tasks in a client server or peer to peer environment.

19. Define Remote Procedure Call.

A method used for connecting two remotely placed methods by using a protocol. Both systems work in the peer to peer communication mode and not in the client server mode.

20. What are the goals of RTOS?

- Facilitating easy sharing of resources
- Facilitating easy implantation of the application software
- Maximizing system performance
- Providing management functions for the processes, memory, and I/Os and for other functions for which it is designed.
- Providing management and organization functions for the devices and files and file like devices.
- Portability
- Interoperability
- Providing common set of interfaces.

21. List the functions of a kernel.

- Process management
- Process creation to deletion
- Processing resource requests
- Scheduling
- IPC
- Memory management
- I/O management
- Device management

22. What are the two methods by which a running requests resources?

- Message
- System call

23. What are the functions of device manager?

- Device detection and addition
- Device deletion
- Device allocation and registration
- Detaching and deregistration
- Device sharing

24. List the set of OS command functions for a device

- Create and open
- Write
- Read
- Close and delete

25. What is a thread?

A thread otherwise called a lightweight process (LWP) is a basic unit of CPU utilization, it comprises of a thread id, a program counter, a register set and a stack. It shares with other threads belonging to the same process its code section, data section, and operating system resources such as open files and signals.

26. Define Synchronization.

Message passing can be either blocking or non-blocking. Blocking is considered to be synchronous and non-blocking is considered to be asynchronous.

27. Define Inter process communication.

Inter-process communication (IPC) is a set of techniques for the exchange of data among multiple threads in one or more processes. Processes may be running on one or more computers connected by a network. IPC techniques are divided into methods for message passing, synchronization, shared memory, and remote procedure calls (RPC). The method of IPC used may vary based on the bandwidth and latency of communication between the threads, and the type of data being communicated.

28. What is priority inheritance?

Priority inheritance is a method for eliminating priority inversion problems. Using this programming method, a process scheduling algorithm will increase the priority of a process to the maximum priority of any process waiting for any resource on which the process has a resource lock.

29. What are the various scheduling criteria for CPU scheduling?

The various scheduling criteria are
- CPU utilization
- Throughput
- Turnaround time
- Waitingtime
- Response time

30. Define deadlock.

A process requests resources; if the resources are not available at that time, the process enters a wait state. Waiting processes may never again change state, because the resources they have requested are held by other waiting processes. This situation is called a deadlock.

31. What is mailbox, message queue and message pipe?

- A mail box is a pointer sized variable through which a message from a task is addressed for another tasks.
- A message queue is basically collection of mail boxes. It is IPC function offered by RTOS and is used to one or more message to a task.

- A message pipe is a device for use by the task for sending the message and another task using the device to receive the message as stream. A pipe is a unidirectional device.

32. What is semaphore? Mention its uses.

Definition:

A special variable operated by the OS functions which are used to take note of certain actions to prevent another task or process from proceeding further.

Uses:

• Semaphore act as a resource key for avoiding shared data problem
• Used as an event signaling or notifying variable
• Way of synchronizing concurrent processing operation

33. What are the types of semaphores?

- Mutex- Mutually Exclusive semaphore
- P & V semaphore- signal and wait semaphore
- Counting semaphore
- Binary semaphore

34. What are the problems of semaphore?

Priority inversion problem – main problem

Dead lock problem

Forgetting to take semaphore, to release semaphore, taking wrong semaphopre

35. What is priority inversion and Deadlock situations?

Priority inversion: it is a problem in which a low priority task inadvertently does not release the process for a higher priority task. An OS can take care of this by appropriate provisions.

Deadlock situation: it is a situation in which a task waits for the release of semaphore from a task and another different task waiting for another semaphore release to run. None of these is able to proceed further due to circular dependency.

36. What is IPC? Mention the two different ways available for it.

The process of a task or ISR to communicate information to another task is called inter process or inter task communication. It can be done in two ways.

1. Data sharing
2. Message passing

37. What is Task scheduler?

A part of the RTOS called the scheduler keeps the track the state of which one task should go into the running state.

38. How does the scheduler know when a task has become blocked or unblocked?

The RTOS provides a collection of functions that track can call to tell the scheduler what events they wait for and to signals that event has happened.

39.   What is shared data problem?

If a variable is used in two different processes and if another task interrupts before the operation on that data completed then the shared data problem arises.

40.   What is reentrant function? Write the rules that decide whether the given function is reentrant or not.

Definition: A function that works properly even if it is called by more than one task is called reentrant function.

Rules: 1. a reentrant function may not use variables in non atomic way.

2. A reentrant function may not call any other functions that are not themselves reentrant.

3. It may not use hardware's in non atomic way.

41.   What are the ways to eliminate Shared Data problem?
- Disabling interrupts
- Using semaphores
- Disabling scheduler
- Using volatile keyword

42.   Mention some task scheduling algorithms.
- Cooperative task scheduling
- Preemptive task scheduling
- Cyclic and Round Robin scheduling
- Rate monotonic task scheduling
- Earliest deadline first scheduling

43. Define process, thread and Task?

Process: it is defined as a sequentially executable codes or program and its state. It is a heavy weight entity.

Thread: a thread is a process or sub process within a process that has its own PC, SP, stack and own priority parameters for its scheduling by thread scheduler.

Task: it is defined as a sequentially executable codes or program that runs on a CPU, under state control of kernel of an RTOS.

44.   What are the task states? Draw the state diagram of task?
- Running state – Microprocessor is executing the instruction that make up this task.
- Ready state- ready to execute the task.
- Blocked state- Task hasn't got anything to do right now, even if the microprocessor become available.

Figure 6.1 Task States
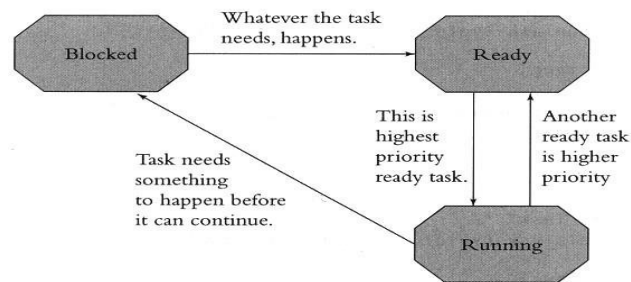
45. What are the consequences of task states?

- A task should be running just before it is blocked.
- All tasks are blocked and scheduler idles forever (not desirable!)
- Two or more tasks with same priority levels in Ready state (time-slice, FIFO)
- The shuffling of tasks between the ready and running state is entirely work of the scheduler.

46. What are the features of the task?

- Task has unique ID.
- Task has a process structure called task control block saves at the memory
- Multitasking operations are by context switching between the various tasks.

PART-B

1. Explain the cooperative scheduling and round robin scheduling with a suitable diagram.
2. Explain any three types of inter process communication functions between the tasks.
3. Explain in detail about semaphores and its applications.
4. Explain in detail about shared data problem and its possible solutions.
5. Explain in detail about semaphores and its applications.
6. List out various problems associated with semaphores. Discuss with suitable examples about priority inversion and dead lock situations.
7. What is IPC? Mention the two methods available for it. Explain in detail about message queues.
8. Discuss in detail about the following.
   1. Timer function events.
   2. Memory management functions.

1. What is a "Thing" in the context of Internet of Things (IoT)?

Answer: The "Thing" commonly referred to by the concept of the Internet of Things is any item that can contain an embedded, connected computing device. A "Thing" in the IoT could be a shipping container with an RFID tag or a consumer's watch with a WiFi chip that sends fitness data or short messages to a server somewhere on the Internet.

2. How the Internet of Things (IoT) makes a difference to the businesses?

Answer: Businesses focus on getting products to the marketplace faster, adapting to regulatory requirements, increasing efficiency, and most importantly, persisting to innovate. With a highly mobile workforce, evolving customer, and changing supply chain demand, the IoT can move your enterprise forward, starting today.

3. What are the major Previacy and Security Issues in case of Internet Of Things (IoT)?

Answer: Cyberattacks may also compromise privacy, resulting in access to and exfiltration of identifying or other sensitive information about an individual. For example, an intrusion into a wearable device might permit exfiltration of information about the location, activities, or even the health of the wearer.

In addition to the question of whether security measures are adequate to prevent such intrusions, privacy concerns also include questions about the ownership, processing, and use of such data. With an increasing number of IoT objects being deployed, large amounts of information about individuals and organizations may be created and stored by both private entities and governments.

With respect to government data collection, the U.S. Supreme Court has been reticent about making broad pronouncements concerning society?s expectations of privacy under the Fourth Amendment of the Constitution while new technologies are in flux, as reflected in opinions over the last five years.

4. What are the top 5 Machine-to-Machine (M2M) applications in the world?

Answer: 1. Asset Tracking and/or Monitoring in some form or another (Stolen Vehicles, Fleet, Construction Equipment, Wood Pellets, Tank level monitoring, etc.) seems to be the biggest. Low data requirements, high volumes of devices, etc. It isn't hot or particularly exciting, but it is changing the world in subtle ways and very quickly. New business models will spring from this.

2. Insurance Telematics is huge as if offers Insurance companies the opportunity to cut risk and drive better/more attractive pricing.

3. Utilities/Automated Meter Reading/Smart Grids – lots of regulation and investment into this at the moment. There a lots of national solutions as the requirements and business case are driven in very diverse ways.

5. How Does the Internet of Things (IoT) Work?

Answer: The IoT is not separate from the Internet, but rather, a potentially huge extension and expansion of it. The ?things? that form the basis of the IoT are objects. They could be virtually anything? streetlights, thermostats, electric meters, fitness trackers, factory equipment, automobiles, unmanned aircraft systems (UASs or drones), or even cows or sheep in a field. What makes an object part of the IoT is embedded or attached computer chips or similar components that give the object both a unique identifier and Internet connectivity. Objects with such components are often called "smart"?such as smart meters and smart cars.

6. What is the difference between the Internet of Things (IoT) and Machine to Machine (M2M)?

Answer: Generally speaking, M2M could be considered a subset of IoT. M2M is like a line connecting 2 points, and IoT is like a network, a system composed of lots of M2M and triggering lots of interactions/activities.

Giving a simple definition to M2M which is transferring data from one machine to another one. It's been used everywhere in our daily life. For example, entrance security. Just like using your employee card to unlock a door. When the security detector receives the ID from the employee card and then unlock the door once the ID is approved. This is M2M.

7. What is difference between Wireless Sensor Network (WSN) and Internet of Things (IoT) network (sensor)?

Answer: About WSN:

Wireless sensor network is the foundation of IoT applications.

WSN is the network of motes, formed to observe, to study or to monitor physical parameters of desired application.

8. What is IoT?

Answer: IoT stands for Internet of Things. It is basically a network using which things can communicate with each other using internet as means of communication between them. All the things should be IP protocol enabled in order to have this concept possible. Not one but multiple technologies are involved to make IoT a great success.

9. How does the Internet of Everything relate to the Internet of Things?

Answer: The "Internet of Everything" builds on the foundation of the "Internet of Things" by adding network intelligence that allows convergence, orchestration and visibility across previously disparate systems.

10. What are the important Components of Internet of Things?

Answer: Many people mistakenly think of IoT as an independent technology. Interestingly, internet of things is being enabled by the presence of other independent technologies which make fundamental components of IoT.

The fundamental components that make internet of things a reality are:-

1. Hardware-Making physical objects responsive and giving them capability to retrieve data and respond to instructions

2. Software – Enabling the data collection, storage, processing, manipulating and instructing

3. Communication Infrastructure – Most important of all is the communication infrastructure which consists of protocols and technologies which enable two physical objects to exchange data.

11. Application of IoT:

- Smart home
- Connected car
- Smart city
- Smart Retail
- Connected Health
- Smart grids
- Smart Farming

PART_B

1. Explain the Physical Design of IoT and Logical Design of IoT with function block diagram.

2. Write the case study on IoT based Weather monitoring with examples.

3. Write the case study on IoT based Smart Irrigation with examples.

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