**Unit 4**

**1. Principles of RTOS**

1. What does RTOS stand for?  
   a) Real-Time Operating System  
   b) Recursive Time Operating System  
   c) Reliable Time Operating System  
   d) Random Time Operating System
2. A task in an RTOS is typically represented by:  
   a) A process  
   b) A thread  
   c) A function  
   d) A data structure
3. The key feature of an RTOS is:  
   a) Large memory footprint  
   b) Deterministic task scheduling  
   c) High graphics capability  
   d) Network compatibility
4. Which of these scheduling algorithms is most commonly used in RTOS?  
   a) Round Robin  
   b) Multilevel Feedback Queue  
   c) Rate-Monotonic Scheduling  
   d) Random Scheduling
5. RTOS is most commonly used in:  
   a) General-purpose computers  
   b) Embedded systems  
   c) Supercomputers  
   d) Desktop applications

**2. Semaphores and Queues**

1. A semaphore in RTOS is used to:  
   a) Synchronize tasks  
   b) Save memory  
   c) Manage power  
   d) Increase speed
2. Binary semaphores can have:  
   a) Two values  
   b) Three values  
   c) Infinite values  
   d) None of the above
3. Counting semaphores are used to:  
   a) Allow multiple resources to be shared  
   b) Block task execution  
   c) Save energy  
   d) Assign priorities
4. Queues in RTOS are primarily used for:  
   a) Synchronization  
   b) Inter-task communication  
   c) Debugging  
   d) Memory allocation
5. A common issue when using semaphores is:  
   a) Semaphore Overflow  
   b) Semaphore Underflow  
   c) Priority Inversion  
   d) Stack Overflow

**3. Hard Real-Time Scheduling Considerations**

1. A hard real-time system must guarantee:  
   a) Fast execution  
   b) Low power usage  
   c) Deterministic timing  
   d) High memory usage
2. Rate-Monotonic Scheduling is:  
   a) Dynamic scheduling  
   b) Static priority scheduling  
   c) Non-deterministic scheduling  
   d) None of the above
3. The utilization bound for Rate-Monotonic Scheduling for three tasks is:  
   a) 0.55  
   b) 0.69  
   c) 0.75  
   d) 0.85
4. A hard deadline in a real-time system means:  
   a) Task completion is optional  
   b) Task completion is flexible  
   c) Task must be completed on time  
   d) Task completion time can vary
5. In preemptive scheduling, a higher-priority task can:  
   a) Wait for the lower-priority task to finish  
   b) Preempt the lower-priority task  
   c) Block all other tasks  
   d) Ignore the scheduler

**4. Saving Memory and Power**

1. RTOS minimizes memory usage by:  
   a) Using dynamic memory allocation  
   b) Using static memory allocation  
   c) Increasing stack size  
   d) Avoiding memory fragmentation
2. Power saving in embedded systems can be achieved by:  
   a) Increasing CPU clock speed  
   b) Reducing idle time  
   c) Putting the system into sleep mode  
   d) Increasing memory usage
3. The most energy-efficient CPU state is:  
   a) Active  
   b) Idle  
   c) Sleep  
   d) Powered off
4. Which type of memory is most power-efficient?  
   a) DRAM  
   b) SRAM  
   c) Flash memory  
   d) Cache memory
5. An RTOS can save power by:  
   a) Implementing task prioritization  
   b) Using low-power task states  
   c) Increasing context switches  
   d) Avoiding interrupts

**5. µC-OS Example**

1. µC-OS is an example of:  
   a) Hard real-time system  
   b) Soft real-time system  
   c) General-purpose OS  
   d) None of the above
2. µC-OS is:  
   a) Proprietary software  
   b) Open-source software  
   c) Freeware  
   d) Shareware
3. Tasks in µC-OS communicate using:  
   a) Semaphores  
   b) Queues  
   c) Mailboxes  
   d) All of the above
4. The number of tasks supported in µC-OS is limited by:  
   a) CPU speed  
   b) Available memory  
   c) Number of peripherals  
   d) None of the above
5. µC-OS is primarily written in:  
   a) C  
   b) Python  
   c) Java  
   d) Assembly

**6. Embedded Software Development Tools**

1. Host machine refers to:  
   a) The embedded system hardware  
   b) The development system  
   c) The target system  
   d) The debugger
2. Target machine refers to:  
   a) The development machine  
   b) The embedded system hardware  
   c) The operating system  
   d) The compiler
3. Cross-compilation is the process of:  
   a) Debugging code on the target  
   b) Compiling code on the host for the target  
   c) Running code on the host  
   d) Testing software on the host
4. Which tool is used for debugging in embedded systems?  
   a) Compiler  
   b) Emulator  
   c) Oscilloscope  
   d) Debugger
5. IDE stands for:  
   a) Integrated Debug Environment  
   b) Integrated Development Environment  
   c) Internal Development Editor  
   d) Internal Debug Editor

**General Questions**

1. Hard real-time systems are used in:  
   a) Web servers  
   b) Medical devices  
   c) Video games  
   d) Social media applications
2. RTOS tick rate refers to:  
   a) Task execution speed  
   b) Timer interrupt frequency  
   c) Scheduler loop time  
   d) Task stack size
3. A watchdog timer in RTOS is used for:  
   a) Synchronization  
   b) Debugging  
   c) System recovery  
   d) Power management
4. Mutual exclusion is achieved using:  
   a) Semaphores  
   b) Queues  
   c) Stack  
   d) RAM
5. Stack overflow in an RTOS can lead to:  
   a) Improved performance  
   b) System crash  
   c) Reduced power consumption  
   d) Faster scheduling