Reg. No.																

Question Paper Code	14688

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Second Semester

M.E. - Embedded Systems Technologies

24PESPC201 - REAL TIME OPERATING SYSTEMS

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	What type of system call is used to create a new process in Unix? a) read() b) fork() c) write() d) open()	1	K2	CO1
2.	In a distributed system, which of the following is used to order events without a global clock? a) UTC Timestamps b) Logical Clocks c) CPU Counters d) Interrupt Vectors	1	K1	CO1
3.	A process that has completed execution but whose entry still exists in the process table is called: a) Orphan Process b) Daemon Process c) Zombie Process d) Background Process	1	K1	CO1
4.	In RTOS, a task that is waiting for an event to occur is in which state? a) Running b) Ready c) Blocked/Waiting d) Terminated	1	K2	CO2
5.	In a multithreaded preemptive scheduler, which task runs first? a) The task created first b) The task with the highest priority c) The shortest task d) A randomly chosen task	1	K2	CO2
6.	The classical synchronization problem that models fixed buffer size and producer-consumer interaction is: a) Dining Philosophers b) Sleeping Barber c) Bounded Buffer Problem d) Cigarette Smokers Problem	1	K1	CO2
7.	Which real-time model represents system behavior as a set of concurrent sequential processes? a) Event-Based Model b) Process-Based Model c) Graph-Based Model d) State Machine Model	1	K1	CO3
8.	A Task Control Block (TCB) stores: a) Compiled machine code b)Task state, priority, and stack pointer c) Hardware interrupt vectors d) File descriptors	1	K1	CO3
9.	Which scheduling algorithm guarantees optimality for preemptive scheduling on a single processor? a) Rate Monotonic Scheduling b) Earliest Deadline First c) Least Laxity First d) Priority Ceiling Protocol	1	K2	CO3

10.	VxWorks is primarily used in which type of applications? a) Desktop computing b)Web servers c) Safety-critical embedded and aerospace systems d) Mobile gaming	*1*	*K2*	*CO4*
11.	The minimal set of RTOS services needed to run an application on a target platform is called: a) Full OS b) RTOS Kernel c) Bootloader d) HAL	*1*	*K3*	*CO4*
12.	Which feature makes VxWorks preferred over Linux for hard real-time applications? a) Open-source license b) Bounded and deterministic response times c) Large developer community d) GUI support	*1*	*K3*	*CO4*
13.	In Android architecture, which layer sits immediately above the Linux kernel? a) Application Framework b) Hardware Abstraction Layer (HAL) c) Android Runtime d) System Apps	*1*	*K3*	*CO5*
14.	Which component of the Android stack includes the Dalvik Virtual Machine (or ART)? a) Linux Kernel b) Libraries c) Android Runtime d) Application Framework	*1*	*K3*	*CO5*
15.	When validating the performance of an RTOS in a newly developed embedded system, which tool should be applied? a) Debugger b) Benchmark tool c) Editor d) Compiler	*1*	*K3*	*CO6*
16.	During embedded system development, which tool can be used to test the program before deploying it on actual hardware? a) Linker b) Emulator c) Loader d) Scheduler	*1*	*K3*	*CO6*

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)
Answer ALL Questions

17.	Apply the concept of process states to trace the lifecycle of a typical OS process.	*3*	*K3*	*CO1*
18.	Demonstrate the use of mailboxes for inter-task communication in RTOS.	*3*	*K3*	*CO2*
19.	Examine the impact of memory requirements on task execution in RTOS.	*3*	*K4*	*CO3*
20.	Compare VxWorks and C Executive.	*3*	*K3*	*CO4*
21.	Analyze the role of debugging tools in RTOS.	*3*	*K4*	*CO5*
22.	Examine the role of the Options Menu in Android and explain how it supports user interaction within an application.	*3*	*K4*	*CO6*

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)
Answer ALL Questions

23.	a)	Plan a simple inter-process communication model using pipes and message queues for a producer-consumer problem.	*11*	*K3*	*CO1*
		OR			
	b)	Organize a detailed explanation of distributed scheduling algorithms and their trade-offs in terms of performance.	*11*	*K3*	*CO1*

24.	a)	Discuss in detail about RTOS task architecture for an industrial control system using mailboxes and pipes for communication.	*11*	*K3*	*CO2*
		OR			
	b)	Organize the classical synchronization problems into a unified framework mapping each to its real-world RTOS application.	*11*	*K3*	*CO2*
25.	a)	Analyze the event-based, process-based, and graph-based real-time models comparing their structure, advantages, and application domains.	*11*	*K4*	*CO3*
		OR			
	b)	Examine the interrupt processing mechanism in RTOS including ISR design, interrupt latency, and deferred interrupt handling.	*11*	*K4*	*CO3*
26.	a)	Build the RTOS porting workflow for an ARM Cortex-M4 target, covering BSP, startup code, and kernel configuration.	*11*	*K3*	*CO4*
		OR			
	b)	Solve a scheduling latency problem for a given set of tasks on a VxWorks kernel and determine if all deadlines are met.	*11*	*K3*	*CO4*
27.	a)	Analyze the uCOS RTOS architecture and explain how it manages tasks, semaphores, and time management.	*11*	*K4*	*CO5*
		OR			
	b)	Analyze the architecture of a Yamba application by illustrating the role and interaction of the main Android building blocks in its implementation.	*11*	*K4*	*CO5*
28.	a)	Choose the essential components of an Android user interface and evaluate how they contribute to user interaction and application performance.	*11*	*K3*	*CO6*
		OR			
	b)	Develop an Android application architecture for a vehicle tracking system incorporating GPS, maps, and background services.	*11*	*K3*	*CO6*