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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2025 - 2026)

Subject: Embedded System Design

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C**. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

20

1. Attempt all parts:-

- 1-a. The main purpose of an RTOS is: (CO1,K1) 1
- (a) Provide multitasking with timing guarantees
 - (b) Run games
 - (c) Handle graphics
 - (d) Provide cloud storage
- 1-b. Bootloader in embedded systems is responsible for: (CO1,K1) 1
- (a) Running applications
 - (b) Initializing hardware and starting firmware
 - (c) Displaying graphics
 - (d) Installing OS
- 1-c. STM32 supports communication protocols like: (CO2,K1) 1
- (a) UART
 - (b) SPI
 - (c) I2C
 - (d) All of these
- 1-d. The function of GPIO configuration is to: (CO2,K1) 1
- (a) Perform ADC
 - (b) Set pin as input/output
 - (c) Perform analog computation
 - (d) None
- 1-e. The vector table stores: (CO3,K1) 1

- (a) Interrupt service routine addresses
 - (b) Data segments
 - (c) Program counters
 - (d) Configuration bits
- 1-f. In low power mode, WIC detects: (CO3,K1) 1
- (a) Wake-up interrupt signals
 - (b) Bus transfers
 - (c) Timer events only
 - (d) GPIO states
- 1-g. Assembly language is considered a ____ level language. (CO4,K1) 1
- (a) High
 - (b) Low
 - (c) Middle
 - (d) None
- 1-h. Cortex-M4 supports general-purpose registers. (CO4,K1) 1
- (a) 8
 - (b) 12
 - (c) 13
 - (d) 16
- 1-i. The part of the kernel that handles process creation and termination is: (CO5,K1) 1
- (a) IPC subsystem
 - (b) Scheduler
 - (c) Memory Manager
 - (d) Process Management subsystem
- 1-j. Interrupt handlers run in: (CO5,K1) 1
- (a) User space
 - (b) Kernel space
 - (c) Bootloader
 - (d) Shell
2. Attempt all parts:-
- 2.a. Compare sensor and actuators with example. (CO1,K2) 2
- 2.b. Which tool is used to configure ADC pins in STM32 Nucleo (CubeMX, CubeIDE, etc.)? (CO2,K2) 2
- 2.c. Mention any two buses used in Cortex-M4. (CO3,K2) 2
- 2.d. What is the purpose of the Mbed compiler? (CO4,K1) 2
- 2.e. What is init process? (CO5,K1) 2

SECTION-B

30

3. Attempt all parts:-

3.a. Answer any one of the following:-

- 3.a.(i) Discuss embedded system architecture with a block diagram. (CO1,K3) 6

3.a.(ii)	Compare hard and soft real-time embedded systems. (CO1,K3)	6
3.b.	Answer any one of the following:-	
3.b.(i)	Explain the main features of the STM32F401 Nucleo board. (CO2,K2)	6
3.b.(ii)	Explain the use of timers and interrupts in STM32 for periodic sampling. (CO2,K2)	6
3.c.	Answer any one of the following:-	
3.c.(i)	Explain the major features of ARM Cortex-M4 architecture. (CO3,K3)	6
3.c.(ii)	Describe how NVIC interacts with the core registers. (CO3,K3)	6
3.d.	Answer any one of the following:-	
3.d.(i)	Explain the role of CMSIS in ensuring code portability. (CO4,K3)	6
3.d.(ii)	Describe typical file structure and libraries used in an Mbed project. (CO4,K3)	6
3.e.	Answer any one of the following:-	
3.e.(i)	Explain Embedded Linux versus Desktop Linux in detail. (CO5,K3)	6
3.e.(ii)	Explain Linux kernel architecture in detail. (CO5,K3)	6
<u>SECTION-C</u>		50
4.	Answer any <u>one</u> of the following:-	
4-a.	Evaluate the role of embedded systems in industrial automation. (CO1,K3)	10
4-b.	Explain how embedded systems are optimized for cost and energy efficiency. (CO1,K3)	10
5.	Answer any <u>one</u> of the following:-	
5-a.	Explain complete interfacing of LDR with STM32 to control LED brightness. (CO2,K4)	10
5-b.	Discuss the design of an STM32 system displaying temperature on LCD. (CO2,K4)	10
6.	Answer any <u>one</u> of the following:-	
6-a.	Describe how MPU improves system reliability and safety. (CO3,K4)	10
6-b.	Analyze the importance of priority grouping in NVIC. (CO3,K4)	10
7.	Answer any <u>one</u> of the following:-	
7-a.	Evaluate the advantages of C/C++ features in embedded applications. (CO4,K4)	10
7-b.	Explain the significance of API standardization in Mbed. (CO4,K4)	10
8.	Answer any <u>one</u> of the following:-	
8-a.	Analyze how memory management mechanisms such as paging, caching, and virtual memory behave differently in embedded Linux systems. (CO5,K4)	10
8-b.	Discuss the constraints and architectural decisions behind designing minimal root file systems for embedded devices. (CO5,K4)	10