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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| Date: 07 – 01- 2025 Time: 09:30 am – 12:30 pm |

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| **School:** School Of Engineering | **Program:** B. Tech (Electronics and Communication Engineering) |
| **Course Code :** ECE3040 | **Course Name :** Embedded System Design |
| **Semester**:VII | **Max Marks**:100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **27** | **16** | **27** | **30** | **NA** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** |
| **1** | What are the key features of the LPC2148 microcontroller that make it suitable for embedded systems? | **2 Marks** | **L1** | **CO1** |
| **2** | What is the significance of the ARM7 instruction set? Explain the difference between ARM and Thumb instructions. | **2 Marks** | **L1** | **CO1** |
| **3** | What are the different I/O ports available in the LPC2148 microcontroller, and how can they be configured for input and output? | **2 Marks** | **L1** | **CO1** |
| **4** | What is the role of the I2C (Inter-Integrated Circuit) module in LPC2148? How can it be used to interface with external devices like EEPROMs? | **2 Marks** | **L1** | **CO1** |
| **5** | Explain the concept of ARM7's pipeline stages. How does this architecture improve the overall processing speed? | **2 Marks** | **L1** | **CO3** |
| **6** | Write the assembly instruction to perform a multiplication operation between R2 and R3, storing the result in R4. | **2 Marks** | **L2** | **CO2** |
| **7** | Explain the role of ARM7's Barrel Shifter. How does it aid in optimizing certain arithmetic and logical operations? | **2 Marks** | **L1** | **CO2** |
| **8** | What is ’Load/Store' architecture, and how does it impact the design and execution of instructions in ARM7? | **2 Marks** | **L1** | **CO2** |
| **9** | Describe the difference between data-processing and load/store instructions in ARM7. Provide examples of each and their usage. | **2 Marks** | **L1** | **CO1** |
| **10** | What is the role of the MOV instruction in ARM7? How is it different from other data transfer instructions like LDR (Load Register)? | **2 Marks** | **L1** | **CO1** |

**Part B**

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| **Answer the Questions Total 80 Marks** |
| **11.** | **a.** | Describe the GPIO subsystem of the LPC2148 microcontroller and outline the step-by-step procedure for configuring and utilizing GPIO pins for both input and output operations. Include an example configuration. | **10****Marks** | **L2** | **CO2** |
| **Or** |
| **12.** | **a.** | Twenty numbers are stored in the internal RAM of the LPC2148 starting from memory location 10000000h. Write an assembly language program (ALP) to calculate the 10's complement of each number and store the result starting from memory location 10000000h.  | **10****Marks** | **L3** | **CO2** |
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| **13.** | **a.** | Write brief note on need and benefits of stepper motor in LPC2148 based embedded system design. Explain the wave and half step sequence used for stepper motor rotation in detail. | **10****Marks** | **L3** | **CO3** |
| **Or** |
| **14.** | **a.** | An embedded system design engineer has been given a task of designing a robotic arm using stepper motor. Draw an interfacing diagram and write an embedded C program to rotate arm in clockwise direction using full step sequence. | **10****Marks** | **L3** | **CO3** |

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| **15.** | **a.** | Provide a detailed explanation of the ARM architecture, focusing on its features such as the RISC design, register set, memory organization, and modes of operation. Discuss how these features enhance the efficiency and performance of ARM processors. | **10****Marks** | **L2** | **CO4** |
| **Or** |
| **16.** | **a.** | An embedded systems engineer is tasked with designing an automated fan control system using a microcontroller and a temperature sensor. The temperature sensor outputs a voltage corresponding to the current temperature. When the temperature exceeds a certain threshold, the fan should turn on, and when it falls below the threshold, the fan should turn off. Draw the interfacing diagram for the system and write an embedded C program to read the temperature sensor and control the fan accordingly. | **10****Marks** | **L3** | **CO4** |

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| **17.** | **a.** | Write a brief note on Micro-OS-II (μCos-II) Real Time Operating System | **15****Marks** | **L2** | **CO1** |
| **Or** |
| **18.** | **a.** | One hundred numbers are stored in the internal RAM of LPC2140 starting from memory location 00004000h. Write an Assembly Language Program (ALP) to find the largest number in the array. Provide the stepwise procedure to identify the largest number before writing the program. | **15****Marks** | **L3** | **CO1** |

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| **19.** | **a.** | Compare uC/OS-II, VxWorks, and FreeRTOS based on the following factors: licensing model, scalability, real-time performance, and support for networking and communication protocols. Include examples of scenarios where each RTOS would be the preferred choice.s | **15****Marks** | **L2** | **CO3** |
| **Or** |
| **20.** | **a.** | An embedded systems engineer is tasked with developing software for a humidity measurement system in a greenhouse. There are fifteen humidity sensors placed in different zones of the greenhouse. The humidity values from these sensors need to be displayed on an LED matrix sequentially, and they must also be transmitted to a cloud platform for long-term monitoring and data analysis. As an engineer, write a brief design of the RTOS kernel and the necessary modules required for this system. | **15****Marks** | **L3** | **CO3** |

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| **21.** | **a.** | An embedded system design engineer is been given with the task of designing public address system consists of a LCD display interfaced with LPC2148. Elaborate the design process with necessary circuit diagram and embedded C program to display message “ARM7TDMI” on first line and “LPC2148” on second line.  | **20****Marks** | **L3** | **CO4** |
| **Or** |
| **22.** | **a.** | An embedded system engineer is working on developing applications that interface with real-world devices using the LPC2148 microcontroller. Write a brief note on the design procedure for an automated irrigation system that includes three soil moisture sensors and a water pump. The system should activate the pump when the soil moisture level is low. Highlight the role of various Special Function Registers (SFRs) in this process. | **20****Marks** | **L3** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***