Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 21- 05-2026 **Time:** 09:30am – 12:30pm

School: SOE	**Program:** B. Tech	
Course Code: ECE2521	**Course Name:** Embedded Systems Design using Microcontroller	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	14	12	12	24	14	24

Instructions:

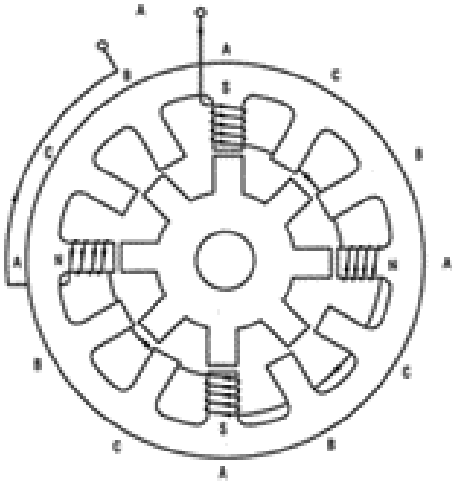
(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	The two common architecture models of Microcontroller are Harvard Architecture and von-Neumann architecture. Compare Harvard Architecture and von-Neumann architecture.	**2 Marks**	**L1**	**CO1**
2.	Embedded systems are specialized computing devices designed for specific tasks. List any four key characteristics of an embedded system.	**2 Marks**	**L1**	**CO1**
3.	Logical instructions perform bitwise logical operations on the two source registers. Mention the operation of BIC instruction used in ARM.	**2 Marks**	**L1**	**CO2**
4.	Embedded C is a set of language extensions for the C programming language. What is the purpose of loop statements in Embedded C?	**2 Marks**	**L1**	**CO3**
5.	The Timer operation is controlled by Timer registers. Explain the concept and function of a Prescaler Register (PR) available in Timers of ARM Processor.	**2 Marks**	**L1**	**CO4**
6.	UART is a hardware communication protocol used in serial communication. Expand UART and explain its purpose and functionality in serial communication systems.	**2 Marks**	**L1**	**CO4**
7.	Timers are used to measures specific time intervals, counting down from a set duration. The LPC2148 processor has PCLK = 60 MHz, using a	**2 Marks**	**L1**	**CO5**

	Timer0 with a resolution of 10 μs it is required to generate a delay of 50 ms. Calculate Prescaler and Match Register values.			
8.	The brightness of an LED depends on the applied electrical power (P=I*V). A desired brightness is obtained by setting the current flowing through it. A LED is connected to port pin of the processor with operating point of 1.7 V and 1 mA. For the positive logic interface, calculate the value of resistor to have desired brightness in the LED.	**2 Marks**	**L1**	**CO5**
9.	The angle at which the rotor of a stepper motor moves when one pulse is applied to the input of the stator is the step angle. For the given stepper Motor as shown in figure below, find the step angle and Total number of steps N required to complete one revolution. 	**2 Marks**	**L1**	**CO6**
10.	Seven segment displays consists of seven LEDs arranged in a figure-eight pattern. Mention the difference between common anode and common cathode seven segment displays?	**2 Marks**	**L1**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	A pipeline processor is a type of CPU architecture that improves processing speed by dividing instruction execution into separate stages. Explain the concept of instruction pipelining with a neat diagram. Describe the different stages of a typical 5-stage pipeline.	**10 Marks**	**L2**	**CO1**
	b.	Addressing Modes define how the CPU calculates the effective address, whether the data is in a register, directly in the instruction, or in memory. Explain the working of various Addressing Modes available in LPC2148 ARM processor with suitable examples.	**10 Marks**	**L3**	**CO2**
Or					
12.	**a.**	Embedded devices are controlled by a layered software stack. Explain the various software components used in controlling an embedded device.	**10 Marks**	**L2**	**CO1**

	b.	An array of numbers are stored in memory locations starting from memory location 0x40000000. Write an ALP using ARM instructions to find the largest number in an array.	**10 Marks**	**L3**	**CO2**

13.	**a.**	Embedded C is a programming language that is used in the development of Embedded Systems. Write a C program microcontroller to find factorial of a number.	**10 Marks**	**L3**	**CO3**
	b.	The timer is a peripheral that allows the user to measure real-time as a number of clock cycles. Explain the architecture and operation of the Timer unit in LPC2148 microcontroller with a block diagram.	**10 Marks**	**L3**	**CO4**
Or					
14.	**a.**	A conditional loop is a programming construct that repeats a block of code as long as a specific condition remains true, or until a condition is met, Discuss Embedded C programming constructs including conditional statements and loop statements with examples.	**10 Marks**	**L3**	**CO3**
	b.	The heart of timers of the LPC2148 Microcontroller is a 32-bit free running counter, which is designed to count cycles of the Peripheral Clock. Explain the steps involved in timer programming with a flowchart.	**10 Marks**	**L3**	**CO4**

15.	**a.**	(PWM) is a technique for controlling analog devices (like motors or LEDs) with digital signals by varying the duty cycle. Describe the Pulse Width Modulation (PWM) unit of LPC2148 and its applications.	**10 Marks**	**L3**	**CO4**
	b.	Stepper Motor is a brushless DC electric motor that rotates in a series of small and discrete angular steps. Describe the construction, working principle, and different types of stepper motors in detail.	**10 Marks**	**L4**	**CO5**
Or					
16.	**a.**	LPC2148 has a PCLK of 60Mhz which is provided to Timer0, the timer is having a resolution of 1μs. Program timer0 to generate a delay of 100μs. Determine the value to be loaded in the Prescalar register and the Match Register. Write the embedded C program for the same.	**10 Marks**	**L3**	**CO4**
	b.	A DC motor is an electrical motor that uses direct current (DC) to produce mechanical force. Describe in detail the construction and working principle of a DC motor, supported with suitable diagrams.	**10 Marks**	**L4**	**CO5**

17.	**a.**	The direction and the speed of DC motor is controlled by interfacing the motor with the ARM processor. Explain & Write a C program to control the movement of DC Motor for LPC2148	**10 Marks**	**L3**	**CO6**

		in both clockwise and anticlockwise. Pin numbers P0.10 and P0.11 of LPC2148 is connected to the two inputs of the DC motor.			
	b.	Seven segment display consists of seven LEDs arranged in a figure-eight pattern. Each segment is labeled A through G, and when illuminated in specific combinations, they form digits (0–9) and letters (A–F). Explain how digits (0–9) are displayed using a seven segment display with an example. Use common cathode configuration of LED display.	**10 Marks**	**L3**	**CO6**
Or					
18.	**a.**	GPIO act as the interface between the CPU and external electronics, reading data from sensors (input) or driving components like LEDs and motors (output). Write an embedded C program for LPC2148 to configure Port 0 such that: • Pins P0.0 to P0.7 are configured as outputs. • Pins P0.8 to P0.15 are configured as inputs. • The program should read the status of pins P0.8 to P0.15 and display the 8-bit value on P0.0 to P0.7 (i.e., the input value from upper byte should be shown on lower byte). Use proper bit masking and shifting if required.	**10 Marks**	**L3**	**CO6**
	b.	Digital to Analog Converter (DAC) is used to convert digital signal into analog form. Discuss the working of DAC module in LPC2148 microcontroller with suitable applications.	**10 Marks**	**L3**	**CO6**