PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
Make Up Examinations – December 2025

Semester : MK	**Date :** 27-12-2025
Course Code : ECE3040	**Time :** 09:30am – 12:30pm
Course Name : Embedded Systems	**Max Marks :** 100
Program : B TECH	**Weightage :** 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A			
ANSWER ANY 5 QUESTIONS		**5Q X 2M=10M**	
1	Differentiate between Embedded systems and General computing systems.	(CO1)	[L1]
2	Mention any two advantages of Commercial off the Shelf Component (COTS).	(CO1)	[L1]
3	Write any two salient features of LPC2148 processor.	(CO2)	[L2]
4	Write an assembly language instruction to execute a logical AND operation between R1 and R4, storing the result in R5.	(CO2)	[L2]
5	The operation of a stepper motor is based on electromagnetic principles. The movement of a stepper motor is determined by the step angle, which is influenced by the total number of magnetic poles in the motor. Given that the stepper motor has 6 phases and 18 rotor teeth, as depicted in the figure below, calculate the step angle and the total number of steps (N) needed for one complete revolution.	(CO3)	[L3]
6	The resistor value is chosen to set the correct current for the LED. For active logic, the voltage applied to the LED is approximately 3.3V, and the power supplied to the LED is controlled by the current. If the required brightness corresponds to an operating voltage of 2.1V at 8 mA, what should the value of the resistor be?	(CO3)	[L3]
7	In an operating system, the kernel is the core and smallest component that offers services to manage memory and devices. Kernels can generally be	(CO4)	[L3]

	categorized into three types: Monolithic kernels, Microkernels, and Exo-kernels. Define Monolithic kernels and Microkernels.		

PART B			
ANSWER ANY 5 QUESTIONS			5Q X 10M=50M
8	An embedded system is a combination of computer hardware and software designed to perform a specific function. These systems can vary in complexity, ranging from simple systems with a single microcontroller chip to highly complex systems with multiple units, peripherals, and networks. Briefly discuss the different types of cores used in the development of embedded systems.	(CO1)	[L1]
9	The Cortex-M3/M4 processor includes registers R0 to R15, along with several special registers. One such special register is the Program Status Register (xPSR), which is used to monitor and control internal operations. List the different bits available in the xPSR.	(CO2)	[L2]
10	In ARM Processor, Addressing modes is the way for which an operand is specified for an instruction in the general purpose register or in memory location. Illustrate the different addressing modes available in the ARM Processor and output for each of the following cases. Given R1= 42120211h, R2= 12131514h, and R3= 01001FEEh. (a) LDR R7, [R1, R3 LSR#3] (b) STR R3, [R1, R2 LSL#4] (c) STR R1, [R3], R2 (d) LDR R0, [R1], -R3, LSR#4	(CO2)	[L2]
11	Describe how a stepper motor can be utilized in real-world applications such as robotics or CNC machines. Additionally, explain in detail the half-step and full-step sequences used for the rotation of a stepper motor.	(CO3)	[L3]
12	The Serial Communication protocol is a set of rules for transmitting and receiving messages among electronic devices in a network. It specifies how data is transferred from one device to another and was primarily developed for the automotive industry. Using a block diagram, explain the operations performed in the I^{2}C bus protocol.	(CO3)	[L3]
13	The kernel is a critical component of an embedded Operating System (RTOS), responsible for managing device interactions, memory allocation, and handling interrupts and requests from processes running on the embedded system. Explain the functions of the kernel in an RTOS, providing suitable examples.	(CO4)	[L3]
14	With more than 100 RTOS options available in the commercial market, selecting the appropriate one for an embedded system can be challenging due to compatibility issues with the hardware platform and the architecture of the target system. Highlight the key features of the following RTOS options: MicroC/OS-II, VxWorks, RTLinux, and FreeRTOS.	(CO4)	[L3]

	PART C		
	ANSWER ANY 2 QUESTIONS	**2Q X 20M=40M**	
15	Addressing mode defines how the operand of an instruction is specified and outlines the rules for interpreting or modifying the instruction's address field before the operand is executed. With examples, explain the different addressing modes used in the ARM processor.	(CO2)	[L3]
16	An embedded system design engineer working on applications that involve real-world interfacing with the ARM processor is tasked with designing an automated forward collision avoidance system for a car. This system uses three obstacle sensors and a buzzer to indicate potential collisions. Provide a brief note on the design procedure for this system, emphasizing the role of various Special Function Registers (SFRs) in the process.	(CO3)	[L3]
17	a) A collection of pins on a processor is referred to as a port. Between the pins and the port's registers, there is circuitry that enables communication between the processor and external devices. These pins can be configured as either inputs or outputs. Explain the I/O port operation in the processor of an embedded system, supported by appropriate diagrams. (10 Marks) b) In C programming, a loop statement is used to repeat a block of code until the specified condition is met. Write a C program to print numbers from 1 to 10 using (i) While loop and (ii) for loop. Indicate the importance of each loop. (10 Marks)	(CO4)	[L3]