

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3151107

Date: 25/05/2026

Subject Name: Advance Microcontroller

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a) State the difference between Von Neumann and Harvard architecture. **03**
 - (b) Explain CPSR and SPSR Register of ARM microcontroller. **04**
 - (c) Draw and explain the ARM core dataflow model. **07**
- Q.2**
- (a) Write syntax and usage of following instructions: TST, EOR, RSB **03**
 - (b) Write a program to toggle LEDs connected to port pin P0.2 using in ARM7 microcontroller. **04**
 - (c) Explain 5-stage pipelines used in ARM processor. **07**
- OR
- Q.2**
- (c) Write a short note on exceptions in ARM processor. Discuss the types of exceptions, the exception handling mechanism. **07**
- Q.3**
- (a) Describe Software Interrupt instruction with example. **03**
 - (b) Write an assembly language program to count no of 0's in R2 register. **04**
 - (c) Write a C program to interface a UART device with an ARM microcontroller. **07**
- OR
- Q.3**
- (a) List the properties of the Thumb Instruction Set in ARM processors. **03**
 - (b) What is conditional execution? What are the mnemonic extension codes used for conditional execution? Explain with example. **04**
 - (c) Draw and explain Timer block diagram in LPC2148. **07**
- Q.4**
- (a) Explain the importance of Memory Protection Unit. **03**
 - (b) Describe how bit-wise operations can be performed in C using the ARM compiler. **04**
 - (c) Explain techniques used for memory optimization in embedded systems. **07**
- OR
- Q.4**
- (a) Explain flush and clean operation performed on a cache memory in ARM. **03**
 - (b) Explain the role of the various registers in the ADC of an ARM processor. **04**
 - (c) Write a short note on translation look aside buffer. **07**
- Q.5**
- (a) Compare ARM System Bus (ASB) and ARM Peripheral Bus (APB) by listing their differences. **03**
 - (b) Explain concept of delayed branch. **04**

- (c) Draw interfacing diagram of Common Cathode seven segment display connected to port P0.0 to P0.7. Write C language program to display 0 to F continuously with delay. **07**

OR

- Q.5** (a) Explain advance microprocessor bus architecture (AMBA) and discuss its special features. **03**
- (b) Draw the interfacing diagram of a relay with LPC 2148 and explain its working. **04**
- (c) Write a C program to generate PWM signals with 60% duty cycle in LPC2148. Also, explain the significance of using PWM in embedded systems. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V EXAMINATION – SUMMER 2025

Subject Code:3151107

Date:15-05-2025

Subject Name:Advance Microcontroller

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) What is difference between branch instructions “B” and “BL” ?	03
	(b) Explain optimization techniques of Embedded C Programming	04
	(c) Explain the key features and components of the ARM7TDMI architecture. Discuss the ARM7TDMI processor modes	07
Q.2	(a) Why interrupt latency of FIQ is less than IRQ in ARM Microcontroller?	03
	(b) Discuss the advantages of using the ARM7TDMI Thumb state in low-power and code size-constrained applications. How does Thumb state reduce memory bandwidth and energy consumption compared to the ARM state?	04
	(c) Explain difference between RISC and CISC architecture. Which RISC features are selected in ARM processor and which features are rejected in ARM processor?	07
	OR	
	(c) Describe the ARM7TDMI pipeline architecture and the stages involved in the execution of instructions. Discuss the role of pipeline hazards and techniques such as forwarding and stalling in optimizing pipeline performance.	07
Q.3	(a) Explain the concept of little-endian byte ordering in ARM7TDMI processors. How does byte ordering affect memory access and data representation?	03
	(b) Explain the role of the ARM7TDMI Status Register (CPSR) in managing processor state and controlling program execution. Discuss the flags contained in the CPSR and their significance in instruction execution.	04
	(c) Describe the ARM7TDMI interrupt handling mechanism and the process of prioritizing and servicing interrupts in ARM7TDMI-based systems.	07
	OR	
Q.3	(a) What is will be content in register R3 after executing following instructions in ARM Microcontroller? LDR R1,=0xFFFFFFFF LDR R2,=0x11118888 BIC R3,R1,R2	03
	(b) Discuss the role of the ARM7TDMI Link Register (LR) in function calls and returns. How is the LR register used to store the return address and control program flow during function execution?	04
	(c) Describe the process of branching and conditional execution in ARM7TDMI assembly language programming. How are branch instructions encoded and executed, and how are conditional flags used to control program flow?	07

- Q.4 (a)** Write C Program to turn ON and OFF electrical device controlled by port pin P1.7 ON and OFF should be done at the interval of 10 second. Assuming relay driver circuit is available and connected with port pin P1.7 to control electrical device and devices turns ON when logic 1 is available on the port pin. **03**
- (b)** Explain the process of configuring and programming timers in ARM7TDMI to perform tasks such as generating precise delays with help of examples. **04**
- (c)** Explain following assembly language instructions: **07**
 [a] LDMIA R0!,{R1-R7} [b] MVN R1,R3 [c] MOV R1,R2,LSL #2
 [d] LDR R1,[R2] [e] RSC R0,R1,R2 [f] ADDEQ R0,R1,R2
 [g] TST R1,R2
- OR**
- Q.4 (a)** Write equivalent assembly language instruction for following “C” statement: **03**
 if (z==1) { R1=R2+(R3*4); }
 Where z is Zero flag and R1,R2, R3 are registers
- (b)** Write C language program to set port pins P0.16 to P0.20 and P1.8 to P1.15 in ARM processor **04**
- (c)** Describe the principles of Pulse Width Modulation (PWM) and its applications in embedded systems. Discuss how PWM signals are generated using timers. Provide an example of using PWM to control the brightness of an LED with interfacing diagram. **07**
- Q.5 (a)** Describe the basic steps involved in configuring the ADC module of an ARM7TDMI microcontroller for analog input signal conversion. **03**
- (b)** Explain the role of page tables in virtual memory management. **04**
- (c)** Explain the concept of cache memory in ARM7TDMI processors and the benefits of using cache memory for improving memory access performance. **07**
- OR**
- Q.5 (a)** Explain the process of reading analog input values from the ADC data registers in ARM7TDMI programming. How are the converted digital values accessed and processed for further use in the application? **03**
- (b)** Describe the concept of address translation in virtual memory systems. **04**
- (c)** Describe the Advanced Microprocessor Bus Architecture (AMBA) in detail, highlighting its key components and their roles in ARM7TDMI-based systems. Discuss how AMBA facilitates high-performance and scalable interconnectivity between different system components. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2024****Subject Code: 3151107****Date: 18-05-2024****Subject Name: Advance Microcontroller****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1** (a) What is interrupt latency? How FIQ interrupt latency is reduced in ARM Microcontroller? **03**
- (b) For what type of applications ARM is preferred over AVR microcontroller? What is advantage of 32-bit processor over 8-bit processor? **04**
- (c) Explain ARM Architecture and Programming model. What are the special purpose registers? Explain importance of barrel shifter with example. **07**
- Q.2** (a) Explain flags in ARM. What is the purpose of CPSR and SPSR? **03**
- (b) What problem will occur with pipeline during branch instruction? How this problem is resolved in ARM ? **04**
- (c) Explain following ARM assembly language instructions: **07**
 (1) LDR R1,[R2,#8] (2) LDRB R1,[R0],#1 (3) TST R1,R2
 (4) LDMIA R0!, {R1-R3} (5) CMN R1,R2 (6) ASR (7) BX
- OR**
- (c) Why ARM is not known as pure RISC machine? What are the features selected in ARM from RISC machine and what are the features not adopted in ARM from RISC machine? **07**
- Q.3** (a) What will be content of register R1 after executing following instruction. (Assume initial content of R1=0xFAFAFAFA and R2=0x55555555) **03**
 BIC R1,R1,R2
- (b) Discuss how to toggle the state of GPIO port pin P1.0. Explain the use of bitwise XOR (exclusive OR) to change the state of the pin. Write C program for toggling the P1.0 pin's state to generate square wave with highest frequency. **04**
- (c) What are the exceptions and interrupts in ARM ? How exception handling done? **07**
- OR**
- Q.3** (a) What will be content of register R3 and R4 after executing following instructions ? **03**
 MOV R1,#0x11
 MOV R2,#0x44
 ORR R3,R2,#0xAA
 AND R4,R1,R2
- (b) 8 LEDs are connected to port pin P1.16 to 1.23. Write C program to blink (Flash) LED with any amount of delay. **04**

- (c) Describe how to configure a timer on an ARM microcontroller. Explain how to set the key parameters such as pre-scaler, clock source and mode of operation. **07**
- Q.4** (a) Explain the steps involved in configuring and initializing the ADC module in an ARM microcontroller. **03**
- (b) What advantages does the AMBA architecture bring to ARM-based SoC designs? How does it improve system scalability, modularity, and performance? **04**
- (c) What are the advantages and disadvantages of C programming over assembly programming for embedded systems? Explain any two optimization techniques of C program with help of example **07**
- OR**
- Q.4** (a) Write equivalent assembly language instruction for following “C” statement:
 if (z==1) R1=R2+(R3*4)
 { z is Zero flag and R1,R2, R3 are registers } **03**
- (b) Explain branch instructions B and BL. What is the difference between B and BL? **04**
- (c) Describe the different types of AMBA buses, such as AHB (Advanced High-Performance Bus) and APB (Advanced Peripheral Bus). How do these buses differ in terms of functionality and performance? **07**
- Q.5** (a) Digital sensor is connected to port pin P0.0 and Buzzer is connected to port pin P1.0. Write C Program to sound buzzer when digital sensor provides logic 1 and mute buzzer when digital sensor provides logic 0. **03**
- (b) What is virtual memory, and why is it essential in computer systems? Describe the primary purpose it serves in managing system memory. **04**
- (c) Write subroutines to set port pins IOSET() and clear port pins IOCLR() where pin number can be specified in argument in these subroutines. Write main program to set port pin P1.6 and clear port pin P1.4 using these subroutines. **07**
- OR**
- Q.5** (a) Explain ADxCR (Analog to Digital Conversion Control Register) for channel selection, resolution and start of conversion. **03**
- (b) Describe the cache hierarchy commonly used in ARM processors, including L1, L2, and L3 caches. How do these levels of cache differ in terms of capacity, proximity to the CPU ? **04**
- (c) Explain the concept of PWM using timers. How can you generate PWM signals for controlling devices such as motors or LEDs using ARM Microcontroller? What are the registers useful for PWM programming? **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- V EXAMINATION-SUMMER 2023****Subject Code: 3151107****Date: 26/06/2023****Subject Name: Advance Microcontroller****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Compare RISC and CISC philosophy.	03
	(b) List the features rejected from RISC Design for improved ARM Design.	04
	(c) Draw and explain ARM Core data flow model.	07
Q.2	(a) Describe the load store architecture used in ARM controller.	03
	(b) Explain the ARM7TDMI programmer's model.	04
	(c) Explain following ARM instruction with example: 1)UMULL 2)SBCS 3)BL 4)BIC 5)RSC 6)EORS 7)MOVEQ	07
	OR	
	(c) Write a program to count a number of 1's in R0. Assume that R0 contains any 32-bit data.	07
Q.3	(a) Describe software interrupt instruction SWI with its importance.	03
	(b) Explain barrel shifter instructions with example.	04
	(c) Explain the 5-stage Pipeline architecture used in ARM controller with necessary figures.	07
	OR	
Q.3	(a) Explain the BX instruction with suitable example.	03
	(b) Explain how register allocated by ARM C compiler.	04
	(c) Write a short note on stack implementation in ARM.	07
Q.4	(a) List the portability issues encounter when porting C code to the ARM.	03
	(b) Draw and explain the memory hierarchy used in a computer system.	04
	(c) Write a C program to blink LED connected to pin P0.3 at the interval of 1 second in LPC2148. Generate a delay using Timer.	07
	OR	
Q.4	(a) Explain control flow instructions for ARM controller with suitable examples.	03
	(b) Briefly discuss the Thumb Programmers model.	04
	(c) Explain ARM addressing modes with suitable examples.	07
Q.5	(a) Write down the MMU Advantages for ARM processor.	03
	(b) Explain mapping a task in virtual memory to physical memory using a relocation register.	04
	(c) Discuss the APB bus transfers. Explain the need of APB bridge.	07
	OR	
Q.5	(a) Briefly discuss the AHB bus features.	03
	(b) Explain the unified split cache memory.	04
	(c) Discuss Tightly coupled Memory (TCM).	07

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V(NEW) EXAMINATION – SUMMER 2022****Subject Code:3151107****Date:04/06/2022****Subject Name:Advance Microcontroller****Time:02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) What is the advantage of barrel shifter in ARM?	03
	(b) Why FIQ response is fast than IRQ response in ARM processor? Explain necessity of FIQ with one example.	04
	(c) Explain difference between RISC and CISC architecture. Which RISC features are selected in ARM processor and which features are rejected in ARM processor?	07
Q.2	(a) What are the special functions of R13, R14 and R15 registers?	03
	(b) What is the purpose of CPSR and SPSR in ARM processor?	04
	(c) Explain ARM7TDMI architecture and its programming model	07
	OR	
	(c) Explain ARM 3 stage and 5 stage pipeline. If an instruction takes 3 cycles for execution, then how many cycles are needed for executing 4 instructions of the same type in a sequence using a 3-stage pipeline? Assume that there are no interrupts or exceptions while executing the instructions.	07
Q.3	(a) Explain difference between Little endian & Big Endian with example	03
	(b) What is default ARM exception priority? What will be effect of setting I and F bit?	04
	(c) Explain following assembly language instructions: [a] LDMIA R0!,{R2-R6} [b] MVN R1,R4 [c] MOV R5,R6,LSL #2 [d] LDR R1,[R3] [e] RSC R0,R1,R2 [f] ADDEQ R0,R1,R2 [g] TST R1,R2	07
	OR	
Q.3	(a) Explain difference between Harvard & Von-Neumann Architecture	03
	(b) In ARM processor, content of register R1=0x7FFFFFFF and R2=0x00000001. What will be content of register R3 and status of flag V after execution of instruction ADDS R3,R1,R2 ?	04
	(c) Draw interfacing diagram to interface LCD with ARM processor. Write Assembly or C program to display message "DIGITAL INDIA" on the LCD.	07
Q.4	(a) Write initialization instruction in Embedded C language for ARM if we want to connect 4 push-button SW with P0.0 to P0.3, 8 LEDs with P0.4 to P0.11, Digital sensors with P0.12 to P0.15 and Actuators with P0.16 to P0.19 pins of ARM Chip.	03
	(b) List ARM development tools and advantages of Embedded C Programming.	04

- (c) What are the exceptions in ARM processor? Explain mode of operation for different exceptions **07**
- OR**
- Q.4** (a) List I2C and SPI interface signals. Is it possible to connect multiple devices with I2C interface? **03**
- (b) What is cache memory? What is advantage of using cache memory? Explain concept of cache memory **04**
- (c) List optimization techniques of Embedded C Programming. Explain any three techniques in detail with examples. **07**
- Q.5** (a) Discuss variable storage class: Automatic, Register and static. **03**
- (b) What is difference between Cortex A, Cortex M and Cortex R series of ARM? **04**
- (c) Design ARM based system to control solenoids S1, S2, S3 and S4. Write Embedded C program to operate solenoid in such a way that solenoid S1 and S3 should be ON for 5 second and then after solenoid S2 and S4 should be ON for 3 second and then after repeat the sequence continuously. **07**
- OR**
- Q.5** (a) Justify the statement “Virtual memory is illusion of large main memory” **03**
- (b) What is AMBA? Why AMBA is popular in modern embedded system design? **04**
- (c) Design ARM system to generate two PWM signals to control devices. Write C program to generate PWM on any two PWM pins with duty cycle of 20% and 40% respectively. **07**
