

Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering - SEMESTER - V EXAMINATION - WINTER 2025

Subject Code: 3151107

Date: 19-11-2025

Subject Name: Advance Microcontroller

Time: 10:30 AM TO 01:00 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) Write three features of the ARM processor family.	03
(b) What is the RISC design philosophy?	04
(c) Describe the ARM design philosophy in detail. Explain why ARM became popular in embedded systems.	07
Q.2 (a) What is endianness? Differentiate between little-endian and big-endian.	03
(b) Write a short note on ARM7TDMI interface signals.	04
(c) Discuss pipeline hazards in ARM processors and explain how data forwarding helps overcome them.	07
OR	
(c) Describe the ARM memory map and load-store architecture with an example.	07
Q.3 (a) Differentiate between a processor core and a CPU core.	03
(b) Explain following instructions. 1.SWP R0, R1, [R2] 2.MOV R0, R1, LSL R2	04
(c) Explain ARM program control flow instructions (B, BL, BX) with examples.	07
OR	
(a) Explain working of various multiply instructions in ARM with proper example.	03
(b) Describe following instructions with suitable example. (1) LDMIA R1, {R2-R10} (2) LDMDB R1!, {R2-R10}	04
(c) Discuss ARM exception handling mechanism with reset example.	07
Q.4 (a) Define pointer aliasing in Embedded C. Why is it a concern?	03
(b) Explain how inline functions differ from normal functions in ARM C. Give an example.	04
(c) Compare SPI and I2C in terms of protocol, speed, and usage in ARM Embedded C.	07
OR	
(a) Describe following assembler directives: ENTRY, ADR, DCD	03

- (b) Why FIQ response is fast than IRQ response in ARM processor? Explain necessity of FIQ with one example. 04
- (c) List optimization techniques of Embedded C Programming. Explain any three techniques in detail with examples. 07
- Q.5** (a) Explain ARM MPU (Memory Protection Unit) with an example. 03
- (b) Compare unified cache and split cache. 04
- (c) Explain hierarchical memory organization in ARM systems and the role of each level. 07
- OR**
- (a) Differentiate between paging and segmentation. 03
- (b) Differentiate AHB and APB bus transfers. 04
- (c) Compare Cortex-M, Cortex-R, and Cortex-A in the context of AMBA interconnect usage. 07

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2024****Subject Code:3151107****Date:28-11-2024****Subject Name:Advance Microcontroller****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
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		Marks
Q.1	(a) What is the Reduced Instruction Set Computer (RISC) design philosophy? List down features of its.	03
	(b) Give different applications of ARM processors.	04
	(c) Which are the different features of ARM instruction set that make it suitable for embedded applications?	07
Q.2	(a) Explain Non-protected memory, MPU & MMU.	03
	(b) With a neat diagram explain the different general purpose registers of ARM processors.	04
	(c) What are banked registers? Show how the banked registers are utilized when the user mode changes to IRQ mode.	07
	OR	
	(c) Explain ARM pipeline with 3,5,6 stages.	07
Q.3	(a) Discuss variable storage class: Automatic, Register and static.	03
	(b) List ARM development tools and advantages of Embedded C Programming.	04
	(c) How are interrupts or exceptions handled in ARM processors?	07
	OR	
Q.3	(a) Justify the statement “Virtual memory is illusion of large main memory”.	03
	(b) Explain following instructions with at least one example for each. (1) BIC (2) EOR (3) TEQ (4) RSB	04
	(c) What is the use of paging mechanism? Show how paging is done in any of ARM families of processors.	07
Q.4	(a) What is the advantage of barrel shifter in ARM?	03
	(b) How will you perform bit-wise operation in C using ARM compiler?	04
	(c) Write a c program that send and receive data from UART device interfaced with ARM.	07
	OR	
Q.4	(a) Explain following directives of ARM assembler 1. EQU 2. RN 3. ALIGN	03
	(b) Explain flush and clean operation performed on a cache memory in ARM	04
	(c) Discuss techniques for optimization of memory needs while writing C program for ARM based microcontroller.	07
Q.5	(a) What is a Thumb mode in ARM? Explain in brief.	03

- (b) Write ARM assembly language program for HEX number to ASCII conversion. Assume HEX number is stored in register R1. **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**

OR

- Q.5**
- (a) Write C language program to set port pins P0.0 to P0.7 and P1.0 to P1.7 in ARM processor. **03**
 - (b) Compare AHB and APB of AMBA bus system of ARM Architecture. **04**
 - (c) Write a short note on stack implementation in ARM. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2023****Subject Code:3151107****Date:07-12-2023****Subject Name:Advance Microcontroller****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
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MARKS

- | | | |
|------------|--|-----------|
| Q.1 | (a) Describe IRQ and FIQ processor mode in ARM. | 03 |
| | (b) Differentiate RISC and CISC. | 04 |
| | (c) Describe the RISC features which are accepted and rejected to design ARM architecture. | 07 |
| Q.2 | | |
| | (a) Describe each field of CPSR Register. | 03 |
| | (b) Describe following ARM instructions with example:
(1) ADDEQS (2) MLA (3) TEQ (4) MVN | 04 |
| | (c) Describe 3-stage pipelined architecture of ARM7. | 07 |
| OR | | |
| | (c) What is Cortex? Compare features of ARM Cortex series with ARM7 core. | 07 |
| Q.3 | | |
| | (a) Write assembly language program to multiply given number(in R2 register) by 35 without using multiply instructions. Move result to R10 register after operation. | 03 |
| | (b) Describe following instruction with its addressing mode, with example.
(1) LDR R1, [R2], 16
(2) LDR R1, [R2, 16]
(3) LDR R1, [R2, 16]!
(4) LDR R1, [R2, R3]! | 04 |
| | (c) Describe “Branch” and “Branch with Link” instruction with suitable example. | 07 |
| Q.3 | | |
| | (a) Write assembly language program to (1) shift left R1 by 32 and (2) logical shift right R2 by 8 (3) Add both result in R3.
Assume R1=0x34, R2 = 0x53A0,
What will be content of R1, R2 and R3 after executing the code. | 03 |
| | (b) Describe following instructions with suitable example.
(1) LDMIA R1, {R2-R10}
(2) LDMDB R1!, {R2-R10} | 04 |
| | (c) Describe Thumb mode in ARM processor. Differentiate ARM mode and Thumb Mode. How to switch from/to Thumb mode to/from ARM mode? | 07 |

- Q.4** (a) What is MMU? Enlist merits and demerits of MMU. **03**
 (b) Describe following assembler directives: **04**
 AREA, DCD, ADR, ENTRY
 (c) Sketch circuit diagram of LCD interfacing with LPC2148. Write C-program to display "MICROCONTROLLER" on first line of LCD. **07**

OR

- Q.4** (a) Enlist main control components of ARM MMU. **03**
 (b) Write assembly language instruction for following operations: **04**
 if(R0 < (R5+R7))
 {
 R1 = R1 + R2*8
 R3 = R3 - R1*16
 }
 (c) Sketch circuit diagram to interface following devices with LPC2148. **07**
 (1) Eight LEDs at P1.0 to P1.7
 (2) single switch (SW1) at P1.16
 (3) Single relay (R1) at P1.20

Write C-program to turn on LEDs as per binary counter if switch is pressed. When counter pattern reach at 0xFF, turn-on relay for 1 second.

- Q.5** (a) Describe code optimization techniques of embedded C-programming **03**
 (b) Describe basic architecture of cache memory. **04**
 (c) Sketch and Describe AMBA bus arbitration with help of diagram. **07**

OR

- Q.5** (a) Describe concept of inline assembly code in ARM C-program. **03**
 (b) Describe function of translation look aside buffers in virtual memory system. **04**
 (c) Compare AHB, APB and ASB of AMBA bus system of ARM Architecture. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2022****Subject Code:3151107****Date:06-01-2023****Subject Name:Advance Microcontroller****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
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MARKS

- Q.1**
- (a) Why interrupt latency of FIQ is less than IRQ in ARM Microcontroller? **03**
- (b) What is the importance of condition codes with instructions in ARM Microcontroller? **04**
- (c) Explain difference between RISC and CISC architecture. What are the RISC features selected in and what are the features rejected in ARM? **07**
- Q.2**
- (a) What is will be content in register R3 after executing following instructions in ARM Microcontroller? **03**
- LDR R1,=0xFFFFFFFF
LDR R2,=055555555
BIC R3,R1,R2
- (b) Write assembly language subroutine to find value of Y in following equation: **04**
- $Y = 16X + 4$
- (Assume register R1 holds Y and register R2 holds X)
- (c) What is exception? List types of exceptions occur in ARM processor. Explain registers available to programmers during exceptions. **07**
- OR**
- (c) Explain ARM7TDMI architecture and its programming model **07**
- Q.3**
- (a) What is the special purpose of R13, R14 and R15 registers in ARM? **03**
- (b) Explain instructions: [a] LDMIA r0!,{r2-r6} [b] LDR R1,[R2,#8]! [c] TST r1,r2 [d] STR R0,[R1] **04**
- (c) Explain 3 stage and 5 stage pipeline used in ARM Microcontroller **07**
- OR**
- Q.3**
- (a) Explain flags in ARM. What is the purpose of CPSR and SPSR? **03**
- (b) What will be content of register R1,R2 and R3 after executing following instructions? **04**
- MOV R2,#0x04
MOV R1,R2,LSL #3
MVN R3,R2
AND R2,R3,R1
- (c) What is the difference between branch instruction “B” and “BL” ? **07**
- Explain branch instructions of ARM Microcontroller with suitable examples.

- Q.4 (a)** What is the difference between physical and virtual memory? **03**
- (b)** Explain the function of Translation look aside buffers in virtual memory system. **04**
- (c)** What are the advantages and disadvantages of C programming for Embedded Systems over assembly programming? Explain any two optimization techniques of C program with help of example **07**
- OR**
- Q.4 (a)** Write C language program to set port pins P0.0 to P0.7 and P1.0 to P1.7 in ARM processor **03**
- (b)** Explain flush and clean operation performed on a cache memory in ARM. **04**
- (c)** Explain interfacing of 16x2 LCD with ARM Microcontroller. Draw interfacing diagram and write C language program to display message “Atma Nirbhar Bharat” on LCD. **07**
- Q.5 (a)** What is the name of signal used by AMBA’s ASB bus master “x” to the bus arbiter to request bus and what is the name of bus grant signal communicated by bus arbiter? **03**
- (b)** Explain AHB basic data transfer with help of diagram. **04**
- (c)** Discuss UART Programming in ARM Microcontroller. Explain important registers used for UART programming. **07**
- OR**
- Q.5 (a)** What is the purpose of HLOCK signal produced by AHB Master? **03**
- (b)** Explain programming steps for SPI programming **04**
- (c)** Describe AMBA Arbitration with the help of a diagram for AMBA based system **07**
