

Bachelor of Engg. (Electronics and Telecommunication Engg.) Exam., 2025
(Final Year, 2nd Semester Examination, 2025)

Introduction to ARM7TDMI Architecture
(Elective Paper #2)

Time: Three Hours

Full Marks: 100

Answer ALL the Questions

(All Parts of the same question must be answered at one place only)

Module I (CO1)

1. (A) (i) _____ is described by IEEE 1149.1, is a _____ protocol used by ARM to send and receive debug information between the Processor core and test equipment.
(ii) When the power is applied to the core, it starts in _____ mode, which is _____.
(iii) As the _____ length increases, the system latency also increases, because it takes more cycles to fill the _____ before the core can execute an instruction.
(iv) Name the Exception / Interrupt / Vector used when the Processor cannot decode an instruction.
(v) How many hardware extensions ARM wraps around the Core?

(5X2=10 Marks)

(B) Illustrate the Abstract Components that make up an ARM core, and show how different parts / functional units interact. (10 marks)

Module II (CO2)

2. (A) (i) There are _____ different _____ operations that you can use within the Barrel Shifter.
(ii) You need to apply the S suffix for comparison instructions to update the flags.
(State True or False)
(iii) The TST instruction is a logical _____ operation, and TEQ instruction is a logical _____ operation.
(iv) In the ARM7 instruction, LDR r0, [r1, #4] !, name / identify the Index Method used.
(v) In the ARM7 Instruction Set, to aid Programming, there are _____ number of pseudo instructions to move a _____-bit value into a register.

(5X2 Marks)

(B) Write an ARM7 TDMI Assembly Language Program (ALP) to add 10 numbers which are in memory. The numbers are 16-bit long, that is half words, and use two byte spaces. Explain the salient features of the ALP. (10 Marks)

[Turn over

Module III (CO3)

3. (A) (i) Thumb has higher performance than ARM on a processor with a _____ data bus, but lower performance than ARM on a _____ data bus, hence use Thumb for _____ constrained systems.
- (ii) Identify the main reason / driving force for the development of Thumb Instruction set.
- (iii) The limited space available in the 16-bit causes the _____ operations to be separate instructions in the Thumb ISA.
- (iv) From the Thumb instruction set list and the Thumb register usage table, it is observed that there is no direct access to the _____ or _____.
- (v) The Processor (and the Programming) need to be in the _____ to access the Coprocessor for configuring Cache and Memory Management.
- (5X2 Marks)
- (B) (i) Illustrate the Divide code routine implanted in Thumb code.
- (ii) List the Salient Features of ARM – Thumb Internetworking. Illustrate with a Programming example.
- [4+6 Marks]

Module IV (CO4)

4. (A) The LPC 2148 MCU (Microcontroller Unit) from Philips (i) is based on the Core _____ with the size of the on-chip Static RAM _____
- (ii) In the Power Down mode, the _____ is shut down, and the chip receives _____ internal clocks.
- (iii) Name the Register / Identify the on-chip register, [Answer.: _____] whose settings can be used to divide the output frequency of the PLL so as to get a reduced clock frequency for the _____.
- (iv) Four number of _____ and _____ Channels each, are available with the Two 32-bit Timers / External Event Counters in LPC 2148 MCU.
- (v) The On-chip Vectored Interrupt Controller (VIC) in LPC 2148 MCU can support a total of _____ number of interrupt request inputs, out of which, _____ number of inputs are from Vectored IRQ interrupts.
- [5X2 Marks]
- (B) (i) How is the ARM Bus Technology is different from those designed for x86 PCs?
- (ii) Illustrate the standard defined by ARM for On-chip buses in its SoC design / MCU with a Block Diagram / Bus Structure.
- [3+7 Marks]

Module V (CO5)

5. (A) (i) In LPC2148 MCU, only very few pins of Port 1 are available as GPIO, because other pin functions are used for _____.
- (ii) Identify the 32-bit word to be written in the PINSEL0 register for activating PWM1 output available at the output Pin P0.0 [Pin P0.0 corresponds to bit 1 & 0 of the PINSEL0 register]
- (iii) The Timer Count Register – T0TC is incremented by one for every _____, if the Prescaler, PR=1.
- (iv) (a) Given PWM0 = FFH, CCLK = 60 MHz, Prescaler, PR=1, then calculate the Period, T of the output PWM signal.
- (b) Given PWM1 = 0x30H, calculate P(ON) and the Duty Cycle of the output PWM signal. [5X2 Marks]
- (B) (i) List the steps involved For Programming of the On-chip Timer in the LPC2148 MCU (ii) Write an Embedded C Program for the LPC214x MCU, to generate a symmetric square wave at the GPIO P1.15, using Timer0. [4+6 Marks]

CO1: Illustrate the architecture of the ARM7TDMI Processor (K2, A1)

CO2: Understand the Instruction set of ARM Processor and write Assembly Language Program (ALP) (K2, K3, A2)

CO3: Compare and Analyze the advantages of ARM Thumb Instruction Set (K4, A2)

CO4: Describe the ARM Processor as a Microcontroller Unit with appropriate On chip Peripherals (K2, K4, A1)

CO5: Understand and write the Peripheral programming in C language (K2, A3)