

[illegible]

B.Tech. DEGREE EXAMINATION, MAY 2024

Sixth Semester

18ECE204J – ARM - BASED EMBEDDED SYSTEM DESIGN

(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

Note:

- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- (ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours

Max. Marks: 100

Marks	BL	CO	PO
-------	----	----	----

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

1. ARM is a type of _____ processor.
 - (A) CISC
 - (B) RISC
 - (C) 64 bit
 - (D) HPC
 2. What will be output of the instruction ADD R7, R7, R5, LSL#2 when the input is R5=5 and R7=8 is
 - (A) R7=28
 - (B) R7=23
 - (C) R7=24
 - (D) R7=25
 3. The ARM cortex M series for _____ applications.
 - (A) High performance
 - (B) Low power
 - (C) Fast response
 - (D) High power
 4. The instruction RSC R0, R1, R2 will produce which of the following execution
 - (A) $R_0 = R_2 - R_1 + C - 1$
 - (B) $R_0 = R_1 - R_2 + C - 1$
 - (C) $R_0 = R_0 + \text{carry}$
 - (D) $R_0 = R_2 + R_1 + \text{carry}$
 5. In ARM processor peripheral interfacing which register is commonly used to configure a GPIO pin as an input or output?
 - (A) General purpose control register (GPCR)
 - (B) Digital input/output register (DIOR)
 - (C) GPIO direction register (GPIODIR)
 - (D) Peripheral configuration register (PCR)
 6. Which of the following ADC modes in LPC2148 continuously converts and updates the result in the result register?
 - (A) Single conversion mode
 - (B) Burst mode
 - (C) Continuous conversion mode
 - (D) Sequential conversion mode
 7. How is the PWM frequency calculated in LPC2148 microcontroller?
 - (A) PWM frequency = clock frequency / (prescaler * (match register + 1))
 - (B) PWM frequency = clock frequency / (match register value + 1)
 - (C) PWM frequency = clock frequency * (prescaler * (match register value + 1))
 - (D) PWM frequency = clock frequency * (match register value + 1)
 8. In LPC 2148 microcontroller, if the PWM resolution is 2047 and the PWM counter width is 11 bits, how many duty cycle steps are possible?
 - (A) 2048
 - (B) 1024
 - (C) 2047
 - (D) 4096

9. Which of the following synchronous serial communication protocols is commonly used in LPC2148 microcontroller? 1 1 3 1
 (A) UART (B) SPI
 (C) I2C (D) USART
10. How does the I2C protocol handle communication collisions in LPC2148 microcontroller? 1 2 3 3
 (A) By ignoring collisions and (B) By pausing transmission and continuing transmission retying after a random delay
 (C) By using arbitration to (D) By terminating transmission determine which device can and restarting the continue transmission communication process
11. Which interrupt is commonly used to handle time overflow events in LPC 2148 microcontroller interfacing? 1 2 3 3
 (A) Timer 0 interrupt (B) Timer 1 interrupt
 (C) Timer 2 interrupt (D) Timer 3 interrupt
12. In SPI communication, if the clock frequency (SCK) is 1 MHz and the SPI prescaler value is set to A, what is the resulting SPI clock frequency? 1 3 3 3
 (A) 250 kHz (B) 500 kHz
 (C) 1 MHz (D) 4 MHz
13. What is the role of the memory control unit (MCU) in the LPC2148 microcontroller? 1 2 4 1
 (A) To manage access to external memory devices (B) To provide direct access to flash memory
 (C) To control the execution flow of program instructions (D) To interface with peripheral devices
14. What is the role of the ethernet controller in the LPC2148 microcontroller? 1 2 4 1
 (A) To generate clock signals for ethernet communications (B) To interface with external ethernet transceivers
 (C) To manage data transmission and reception over the ethernet interface (D) To handling routing and packet forwarding in the network
15. Which of the following communication interfaces is commonly used for LAN communication with the LPC2148 microcontroller? 1 2 4 1
 (A) UART (B) SPI
 (C) Ethernet (D) I2C
16. In LPC 2148 microcontroller has 64 kB of on-chip flash memory and 16 kB of on-chip RAM. If an external memory chip with 512 kB of flash memory and 128 kB of RAM is connected to the LPC2148 Via EM1, what is the total available flash memory and RAM for the μ C system? 1 3 4 3
 (A) 576 kB of flash memory and 144 kB of RAM (B) 576 kB of flash memory and 16 kB of RAM
 (C) 576 kB of flash memory and 64 kB of RAM (D) 576 kB of flash memory and 128 kB of RAM

- | | | | | |
|--|---|---|---|---|
| 17. Which of the following communication protocols is commonly used for transmitting digital audio data between the LPC 2148 micro controller and external audio peripherals? | 1 | 2 | 5 | 1 |
| (A) I2C | | | | |
| (B) SPI | | | | |
| (C) UART | | | | |
| (D) I2S | | | | |
| 18. The short data type ensures that the data is constrained to 16-bit values; this can be specified as signed and unsigned ranges are | 1 | 3 | 5 | 3 |
| (A) Range (– 48768 to 32767) and range (0 to 125535) | | | | |
| (B) Range(0 to 32767) and range (0 to 65535) | | | | |
| (C) Range (0 to 32767) and range (–65535 to 65535) | | | | |
| (D) Range (– 32768 to 32767) and range (0 to 65535) | | | | |
| 19. A wave audio file has a 16-bit mono data value given by two consecutive bytes. What will be the correct corresponding voltage output, if this corresponding voltage output, if this is output through the MBED's DAC, for the following data 0x3504 (in hexadecimal) | 1 | 3 | 5 | 3 |
| (A) 0.682 volts | | | | |
| (B) 3.293 volts | | | | |
| (C) 0.0114 volts | | | | |
| (D) 0.2114 volts | | | | |
| 20. The frequency of load/store instruction is around | 1 | 2 | 5 | 3 |
| (A) 20% | | | | |
| (B) 10% | | | | |
| (C) 40% | | | | |
| (D) 67% | | | | |

PART – B (5 × 4 = 20 Marks)

Answer ANY FIVE Questions

Marks BL CO PO

- | | | | | |
|--|---|---|---|---|
| 21. Illustrate a block diagram representing an embedded system, and elucidate its characteristics and applications. | 4 | 2 | 1 | 3 |
| 22. Identify and discuss four typical design constraints associated with ARM processors. | 4 | 2 | 1 | 3 |
| 23. Generating a PWM signal with a duty cycle of 75% using the internal PWM module of the LPC 2148 microcontroller. The PWM signal should have a frequency of 10 kHz. Calculate the required values for the PWM period and the match register to achieve the desired duty cycle. | 4 | 2 | 2 | 3 |
| 24. Draw the onchip LPC2148 internal ADC module and explains its necessary special function registers. | 4 | 3 | 2 | 3 |
| 25. Illustrate the UART data transmission and reception process, explaining how data is transmitted a synchronously and synchronized using start and stop bits. | 4 | 1 | 3 | 3 |
| 26. Explain the concept of internet communication in the context of embedded systems. | 4 | 2 | 4 | 1 |
| 27. Define the echo effect in audio processing and explain its perceptual characteristics. | 4 | 2 | 5 | 4 |

PART – C (5 × 12 = 60 Marks)

Marks BL CO PO

Answer ALL Questions

28. a. Examine and illustrate the architectural design of the ARM core in LPC 1768, providing a detailed explanation of its features. 12 3 1 3

(OR)

- b. Write assembly language program for bitwise logical operations (AND, OR and XOR only)(using ARM processor instruction and its represent in binary mode with 8 bit. Consider at least 3 inputs whose are last six digits of your register number (Ex.103301 means, 10 is first number, 33 is second number and 01 is third number) and executes its output through manual representation. 12 3 1 3
29. a. Describe the process of configuring GPIO pins on the LPC2148 micro-controller for input and output operations. Include the necessary register settings and programming steps required to configure a GPIO pin as an output and toggle its state. 12 3 2 3

(OR)

- b. Write embedded C program to flash LEDs using parallel GPIO ports and explain the pin selection register associated with GPIO ports. 12 3 2 3
30. a. Discuss the architectures of the RTC module in the LPC2148 microcontroller, including its registers and operational modes. 12 2 3 1

(OR)

- b. Define timer. Elucidate its characteristics and explain the architecture of timer in LPC 2148 ARM processor with its associated control and timer/counters register. 12 2 3 1
31. a. Compare and contrast the different wireless communication technologies such as Wi-Fi, Bluetooth and cellular networks interns of range, data rate and application scenarios. 12 3 4 3

(OR)

- b. Discuss the steps involved in making an RPC from the client's request to the server's response, highlighting any necessary marshalling and unmarshalling process. 12 3 4 3
32. a. Define digital signal processing and explain its significance in various fields such as tele-communications, audio processing and image processing. 12 2 5 3

(OR)

- b. Discuss the factors that contribute to achieving high fidelity in digital audio playback such as sampling rate, bit depth, signal to noise ratio and frequency response. 12 3 5 4

* * * * *