KTUPredict practice paper, Set 2. Not an official KTU paper.

PBCST504 Microcontrollers

Practice paper · maximum marks 40

PART A Answer all questions. Each carries 2 marks. (16 marks)

1. Compare Harvard and Von Neumann computer architectures. State why Harvard architecture is preferred in ARM Cortex-M microcontrollers. **2**

2. What is the xPSR (program status register) of a Cortex-M processor and what does it store? Name its condition flags. **2**

3. Mention two low-power modes available in the STM32 microcontroller and briefly explain how each mode achieves reduced power consumption. **2**

4. What is a DAC? Write the STM32 HAL statements to output 1.65 V on channel 1 of a 12-bit DAC with a 3.3 V reference. **2**

5. Define CPOL and CPHA. List the four SPI modes. **2**

6. Differentiate synchronous USART and asynchronous UART modes. Explain the function of hardware flow control lines (RTS and CTS). **2**

7. List any four code or memory optimization techniques used in embedded firmware and state the benefit of each. **2**

8. Contrast LoRaWAN with cellular GSM in terms of range, battery life, data rate, and operating frequency bands. **2**

PART B Answer any one full question from each module. Each question carries 6 marks.

Module 1

9. Explain the structure of an Embedded C program with a neat diagram. **6**

OR

10. Compare the Cortex-M33 processor with previous ARM Cortex-M generations (Cortex-M3 and Cortex-M4). Highlight improvements in security, DSP performance, and bus architecture. **6**

Module 2

11. Explain the architecture and key features of the STM32U575 microcontroller. Discuss how the STM32CubeIDE and HAL libraries simplify peripheral configuration and cross-platform embedded firmware development. **6**

OR

12. Explain how a sine wave can be generated using the DAC of an STM32 microcontroller with a lookup table, and write the HAL code for it. How can the same approach be extended to generate an audio signal? **6**

Module 3

13. Explain the complete byte transfer sequence on an I2C bus including START, 7-bit slave address, R/W bit, ACK/NACK generation, data byte transfer, and STOP condition with timing diagrams. **6**

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14. Explain the write and read operations of an SPI EEPROM, including WREN, status register and the HAL code. **6**

Module 4

15. Explain how an STM32 microcontroller can be interfaced with a GSM module using AT commands to send sensor alert SMS and establish an HTTP connection. **6**

OR

16. Design an IoT-based home automation system using an STM32 microcontroller. Draw the block diagram and explain how the sensors, relays, wireless module and an MQTT broker work together. **6**

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