Electronics System Design – Mid Semester Exam (Feb 2025)

Please note the following:

1. Please attempt any 10 questions from the below set of questions.
2. Each question is for 4 marks. Total exam score is 40 marks
3. Maximum time for exam is 90 minutes

Q1. Draw the approximate internal diagram of a GPIO of the STM32 MCU showing clearly the Input and Output path. Add few lines of explanations

Q2. What is the process of designing an Embedded system. Specify different stages of this design process with suitable examples in the explanation of all the stages.

Q3. State the differences between x86, ARM and RISC-V architectures in a table with minimum 4 points.

Q4. How would you explain the STM32 MCU toolchain and ecosystem. What benefit does it provide for the developers ? Write in bullets explaining them in minimum 3 points.

Q5. How do you define Embedded Systems ? How is it different from a Smartphone ? List minimum 4 differences.

Q6. How would you interface a 7-Segment LED display with internal Common Anode configuration using GPIOs of an MCU ? How would you write numbers 3, 6 on it ?

Q7. How would an Analog watchdog work for STM32 ADC ? Draw the diagram and events associated.

Q8. What is over sampling in ADC. What benefits does it provide for the ADC feature? With changing input signal, how would over-sampling work ?

Q9. What are differences between MCU and MPU. Answer in table with 5 points and add suitable examples.

Q10. You are asked to design a smart-remote controller for Air-conditioner. What would be your design considerations ? Which communication technology would you use to replace the IR interface ? Justify.

Q11. You have to design a digital CCTV surveillance camera to upload the images of 640 pixel by 480 pixel per picture. Consider 2 bytes information per pixel. The frame rate asked by customer is 20 fps for remote monitoring using Smart-phone. Make a block diagram and explain the design blocks with reasoning.

Q12. A General purpose MCU datasheet mentions the following specifications

	Symbol	Min	TYP	Max	Unit
Standard operating voltage	VDD	1.7		3.6	V
User external clock source frequency	F_{HSE_ext}	4	8	48	MHz
Absolute maximum external supply voltage	VDD	-0.3		4.0	V

Consider:

a. Possible 10% error in power supply connected to MCU VDD
b. Consider possible 5% tolerance in XTAL frequency

Designer decides to use this MCU in a circuit with following conditions. What would you comment on the design choices used by designer. Justify with reasons

a. Using external crystal of 44MHz, MCU is powered by 3V supply
b. MCU is powered at 1.8V, connected to external crystal of 8MHz.
c. Using external crystal of 4MHz at 3.7V
d. Using external crystal of 10MHz at 1.8V

Electronics System Design – End Semester Exam (April 2025)

Please note the following:

1. Please attempt 10 questions from the below set of questions.
2. Each question is for 4 marks. Total exam score is for 40 marks.
3. Total time for exam is 120 minutes.

Q1. Draw the System block diagram of the Embedded System made by you in the project ? Please explain different blocks with their interfaces and voltage levels. (CO3, CO4)

Q2. Write down 5 technical challenges you encountered during the development of the project. How did you solve them? Explain with specifics. (CO2, CO4)

Q3. What are the different Clock sources available for STM32G0 ? What is the use of these sources? (CO3)

Q4. What are the decision making factors between the usage of a professional (license paid) or open-source tool chain that a product design engineer has to take. Justify with atleast 4 factors and examples in tabular form. (CO1,CO2)

Q5. Why do we see 32.768kHz XTAL on some of the evaluation boards and embedded designs ? Which applications would need them ? Give examples. Which applications will not require the usage of this XTAL, give examples. (CO1,CO3)

Q6. Draw the UART data packet communication diagram between transmitter and receiver. Explain the bits of the communication packet. Explain with drawing. (CO3)

Q7. While making the prototype for a design, you have picked an Arduino shield which has digital IO devices. While interfacing it to STM32, what kind of challenges you foresee ? Explain with diagram. (CO1, CO2)

Q8. For a Simplex mode communication, what is the difference between differential pair and single ended connection. Which one is better and why ? Draw the diagram. (CO3)

Q9. For reading a serial memory at the required rate of 6Mbps, which kind of communication would you suggest to be implemented while designing digital interface for such a serial memory? Explain with reasons why this interface is better and not others ? (CO3)

Q10. How to connect one master and 3 slave nodes using SPI communication ? Which considerations you will take for such interfacing. Make the diagram as well. (CO3)

Q11. How does CSS: Clock Security System work in STM32 MCU. (CO3)

Q12. While configuring SPI peripheral of the STM32G0 or any other MCU, which all settings would needs to be configured ? (CO3)