

Important Notes:

- This paper contains **FOUR** questions in **THREE** pages.
- Attempt **ALL** questions.
- Total Marks: **60**

Q.1 [18 Marks, 3 each] Underline the false statement, explain why it is wrong and correct it:

1.
 - AVR ALU is directly connected to register file.
 - In Harvard architecture, CPU can read RAM and ROM simultaneously.
 - In sequential processing next instruction is fetched while the current instruction executes.

Correction:

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2.
 - The microprocessor is a microcomputer system in a single chip.
 - The general purpose registers in the ATmega328p are 1 byte wide.
 - ROM address bus of ATmega328p depends on program counter width.

Correction:

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3.
 - Setting all bits of PIND makes all pins of port D as outputs.
 - I2C technique uses only 2 lines to have half duplex data transmission hence called TWI.
 - EPROM memory can be erased using electrical signal.

Correction:

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4.
 - ST is considered one of data transfer instructions.
 - MOV instruction is used in indirect addressing mode.
 - Light emitting diodes are considered low power TTL compatible devices.

Correction:

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5.

- Pin 1 of ATmega328p DIP chip is an active low pin used to reset MCU.
- ATmega328p has 23 digital I/O lines distributed in three ports.
- The first packet in I2C protocol is called error check packet.

Correction:

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6.

- ATmega328p requires a drive circuit to control high power devices such as DC motors.
- ATmega328p has 2 Kbytes of flash memory.
- The internal Vref of ATmega328 ADC is 1.1V.

Correction:

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Q.2 [12 Marks] Using proper diagrams, explain in your own words:

- [6 marks] How Successive Approximation ADC works.
- [6 marks] With SAR ADC resolution of 4-bits, show the steps of converting 4V input into digital number, if reference voltage is 5V.

Q.3 [16 Marks] Write ATmega328 assembly instruction(s) for the following tasks:

- [4 marks] Multiplying the contents of the first two registers of SRAM and saving the result in Y register.
- [6 marks] Setting UART transmission speed at 4800 bps if MCU clock is 16 MHz.
- [6 marks] Generating a PWM signal with 60% duty cycle using Timer2.

Q.4 [14 Marks] Study the UART signals shown in figure (1), and then answer the following:

- [3 marks] What is the proper terms for signal parts A, B and C?
- [6 marks] Using ASCII table shown in figure (2), extract the characters from signals in figure 1 a, b and c knowing that the frame consists of 8 data bits, no parity bit and 2 stop bits. Elaborate your answer.
- [5 marks] Redraw the UART signal to represent the first letter of your name with same configuration as above.

