

EN2532 Robot Design and Competition

Laboratory Sheet-Practical No: 2

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Name:	Team Cosmo	Group No:	06

1) Why PWM modules are not suitable for RC servo pulse generation?

- ☐ a. Selectable 8 bit or 10-bit mode in PWM generation
- ☒ b. Typical hardware PWM generator is 8 or 10 bits say, then we can only use a small fraction of the bits to generate the pulse width we need and so we lose a lot of accuracy
- ☐ c. There are several PWM generators in a microcontroller
- ☐ d. More accurate pulse generation in PWM modules

2) What is the standard servo pulse period?

- ☐ a. Approximately 20us
- ☐ b. Approximately 2ms
- ☐ c. Approximately 1us
- ☒ d. Approximately 20ms

3) Choose the **incorrect** statement.

- ☐ a. The position-sensing mechanism tells the servo what position the shaft currently has
- ☐ b. The control circuitry notes the difference between the desired position and the current position
- ☒ c. A normal RC servo is mechanically capable of turning its shaft farther than 180 degrees
- ☐ d. All RC servos have three connections: power (positive), power (ground or negative), and the controlling signal

4) Error amplifier is

- ☐ a. An operational amplifier with positive feedback
- ☒ b. Always try to minimize the difference between the inverting (negative) and non-inverting (positive) inputs by driving its output to the appropriate direction
- ☐ c. An electronic circuit which converts pulse width signal to voltage signal
- ☐ d. A position sensor

5) If the circuit finds the angle position of the RC servo motor is not correct

- ☐ a. The motor shuts off
- ☐ b. It will turn the motor for 180 degrees

- ☒ c. It will always try to minimize the difference between the inverting (negative) and non-inverting (positive) inputs by driving its output
- ☐ d. It will stop the pulse width to voltage conversion
- 6) If the external oscillator of a microcontroller has a value of 40MHz, then what is the time taken to execute one instruction cycle?
- ☐ a. 10MHz 40MHz if the instruction cycle takes 1 clock cycle.
- ☐ b. 20MHz But if we assume an instruction cycle takes 4 clock cycles, then with a 40MHz
- ☒ c. 40MHz clock, the frequency of executing instruction cycles would be
- ☐ d. 80MHz $40\text{MHz}/4 = 10\text{MHz}$. So, the answer would be a. 10MHz.
- 7) Identify a disadvantage in using the microcontroller in the manner as in the above code to drive a servo motor

The problem with this code is that it makes the servo motor move in a set pattern and doesn't allow the microcontroller to do other things at the same time. It's inflexible because it doesn't respond to changes or events, and it doesn't handle errors or explain how it works very well. And this uses PWM signals to regulate motor position, offering limited real-time responsiveness.

Also the code does not include error handling or safety checks. If the servo encounters an obstacle or reaches its mechanical limits, there is no method in the code to handle these situations.

- 8) Explain a way to circumvent this disadvantage.

We can write code to set registers and make a 50Hz PWM signal. This involves making a triangular wave and a DC signal in two registers. To control the angle, we use the PWM duty cycle, which depends on the DC signal in the register. This helps eliminate code delays.

Also if the servo finds a mechanical limit, it can stop or change direction, preventing damage. And another way to approach is using an error handling block in code.