**DS20613 - Assignment 3**

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**Question-1.** **Which are the PWM pins and the registers of each PWM pins? How can you change the default frequency of PWM pins?**

**PWM Pins**

PWM Pins used in Arduino Uno Board with Atmega 328P Micro-controller are

**Digital I/O pins:** 3, 5, 6, 9, 10, 11

Pins 3,9,10,11 uses 490 Hz whereas Pins 5 and 6 uses 980 Hz.

**Registers associated with PWM:**

Digital I/O PWM pins: 5 and 6 – **Timer 0 Registers (**TCCR0A/B, OCR0A/B**)**

Digital I/O PWM pins: 9 and 10 – **Timer 1 Registers (**TCCR1A/B/C, OCR1AH/BL, ICR1**)**

Digital I/O PWM pins: 3 and 11 – **Timer 2 Registers (**TCCR2A/B, OCR2A/B**)**

**Controlling the Frequency of PWM**

One can control the frequency of PWM by using different clock source. Once the clock source is fixed, different modes available in ATMEGA328P can be used to fine-tune the frequency of PWM. Setting the Pre-scaler bits (CS02, CS01 and CS00) of TCCRnB to higher or lower pre-scaler values (0,8,64,256,1024) can be used to control the clock source. OCRnA/B register can be used to control the duty cycle.

The following are the five modes of PWM operation which can be switched by assigning the bits (WGMn2:0) associated Timer Register [ TCCRnA (WGM01 WGM00) and TCCRnB (WGM02) ].

**- Normal Mode (**WGMn2:0 = 0**) 🡪 Default mode**

**- Fast PWM Mode (**WGMn2:0 = 3 or 7**)**

**- Phase Correct PWM Mode (**WGMn2:0 = 1 or 5**)**

**- Clear Timer on Compare Match (CTC) Mode (**WGMn2:0 = 2**)**

**- Phase and Frequency Correct PWM Mode (**Timer-1 alone - WGM13:0 = 8 or 9**)**