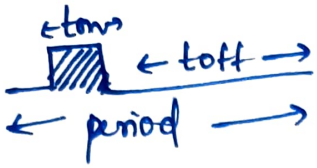
Pulse Width Modulation (PWM)



∴ To vary the duty cycle $\left(\frac{T_{ON}}{T_{ON}+T_{OFF}}\right)$ by varying the ton period after the given clock cycles.

Code:-

```
timescale 1ns/1ps
module pwm (input clk, rst, output reg dout);
 parameter period = 100;      // Taking 100 as the total period of o/p (dout).
 integer count = 0;           // To maintain the pulse width store
 integer ton = 0;             // To the value of on time.
 reg nc = 1'b0;               // To show there via new cycle after 100 units period to vary the pulse width
 reg key = 1'b0;              // To adjust the the pulse width to go fall back reverse after completion of man ton time.
always @(posedge clk) begin
    if(rst == 1'b1) begin     // To maintain the reset conditions.
        count <= 0;
        ton <= 0;
        nc <= 1'b0;
    end
```

```
else begin
    if(count < = ton)
        begin
        count <= count+1;
        dout <= 1'b1;
        nc <= 1'b0;
    end
    else if (count < period) begin
        count <= count+1;
        dout <= 1'b0;
        nc <= 1'b0;
    end
    else
    begin
        nc <= 1'b1;
        count <= 0;
    end
end
end
always @(posedge clk) begin
    if (rst == 1'b0) begin
        if (nc == 1'b1)
        begin
            if (key == 1'b1 && ton == 0) begin
                key <= 0;
                ton <= 0;
            end
        end
```

// To maintain the ton time of the dout pin.

// To maintain the toff time of the dout pin

// After the completion of 1 cycle to vary the ton time we maintain a variable

maintaining the conditions only if not reset & then is new cycle.

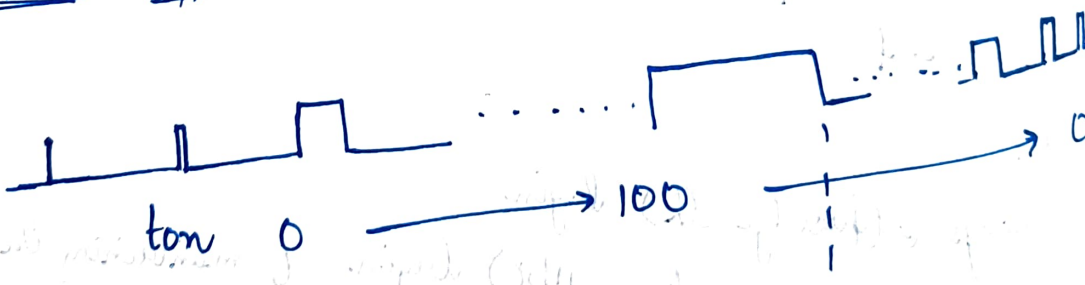
this indicates the conditions when dout completes 0 → 100 & 100 → 0 transition.

```
else if (key == 0 && ton < period) begin
        key <= 0;
        ton <= ton + 5;
    end
    else begin
        key <= 1;
        ton = ton - 5;
    end
  end
end
end
endmodule
```

// This happens when the key value is 0 where we are moving forward by increasing ton value by increasing +5.

// This is the case where we reached 100 & we are traversing back to again 0 ton period where are reversing back.

Required o/p :-



∴ This is how we want to vary the pulse width of the system as per our count & varying value. Here its (100 & 5 for period & increasing scale respectively.

- Basic usage : ~~Blink~~ • Brightness of LED.
  - Used in motors by varying the vo
- For the main cause of power optimization.