

## Experiment - 7

Aim: To study time response of PD, PT & PID controllers

Apparatus: Oven heater, stop watch, PID controller kit.

Theory: PID controller has three adjustable parameters as PID each has three potentiometers with dial knobs which are subdivided for 0.5 resolution switch provided to add or cut mode.

The process: It is an oven housed in painted mould in which resistive heater heat up a small piece of alumina.

The Controller: PD controller provided in the set up have three separate control knobs for each parameter. P for proportional gain, I for Integral gain and D for derivative gain.

The Controller has an operating range between 1 to 9, while at minimum position it is referred as '0' & at max as 10.

The P Controller: The total proportional gain of Controller is between 0-20, thus each major gradient is equal to gain of 2. In other words, each major gradient should be multiplied by a factor of 2 to obtain proportional gain.

The 'I' Controller: It is slightly different from the P & D Controller. This control has minimum value equal to 0.8 s' and more 215'

The 'D' Controller: It is similar dial has linear response b/w 0-5s. The major gradients has multiply factor equal to 0.5s value.

The Indicator: The temperature is shown by a  $3\frac{1}{2}$ , digit digital display which is calibrated in degree Centigrade.

Equation for PID controller.

$$m(t) = 1 + K_p e(t) + K_i K_i \int e(t) dt + K_p K_d \frac{de(t)}{dt}$$

where  $e(t)$  = error signal  
 $m(t)$  is PID of O/P.  
 $K_p$  is proportional signal  
 $K_i$  is integral gain  
 $K_p$  is derivate gain

In Laplace domain

$$m(s) = K_p E(s) + \frac{K_i}{s} E(s) + s K_d E(s)$$

Time	Temp.		
	PD	PID	PI
10	31.2	30.7	31.4
20	31.7	31.3	30.7
30	31.4	31.1	30.1
40	31.0	30.7	30.0
50	30.5	30.2	31.4
60	30.1	30.6	31.3
70	30.2	30.7	30.9
80	30.0	30.3	30.3
90	29.7	29.8	29.8
100	29.4	29.2	31.2
110	29.3	29.7	30.8
120	29.2	30.3	30.4
150	29.1	29.8	31
200		30.1	30.8
210		29.6	31.1
220		29.6	31.3
250		30.2	30.0
270		30	30.7
300		29.8	29.6
310		30.1	31.1
320		30.3	31.2
330		30.0	30.9
370			30.7
380			30.2
380			30.2
400			29.5