Consider SISO process with $G_p = \frac{2}{(2D+1)(D-1)}$

(a) Is it open loop stable or unstable. Justify 3

(b) What is the range of P controller gain for which closed loop process is stable. Justify 5

(c) Can a PD controller stabilize the process. If yes, what is the range of τ_D for which closed loop process can be stabilized. 12

(d) A PID controller is used with τ_I chosen to cancel the stable open loop pole. What is the range of τ_D for which the closed loop process can be stabilized. 12

(e) $\tau_D = \frac{1}{2}\tau_D^{critical}$ in part (d) is used, Obtain K_c for sustained oscillations 8

$$G_c^{PID} = K_c \frac{\tau_I D + 1}{\tau_I D} \frac{\tau_D D + 1}{0.1\tau_D D + 1}$$