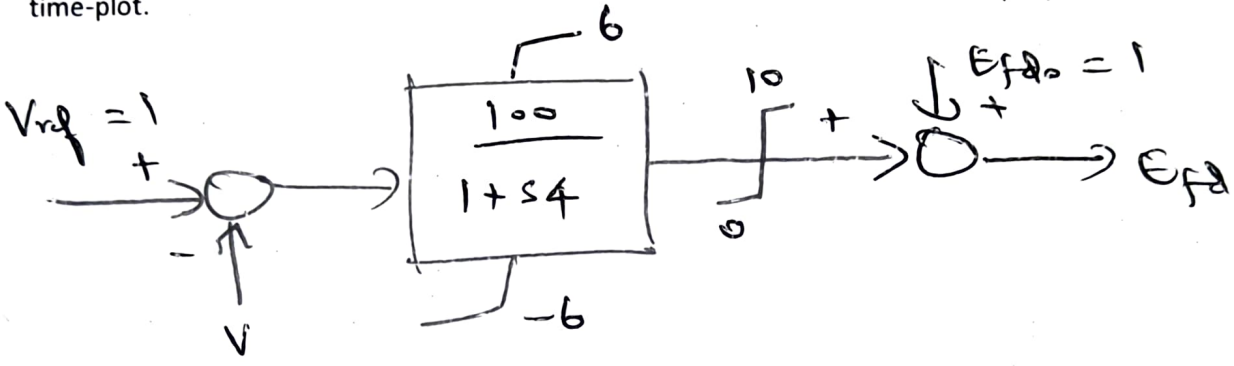
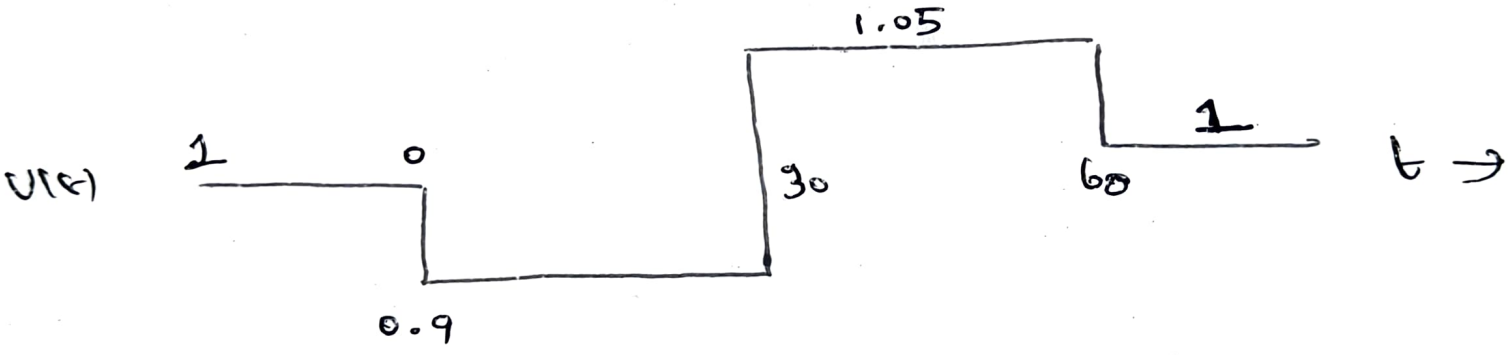
EE523 Power System Stability and Control

Midterm Examination

1) Consider the AVR control below. Plot the E_{fd} output for the given voltage input as shown. Clearly mark and explain all the significant time-instants where the response changes in your time-plot. (25 points)





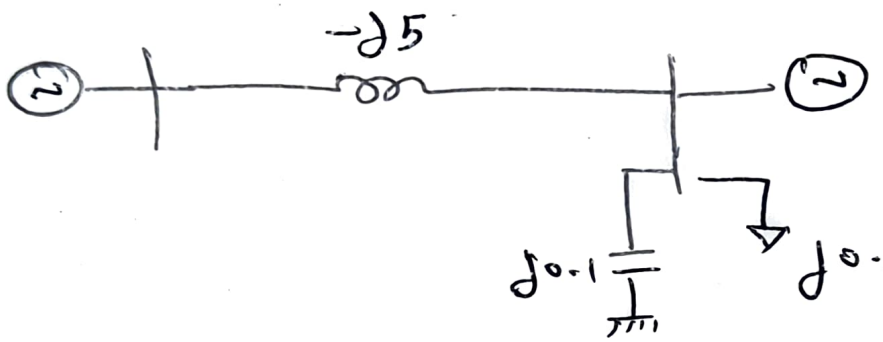
2) a) Draw the architecture diagram showing how AGC is implemented in the power grid. (5 points)

b) Derive the state space swing equations model from Newton's equations stating all the definitions, the steps and the assumptions made. (5 points)

3) Consider the two machine power system below.

a) Find the power-flow solution. (5 points)

b) Derive the classical machine model for the power system. (20 points)



$P_{G2} = 1.0$

$V_2 = 1.05$

$x_d' = 0.3$

$x_q' = 0.2$

$x_d = 1.2$

$x_q = 1.2$

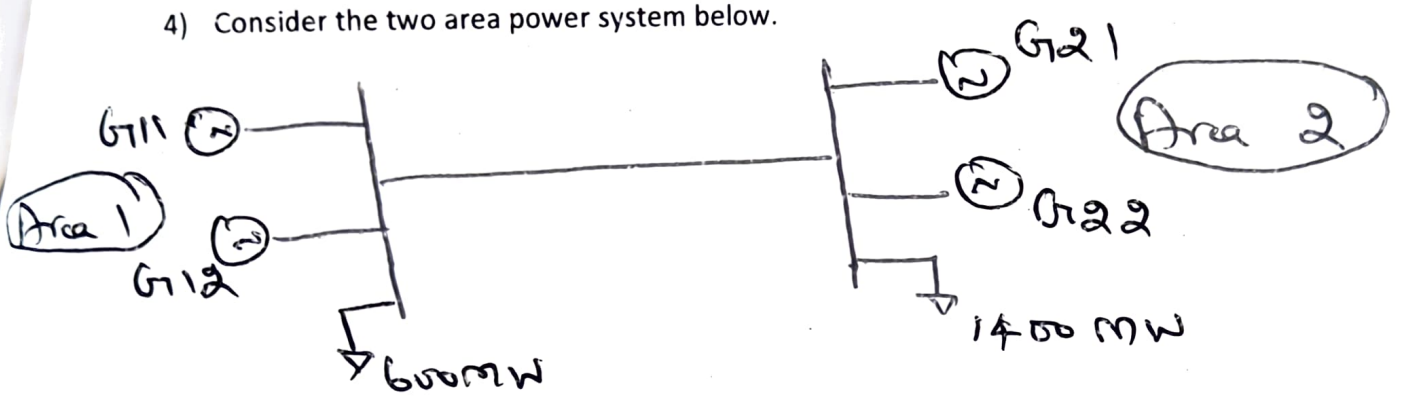
$H = 5$ sec.

$k_D = 1$ pu

$T_{do}' = 10$

$T_{qo}' = 4$

4) Consider the two area power system below.



Generator	Capacity (MVA)	Schedule (MW)	Droop (%)
G11 (Slack)	1000	600	5
G12	1000	400	10
G21 (Slack)	800	500	4
G22	500	500	10

a) Suddenly Area 1 load changes to 500 MW while Area 2 load increases to 1600 MW. Find the steady-state values of governor responses and AGC responses. Plot the time-plots of generator schedules, generator outputs and the system frequency showing different time-scales involved in the response. (25 points)

b) Assume that AGC is only working in Area 1 and not in Area 2. Repeat Part a). (15 points)