4 (a) What are the basic differences between angle and voltage stability? [5]

(b) Describe briefly various types of oscillatory stability in the context of small signal stability is power systems? [5]

(c) The model of a single machine and infinite bus (SMIB) is given by

$$\frac{d\delta}{dt} = (\omega - \omega_s) \quad (4.1)$$

$$M\frac{d\omega}{dt} = P_{mech} - P_{\max}\sin\delta - K_D(\omega - \omega_s) \quad (4.2)$$

Using P_{mech} as input and ω as output, obtain a linear state-space model in the standard form $\dot{X} = AX + Bu$ and $y = CX + Du$. Write down the expression for *A, B,C* and *D* [10]

5 (a) Write short notes on any four of the following:

(i)	Damper winding	[5]
(ii)	Inter-area oscillations	[5]
(iii)	Eigen-value sensitivities in small signal stability	[5]
(iv)	FACTS controllers	[5]
(v)	Effect of Automatic Voltage Regulator (AVR) on power system stability	[5]
(vi)	Midterm and long term stability	[5]

6 (a) Describe the importance of power system stabilizer (PSS) in small signal stability performance of the system. What are the commonly used input signals to PSS? [8]

(b) What is governor droop in turbine speed control? Why is it so important to have a large droop setting for governor in hydraulic turbine?. [5]

(c) Fig 6.1 shows the block diagram of a turbine speed control system. The values of T_W, T_M and K_D are 2.0, 10.0 and 0.0 respectively. Write down the closed-loop transfer function and identify the range of R that ensures closed-loop stability. [7]

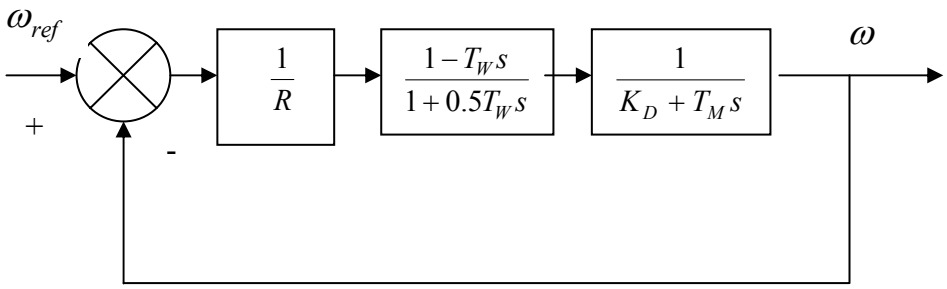

Fig 6.1