**Assignment 1: Synchronous Generator Modeling and Simulation Using MATLAB/SIMULINK**

**Introduction:** The synchronous generator is the heart of the power system and it pumps continuously active and reactive power whenever it is needed to the power network. To understand the operation and visualised its steady-state and transient responses we use MATLAB/SIMULINK package. Investigations include small signal and big disturbance effects on the operation of synchronous generator. The MATLAB would help us to design efficient controllers for the excitation system and the speed governing system so that it remains stable for the purpose of good power security and system reliability.

**Objectives:**

* Derive a seventh order state-space currents model.
* Use the MATLAB to find:

1. Eigen values
2. Transfer function
3. Step response

* Use MATLAB to simulate the step time response of the system for the two inputs.
* Use the SIMULINK to test a step response of Field excitation voltage in open loop mode using the transfer function.
* Use the SIMULINK to test a step response of mechanical torque in open loop mode using the transfer function.
* Design a PID controller that can get optimum time response of the load angle (overshoot <5%, steady-state error<2%)

**Resources:**

* Usethe parameters of the example 4.1 in page 97 of the attached Ebook: <file:///C:/Users/44770/Downloads/Power_Systems_Control_and_Stability_2nd%20(1).pdf>
* In MATLAB command Window type the matrices A, B, C, D as follows:

A=[a11…a1n;a21 …..a2n;…….; an1………ann];

B=[b11….b1n; b21…..b2n;…..;bn1……..bnn];

C=[c11…..c1n; ……..;cn1………..cnn];

D=0;

U=[…..Vf………Tm.];

Sys=ss(A,B,C,D); % this is the state-space model

Step(Sys) % this will show the step response of the system

Eig(A) % this will produce the eigen values of the system

[b,a]=ss2tf(A,B,C,D) % this will give transfer function of the system where b are the coefficients of the numerator and a are the coefficients of the denominator.