# M.E. 2nd Semester (EE) Final Examination, April, 2013
## Subject : Dynamics of Regulated Machines
## (EE-1010)

Time : 3 hours

Full Marks : 70

Answer any ***Five*** questions.
The questions are of equal value.

1. What are the reasons of dynamic oscillations in a regulated machine?
What are the nature of oscillations in a power network connected to regulated machine?
How modal analysis is used to study these oscillations? Establish analytically. [14]

2. Justify how the phase and amplitude of oscillation in a regulated machine can be determined by eigen vector analysis?
What is the role of participation factor ? [14]

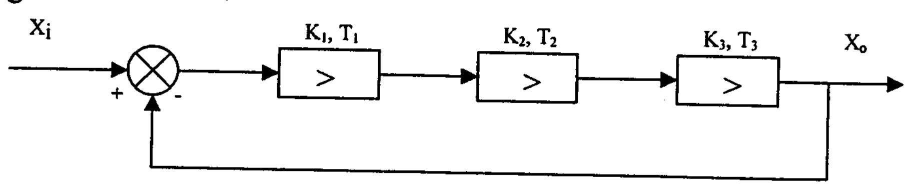
3(a) Deduce the expression for degenerated and auxiliary equations of a system having N aperiodic links of which n links are enclosed by a stabilizing link of transfer function $[T_{N+1}p/(1+T_{N+1}p)]$. What are the conditions for stability when, $(N_2 - N_1) = n$, and the values n are given as:

(i) $n = 1$
(ii) $n = 2$
(iii) $n = 3$

where, $N_1$ is the degree of the polynomial of degenerated equation and $N_2$ is the degree of the polynomial of auxiliary equation. [8+3x2]

4(a) State and explain Vyshnegradskii method for the stability studies of a system. [8]

(b) A dynamic system is represented by three aperiodic links and are enclosed by a unity feedback system as shown in Fig.1. Investigate the stability of the system by Vyshnegradskii method. [6]




Q.2(b) : Fig.-1

5(a) Find the overall transfer function of an Amplidyne and an armature controlled d.c. motor with field excitation current kept constant.
(b) Describe the Routh-Hurwitz stability criterion in detail to find out the conditions of stability starting from first order to fifth order polynomials. [7+7]

6(a) In the structural diagram of a closed loop automatic control system, the basic elements are represented by three series connected aperiodic links. The data of the individual links is as follows:

| | |
|---|---|
| $T_1 = 0.01$ | $K_1 = 40$ |
| $T_2 = 0.34$ | $K_2 = 1$ |
| $T_3 = 0.1$ | $K_3 = 15$ |

Check the stability of the system.

A flexible negative feedback network having a transfer function of the type $\tau P/(1+\tau P)$ be connected in two different ways

(i) When the stabilizing feedback network encloses the first two links.

(ii) When the stabilizing feedback network encloses only the first link.

Check the stability of the system in both the cases with $\tau=0.5$. [7+7]

7(a) Expain in detail and develop the equations of the individual elements to draw the structural diagram of the speed regulating system of a d.c.motor. Check the stability of the system with its parameters having the following values:

| | |
|---|---|
| $T_1 = 0.1$ Sec | $T_2 = 0.1$ Sec |
| $T_3 = 0.5$ Sec | $T_4 = 0.01$ Sec |

The overall gain of the system $K_{av} = 800$

(b) Select frequency plot $\Phi(jw)$ of a closed-loop system. Determine the transient response x(t) for the disturbance f(t), when f(t) is vanishing type. [8+6]