Code No: C0708 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I SEMESTER EXAMINATIONS, APRIL/MAY-2012
ADVANCED CONTROL SYSTEMS
(ELECTRIACAL POWER SYSTEMS)

Time: 3hours **Max.Marks:60**

Answer any five questions
All questions carry equal marks

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1. A unity feed back system is characterized by the open loop transfer function G(s)=K/s(s+3)(s+9)
   (a) Determine the value of K if 20% overshoot to a step input is desired
   (b) For the above value of K determine the settling time and K_v.
   (c) Design a cascade compensator that will give approximately 15% overshoot to a step input, while settling time decreased by a factor of 2.5 and $K_v \geq 20$.

2. A unity feed back system has an open loop transfer function G(s)=K/s(0.1s+1)(0.2s+1), Design a phase lag –lead compensation to achieve the following specifications.
   Velocity error constant $K_v = 30$
   Phase margin $\geq 50^o$
   Band width = 12 rad/sec

3. Explain how to find second order eigen value sensitivities with an example.

4. Explain the distinct eigen values and confluent eigen values associated with single Jordan block.

5. Explain the procedure of how to draw phase trajectories using delta method and draw the phase trajectories of the following system;
   $$\ddot{x} + 4 | \dot{x} | \dot{x} + 4x = 0$$

6.a) Write the Lyapunov theorem for linear systems.
   b) Consider the non linear system described by equation.
   $$\dot{x}_1 = -3x_1 + x_2$$
   $$\dot{x}_2 = x_1 - x_2 - x_2^3$$
   Investigate the stability using Krasovski's method (P is identity matrix).

7.a) Explain common physical non linearities.
   b) What are P,I&D controllers and how they affect on system response.

8. Write short notes on
   a) Describing function method.
   b) Observability structure of multi variable linear systems.

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