Code No: D3706, D7504 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH II - SEMESTER EXAMINATIONS, APRIL/MAY 2012
CONTROL SYSTEM DESIGN
(COMMON TO CONTROL ENGINEERING, CONTROL SYSTEMS)

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

Answer any five questions
All questions carry equal marks

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1.a) Explain the Syrvester's theorem.

b) Using the polynomial placement technique synthesize a controller so as to obtain zero steady state errors for constant disturbances for a plant modeled as

$$G_0(s) = \frac{2}{(s+1)(s+3)}$$

2.a) What are the various limitations in SISO control? How do you avoid actuator saturation?

b) How does Internal Model Principle (IMP) provide complete disturbance compensation and reference tracking in steady state?

3.a) What is wind up in PI controllers? How is protection provided against wind up?

b) What is open loop inversion? How is it useful in control design problems?

4. What are the various design considerations in controller design? Investigate the issue of non minimum phase zeros in closed loop stability.

5. What is decentralized architecture? Discuss briefly the application of the relative gain array method pairing of inputs and outputs in an MIMO system.

6.a) Discuss the concept of feed forward action in decentralized control.

b) Suppose a plant having the following nominal model is given:

$$G_0(s) = \begin{bmatrix} \frac{2e-0.5t}{s^2+3s+2} & 0 \\ \frac{0.5}{(s+1)(\beta s+1)} & \frac{6}{s^2+5s+6} \end{bmatrix}$$

Design SISO PI controller for the 2x2 diagonal term.

7. Consider a quadratic cost function

$J = (T - \Omega U)^T (T - \Omega U)$

Where T and U are vectors and Ω is some NxM matrix. Show that minimum of J is obtained by

$$U = (\Omega^T \Omega)^{-1} \Omega^T T$$

Consider U to be unconstrained.

8. How do you modify MIMO problems so that decentralized control becomes a more attractive option? Discuss this issue in detail.

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