FACULTY OF ELECTRICAL & COMPUTER ENGINEERING

Assignment III

Course: **Modern Control Systems** Deadline: **Feb 06, 2020 @08:00AM** Max Pts.: **5%**

***Note**: - This is a group assignment and each group should be made up of **no more than 5** students.*
- *All students in a group should participate in the assignment work.*
- *Any late submissions will not be accepted.*

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1. For the given system in transfer function,

$$G(s) = \frac{7}{s(s+9)(s+12)}$$

Represent the system in Phase variable and in Cascade form, and also draw the corresponding signal-flow graph for each. **[3 pts]**

2. Using the system given above (in Question. 1), design a controller to yield a closed-loop response of (***choose between 5 - 15%***) overshoot and a peak time of (***choose between 0.1 - 0.3***) second. Place the third pole 10 times as far from the imaginary axis as the second-order dominant pair. Design the controller by:
   - transforming the plant to controller canonical form,
   - evaluating the controllability of the system, and
   - draw a signal-flow graph of the plant, as well as for the plant with state-variable feedback controller.

   [7 pts]

3. Assume that the state variables of the plant in Question 2 are not accessible and design an observer to estimate the states. The desired transient response for the observer is overshoot as the controller, but its natural frequency is **10** times as great as the system response of the designed controller. As in the case of the controller, place the third pole 10 times as far from the imaginary axis as the observer's dominant second-order pair. Design the observer by:
   - transforming the plant to observer canonical form,
   - evaluate the observability of the system, and
   - draw the signal-flow graph of the estimated plant (observer). **[5 pts]**

Good Luck!!!