Potential Questions for Exam I — 330:406

(Last update: March 2, 1998)

(Exam time: Th 9:50–11:10, March 12, 1998)

1) Define the gain and phase stability margins and the gain and phase crossover frequencies by using the Nyquist plot. (GL96, pages 206–207).

2) Define the system transient response parameters and explain the procedure for finding these parameters. (GL96, Sections 6.1 and 6.2, pages 262–269).

3) Explain the importance of system dominant poles for finding the transient response parameters of high-order systems. (GL96, Section 6.3, pages 269–272).

4) Define and derive steady state response errors for linear feedback control systems (GL96, Section 6.4, pages 276–281).

5) Explain the essence of the root locus technique. (GL96, Section 7.1, pages 291–296).

6) Define the minimum phase linear systems and explain why the nonminimum phase systems should be treated with a special care (GL96, page 317).

7) Explain the effect of a stable dipole on the root locus and the system transient response (GL96, pages 343–345).

8) Present design algorithms for PI and phase-lag controllers based on the root locus technique and comment on their main features (GL96, pages 345–352).

9) Present design algorithms for PD and plase-lead controllers based on the root locus technique and comment on their main features (GL96, pages 353–363).

10) Present design algorithms based on the root locus technique for PID and phase-lead-lag controllers and comment on their main features (GL96, pages 364–369).

11) Show how to read from Bode diagrams the phase and gain margins, phase and gain crossover frequencies, and steady state constants (GL96, pages 392–398).

12) Describe the phase-lead controller design algorithm based on Bode diagrams (GL96, page 405, Algorithm 9.1).

13) Describe the phase-lag controller design algorithm based on Bode diagrams (GL96, pages 410–411, Algorithm 9.2).

14) Describe the pole placement design technique for linear control systems represented in phase variable canonical form (GL96, pages 333–335).

15) Explain the full-order observer design technique and draw the corresponding block diagram. Give the observer equations, the equation for the observation error, and explain a rational choice for observer poles. (GL96, pages 241–243).

16) Explain and justify the separation principle in the context of the observer design problem. (GL96, pages 243–244).

17) Present full-order observer design for discrete-time systems (class notes).

18) Present the essence of the reduced-order observer design (GL96, pages 244–247)

19) For a continuous-time linear stochastic system driven by a zero-mean stationary Gaussian stochastic white noise process derive the expression for the state mean. Define the state variance and write the state variance equation (GL96, pages 437–439).

20) Derive the variance equation for a discrete-time linear system driven by white noise (GL96, pages 439–440 and class notes).

21) Formulate the Kalman filtering problem, present its solution and draw the corresponding block diagram. (GL96, pages 444–447).