Electrical

College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra)

End-Semester Examination

EE402 – Control Systems-II

Year: - Final Year B. Tech
Academic Year: 2012-13
Time: 2.00 PM – 5.00 PM

Branch: Electrical
Date: **23-11-2012**
Max. Marks: - 50

Instructions:

1. All Questions are Compulsory.
2. Figures to the **RIGHT** indicate **FULL** marks.
3. Make suitable assumptions, if necessary and state the same.
4. Use of non-programmable pocket calculator is allowed.

Q.1 For the unity feedback system given by ---------- (08)

Design Phase-LEAD compensator to meet the following specification

1. Settling time ≤ 4sec
2. Peak over shoot for step input ≤ 25%

Draw root locus of compensated and uncompensated system

Q.2 Design Phase-LEAD compensator via ***FREQUENCY RESPONSE*** for the system with open loop transfer function given by ---------- (08)

$$G(s) = \frac{K}{S(S+2)}$$

The system is to be compensated to meet the following specifications:

1. Steady state error ≤ 5% for ramp input.
2. Phase margin >45°

Draw the bode diagram for uncompensated and compensated system.

Q.3 A nonlinear system shown in Fig. 3 with,

$$G(s)=\frac{K}{s(5s+1)(10s+1)}$$

1) Find the describing function of the nonlinearity.

2) Determine the system's stability.

3) Determine K and oscilation frequency ω when self-oscilation amplitude is $X=\frac{1}{\pi}$.

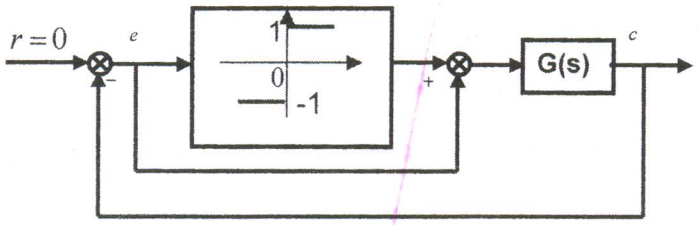

Fig.3

---------- (10)

Q.4

a) Using power series method to find inverse Z transform of the following function ---------- (06)

$$G(z)=\frac{z^3+2z^2+1}{z^3-1.5z^2+0.5z}$$

b) Derive State space representation of discrete time system represented by

G (z) =U (z)/E (z) =K (z+1)/ (z²-1) ---------- (06)

Q.5

a) Explain Zero Order Hold. Write the transfer function of ZOH and draw its frequency response. ---------- (06)

b) For a discrete -time system whose characteristic equation is given by

$$1+KG(z)=1+(\frac{0.368z+0.264}{z^2-1.368z+0.368})K$$

Applying Jury's test for stability of discrete time system, find K such that system is stable. ---------- (06)