



SF-7765

B. E. - IV (Sem. - VIII) (Electrical) Examination

May / June - 2011

Advance Control System

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दशांशिक निशानीवाणी विगतो उत्तरवडी पर अवश्य लपवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. - 4 (SEM. - 8) (ELECTRICAL)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="ADVANCE CONTROL SYSTEM"/>	<input type="text"/>
Subject Code No. : <input type="text" value="7"/> <input type="text" value="7"/> <input type="text" value="6"/> <input type="text" value="5"/>	Section No. (1, 2,.....): <input type="text" value="1&2"/>
Student's Signature	

- (2) Attempt **all** questions.
- (3) Assume necessary data and give sketches whenever necessary.
- (4) Extreme **right** figures indicate full marks of the questions.
- (5) Answer to the two sections must be written in separate answer books.
- (6) Scientific calculator upto casio-100D, 100MS series is permitted.

SECTION - I

- 1 (a) Attempt the following :
 - (i) Define Nonlinear system. 1
 - (ii) The describing function is defined as the ratio of amplitude and phase angle between the fundamental components of output and input sinusoidal. (True/False) 1
 - (iii) What do you mean by international nonlinearity. Give one example if any. 1
 - (iv) Give the classification of nonlinearity. 1
 - (v) Draw the o/p waveform for the relay with saturation and deadzone non linearity. 1
 - (vi) The i/p of the nonlinear system is always sinusoidal. (True/False) 1

- (vii) The jump resonance phenomenon exists in both linear and non linear system (True/False) 1
- (viii) Write the limitation of D.F. 1
- (ix) Define dual input describing function. 1
- (x) Define phase portrait. 1
- (b) Obtain the D.F. for the relay with hysteresis non linearity shown in figure 1. 10

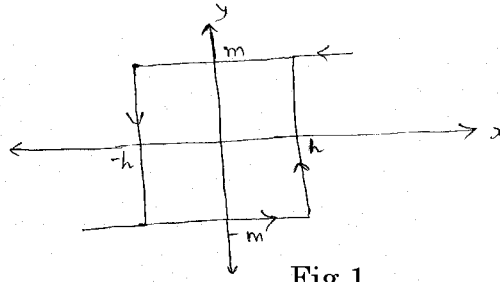


Fig.1

- 2 The unity feedback non linear control system has a ideal relay type non linearity with linear block as shown in figure 2.
- (i) Obtain the D.F. for the non linearity 10
 - (ii) Plot the locus of $\frac{-1}{N(E)}$ 3
 - (iii) Examine for the limit cycle and determine the amplitude and frequency of the limit cycle if any. 2

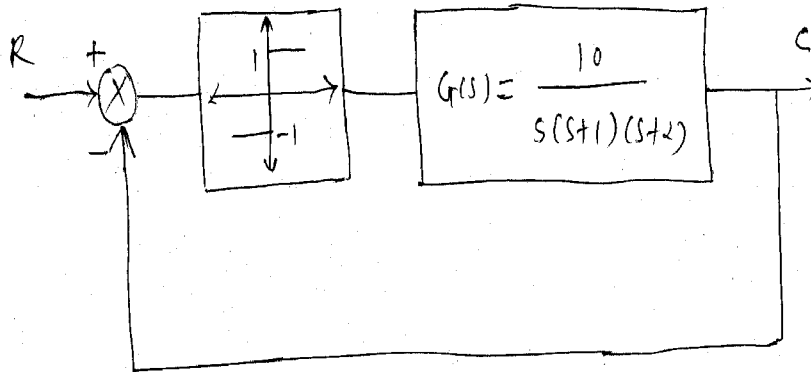


Fig.2

OR

- 2 The unity feedback control system has a ideal relay type non linearity with linear block as shown in figure 3.
- (i) Obtain the D.F. for the non linearity. 10
 - (ii) Plot the locus of $\frac{-1}{N(E)}$ 3

- (iii) Examine for the limit cycle and determine the amplitude and frequency of the limit cycle if any. 2

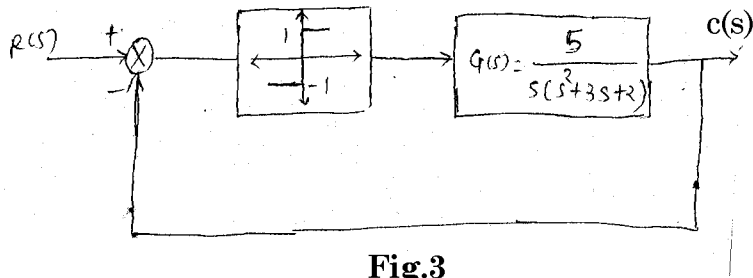


Fig.3

- 3 (a) Explain Jump Resonance. 5
 (b) Draw the phase plane trajectories for the system $\ddot{x} + 0.5 \dot{x} + 0.2 x^2 = 0$ using Pell's method and starting at the point $X(0) = 5$ and $\dot{x}(0) = 2$.

OR

- 3 (a) Explain the delta method for the construction of phase plane trajectories. 5
 (b) Draw the phase plane trajectory of the system shown in figure 4 by using Isocline method. 10

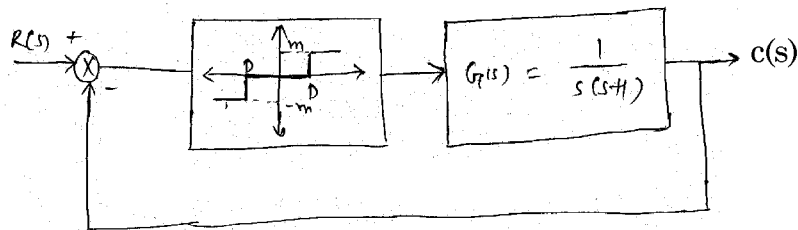


Fig.4

SECTION - II

- 4 (a) Obtain z transform of the following functions : 6
 (i) $x(s) = \frac{1}{s(s+1)}$
 (ii) $x(t) = e^{-at} \cos \omega t$
 (b) Using partial fraction expression method obtain the inverse z transform 6

(i) $x(z) = \frac{z+1}{(z-1)^2(z-2)}$

- (c) State and prove initial value theorem. Determine the initial value $x(0)$ if z-transform of $x(t)$ is given by 6

$$x(z) = \frac{z^{-1}}{(1-z^{-1})(1+1.3z^{-1}+0.4z^{-2})}$$

- 5 (a) Consider the difference equation 8

$$x(k+2) = x(k+1) + x(k)$$

$$x(0) = 0 \quad \text{and} \quad x(1) = 1$$

Obtain the general solution $x(k)$ in closed form show that the limiting value of $\frac{x(k+1)}{x(k)}$ as k approaches infinity is $\frac{(1+\sqrt{5})}{2}$ or approx 1.6180.

- (b) Construct the jury stability table for the following characteristics equation 8

$$p(z) = z^4 - 1.2z^3 + 0.07z^2 + 0.3z - 0.08 = 0$$

Check the stability of the system.

OR

- 5 (a) Discuss the mapping of s-plane into z plane and hence show the constant frequency and constant damping root loci. 10

- (b) Obtain the pulse transfer function for system shown in fig.1 6

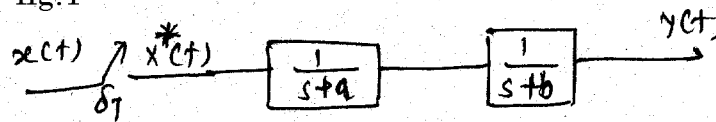


Fig.1

- 6 Attempt any two : 16

- (a) Define static error constants and also find static error constants and hence the steady state error for system in fig. 2 consider unit input of standard test signals.

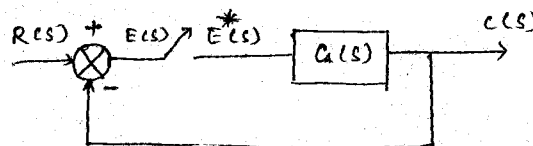


Fig.2

- (b) Define fixed end point variational problem and derive Euler lagrange equation for optimizing performance index (P1).
- (c) Write the steps for drawing a root locus for the discrete time control system.