Reg. No. : | | | | | | | | | | |

Question Paper Code: 35063

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fifth Semester

Instrumentation and Control Engineering

01UIC503 – ADVANCED CONTROL SYSTEM

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. State the condition for controllability by Gilbert's method.
2. Write the state model of LTI system.
3. How the non-linearity is classified? Give examples.
4. How are calculated, when the Eigen vectors values are distinct?
5. Define describing function.
6. Define limit cycles.
7. Classify scalar functions.
8. Give the general state equation for a nonlinear system.
9. Write down the linear continuous-time state equation.
10. Define optimal control.

PART - B (5 x 16 = 80 Marks)

11. (a) Obtain the three canonical state model of the system whose transfer function is given as $\frac{Y(s)}{U(s)} = \frac{10}{s^3+4s^2+2s+1}$ (16)

Or

(b) Obtain the time response of the following system $\begin{bmatrix}\dot{x_1}\\ \dot{x_2}\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$ where *u(t)* is unit-step function occurring at *t*=0. (16)

12. (a) Draw and explain the construction of phase trajectories by using delta method. (16)

Or

(b) A linear second order servo is described by the equation $\ddot{e} + 2\zeta\omega_n\dot{e} + \omega_n^2 e = 0$ Where $\zeta = 0.15$, ω_n = 1 *rad/sec*, *e(0)* 1.5 and $\dot{e}$ (0) = 0 Determine the singular point. Construct the phase trajectory, using the method of isoclines. (16)

13. (a) The response of a system is $y = ax + b\frac{dx}{dt}$ test whether the system is linear or nonlinear. (16)

Or

(b) Derive the describing function for a system with saturation nonlinearity. (16)

14. (a) Consider the dynamics of the system represented by $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -1 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ Formulate the liapunov function to test the asymptotic stability of the system. (16)

Or

(b) Describe Popov's criterion for stability analysis. (16)

15. (a) A first-order system is described by the differential equation $\dot{x}(t) = 2x(t) + u(t)$ It is desired to find the control law that minimizes the performance index. (16)

Or

(b) Derive an iterative method for solving reduced matrix riccati equation. (16)

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