

Code: 9A13601

R09

B.Tech III Year II Semester (R09) Supplementary Examinations December/January 2015/2016

ADVANCED CONTROL SYSTEMS

(Electronics & Control Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 State the basic theorem for determining the concept of controllability of time varying system utilizing state transition matrix. Explain the same with proof.
- 2 (a) Derive the controllability condition of LTI system, show that the controllability and observability conditions are dual to each other.
(b) Explain the principle of duality exists between controllability and observability.
- 3 (a) What is a non-linear system? What are the different types of nonlinearities?
(b) Obtain the describing function of a dead – zone and hysteresis.
- 4 (a) Define singular point. Draw the phase trajectory for different Eigen values and singular points.
(b) The equation of motion of a simple pendulum is: $\ddot{x} + (g/l) \sin x = 0$. Draw the phase trajectory.
- 5 (a) Explain Lyapunov's stability and instability theorems.
(b) Find a Lyapunov function for the following:
$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & 1 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$
- 6 Explain the design procedure of a state feedback controller through pole placement.
- 7 Derive the Euler equation for the fixed end point by using calculus of variation.
- 8 (a) Explain what is meant by optimal control of a system.
(b) Discuss the factors to be considered in the design of an optimal controller.
