

Code No: **R42022****R10****Set No. 1****IV B.Tech II Semester Supplementary Examinations, April - 2018****ADVANCED CONTROL SYSTEMS****(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 75****Answer any FIVE Questions**
All Questions carry equal marks

- 1 a) Show that the solution to the homogenous state equation $\dot{x}(t) = Ax(t)$ is unique. [8]
b) State equation of a control system is given by
$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -5 & 7 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$
Obtain the state transition matrix. [7]
- 2 a) Write the observability tests for continuous time invariant systems? [7]
b) Consider the system $x(k+1) = \begin{bmatrix} 1 & k \\ 0 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 2 \\ k \end{bmatrix} u(k)$ Is this system controllable at $k=0$? [8]
- 3 a) Write a short note on multi variable Nyquist plot. [7]
b) Explain the effect of poles and zero in MIMO systems. [8]
- 4 a) Explain the popular nonlinearities. Derive the describe function of relay with dead zone. [10]
b) List out the properties of nonlinear systems. [5]
- 5 a) State and explain the Lyapunov's instability theorem. [7]
b) State stability in the sense of Lyapunov? Explain in terms of an example. [8]
- 6 a) Explain necessary conditions for the design of state feedback control through pole placement. [8]
b) Describe the effect of state feedback on controllability. [7]
- 7 a) Explain the control and state variable inequality constraints. [7]
b) Find the extremals for the functional $J(x) = \int_0^1 [x^2(t) + \dot{x}^2] dt; x(0) = 1, x(1) \text{ free}$. [8]
- 8 Write short note on the following:
a) Optimal controller design using LQG framework
b) Linear quadratic optimal regulator (LQR) problem formulation [15]