Roll No .....

MEPE-103

M.E./M.Tech., I Semester

Examination, December 2015

Advanced Control System

Time : Three Hours

Maximum Marks : 70

Note : i) Attempt any five questions.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks.

1. a) Explain Controllability.
   b) Explain the principles of root loci.

2. a) Evaluate the controllability of the system with, $\dot{X} = AX + BU$ and $A = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$ $B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$.
   b) Explain effect of load disturbance upon control actions.

3. a) Explain with suitable example necessary and sufficient condition for arbitrary pole placement.
   b) Explain the different methods used to find the state feedback gain matrix and compare them.

4. a) Give the application with necessary - explanation of variable structure control.
   b) Explain variable structure control with suitable example.

5. a) State, prove and explain Lyapunov's stability theorem. Also explain what are the sufficient conditions of stability.
   b) Determine the stability using Lyapunov's stability theorem of a non-linear system governed by the equations.

$$\dot{x}_1 = -x_1 + 2x_1^2 x_2$$
$$\dot{x}_2 = -x_2$$

6. a) Explain phase plane technique for stability.
   b) Explain the principles of causality and invariant imbedding.

7. a) Write short note on Euler-Lagrange equation.
   b) Describe Pontryagin's maximum principle.

8. Write short notes on :
   a) Transversal condition of optimal control
   b) Modeling through differential equation

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