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Question Paper Code : 51687

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Sixth Semester

Electrical and Electronics Engineering

IC2351/IC61/10133IC604 – ADVANCED CONTROL SYSTEM

(Common to Instrumentation and Control Engineering)

(Regulations 2008/2010)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What is need for state observer ?
2. State Duality property.
3. Define limit cycle.
4. Differentiate phase trajectory and phase portrait.
5. What is autonomous system ?
6. Draw the input-output characteristics of relay with dead zone and hysteresis.
7. State Liapunov's stability.
8. What is Aizerman's conjecture ?
9. State optimal control.
10. What is decoupling ?

PART – B (5 × 16 = 80 Marks)

11. (a) The state model of a system is given by (16)

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \\ \dot{X}_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} [u]; y [100] \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$

Convert the state model to controllable phase variable form.

OR

- (b) Consider a linear system described by the transfer function. (16)

$$\frac{Y(s)}{U(s)} = \frac{10}{s(s+1)(s+2)}$$

Design a feedback controller with a state feedback so that the closed loop poles are placed at $-2, -1 \pm j1$.

12. (a) Explain briefly about phase plane and phase trajectories. (16)

OR

- (b) Explain the features, behaviour of non-linear systems and common physical non-linearities. (16)

13. (a) Explain the describing function analysis of nonlinear systems. (16)

OR

- (b) Explain about describing function of saturation nonlinearity. (16)

14. (a) (i) Explain in detail about Liapunov's stability concept and its direct method. (12)

- (ii) Write short note on Lure's transformation. (4)

OR

- (b) Explain in detail about : (16)

- (i) Popov's criterion

- (ii) Circle criterion

15. (a) Explain in detail about LQR steady state optimal control. (16)

OR

- (b) Explain in detail about Multivariable control design. (16)