C 80785 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) (09 SCHEME) DEGREE EXAMINATION, APRIL 2015

AI 09 604—ADVANCED CONTROL THEORY

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Write down Ackermann's formula.
2. Compare discrete time systems with continuous time systems.
3. State Sampling theorem.
4. List out the features of PI control.
5. What is asymptotic stability ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Give practical examples of controllable and uncontrollable systems.
7. What is the need for pole placement ?
8. List out the properties of state transition matrix.
9. What is integral wind up ?
10. Draw the circuit realization for a PID controller.
11. What are the features of robust control systems ?

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*

Module I

12. Derive the necessary and sufficient conditions for arbitrary pole placement.

Or

13. Consider the system :

$\dot{X} = AX + Bu$; $y = CX + du$ and $A = \begin{bmatrix} -2 & -1 \\ 1 & 0 \end{bmatrix}$; $B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$; $C = [0 \quad 1]$ and $d = [2 \quad 0]$. Design a full order state observer so that the estimation error will decay is less than 4 seconds.

Turn over

Module II

14. Obtain three different Canonical state variable models corresponding to the transfer function :

$$G(z)=\frac{4z^3-12z^2+13z-7}{(z-1)^2(z-2)}.$$

Or

15. Using Jury's stability criterion, find if all poles of the following transfer function lie inside the unit circle on the z-plane :

$$G(z)=\frac{3z^4+2z^3-z^2+4z+5}{z^4+0.5z^3-0.2z^2+z+0.4}.$$

Module III

16. Explain Ziegler Nichols rules.

Or

17. Discuss the effects of proportional, integral and derivative control modes.

Module IV

18. Discuss in detail about the design considerations for robust control systems.

Or

19. Consider the non-linear system described by the equations :

$$\dot{x_1}=x_2$$
$$\dot{x_2}=-(1-|x_1|)x_2-x_1.$$

Find the region is the state plane for which the equilibrium state of the system is asymptotically stable.

(4 × 10 = 40 marks)