APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH DEGREE EXAMINATION

Electronics & Communication Engineering

(Robotics & Automation)

04EC6909—Advanced Control Systems

Max. Marks : 60 Duration: 3 Hours

PART A

Answer All Questions

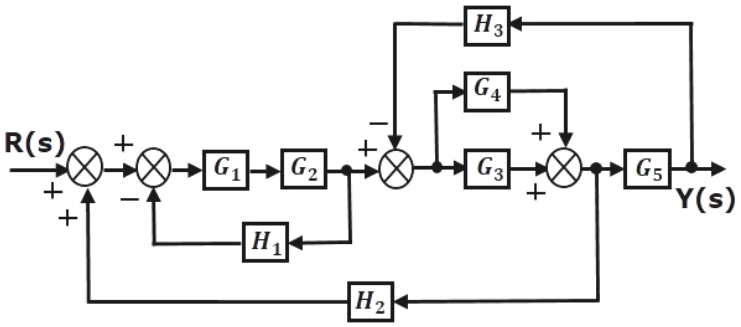
Each question carries 3 marks

1. Explain the principle of automatic control system.
2. What are transient and steady state response of a system?
3. Differentiate breakaway point with breakin point
4. List the drawbacks in the transfer function analysis of control systems
5. Sketch the state diagram of state model
6. What are the properties of state transition matrix
7. Explain the stability analysis methods of single link manipulator.
8. Sketch the block diagram of PID control of single link manipulator

PART B

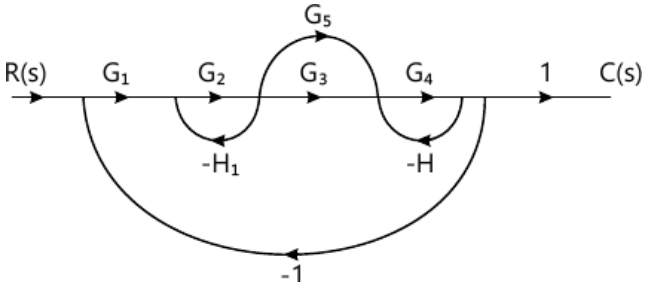
Each question carries 6 marks

9. Using block diagram reduction techniques obtain $\frac{Y}{R}$ by reducing the block diagram shown below.



OR

10. Using Mason's formula find $\frac{C}{R}$



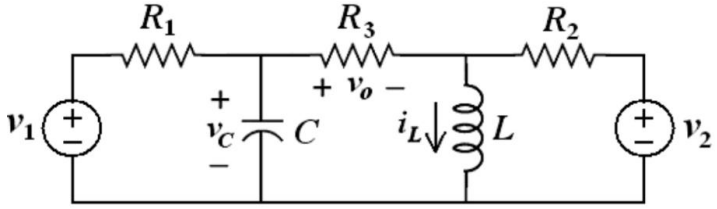
11. Sketch the response of a typical underdamped second order system and using that explain the time domain specifications

OR

12. Explain the impulse and step response of first order system in detail.
13. Construct Routh array and determine the stability of the system whose characteristic equation is $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Comment on the location of the roots of characteristic equation

OR

14. Sketch the bode plot for the following transfer function and obtain the gain margin and phase margin. $G(s) = \dfrac{10}{(1+0.4s)(1+0.1s)}$
15. Construct the state model of the system shown in figure



OR

16. Obtain the state model of the system whose transfer function is given as $\dfrac{Y}{U} = \dfrac{2s+3}{s^2+5s+6}$
17. Compute the state transition matrix for a system represented by the state equation $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ by laplace transform method.

OR

18. A linear system is represented by a state model $\dot{X} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} U$

    $Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} X$. Check whether the system is completely observable.
19. With block diagrams explain the digital control of single link manipulator

OR

20. With neat diagram explain the PID control of multilink manipulator