

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M. TECH DEGREE EXAMINATION

Electronics & Communication Engineering
(Robotics & Automation)

04 EC 6909 Advanced Control Systems

Max. Marks : 60

Duration: 3 Hours

PART A

Answer All Questions

Each question carries 3 marks

1. Check the linearity of the system $Y(n) = x(n)\cos(0.2\pi n)$.
2. Distinguish between a P and PID Controller.
3. What do you mean by frequency domain parameters? Explain.
4. Draw the block diagram representation of a state model.
5. State the condition for Controllability by Kalman's method.
6. What is control law?
7. What are the advantages of model based control of a robotic manipulator over conventional robotic manipulators?
8. How Routh-Hauritz criteria can be used in stability analysis of single link robotic manipulator?

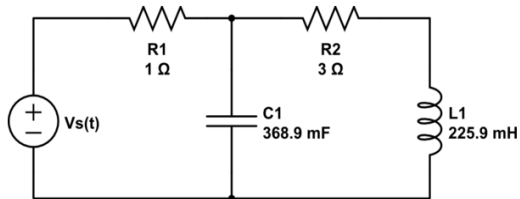
PART B

Each question carries 6 marks

9. Determine the transfer function armature controlled dc motor system.

OR

10. Determine the transfer function of the following system



11. Design and set up a Proportional control for $K_p = 5$ and 10 respectively for the system $G(s) = \frac{1}{s+1}$ and input $x(t) = 5u(t)$. Determine the values of output and error in each case.

OR

12. Determine the values of rise time, settling time, peak overshoot of the system $G(s) = \frac{9}{s^2+9}$ for a unit step input

13. Determine the stability of the system whose overall transfer function is given by

$$G(s) = \frac{2s+5}{s^5 + 1.5s^4 + 2s^3 + 4s^2 + 5s + 10}$$

OR

14. Determine the value of K such that the roots of the characteristics equation $s^3 + 10s^2 + 18s + K = 0$ lie to the left of line $s = -1$.

15. Obtain the state model of the system whose transfer function: $\frac{Y(s)}{U(s)} = \frac{10}{s^3 + 4s^2 + 2s + 1}$

OR

16. Find the transfer function of the system whose system equations are given by:

$$x'(t) = \begin{pmatrix} 0 & 1 \\ -2 & -3 \end{pmatrix} x(t) + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u(t); \quad y(t) = [1 \quad 0] x(t)$$

17. Using series decomposition method, determine the state model of the system with the given transfer function : $Y(s) / U(s) = 1 / (s+3)(s+4)(s+5)$

OR

18. Check the Observability of the given state model

$$\begin{pmatrix} x1' \\ x2' \\ x3' \end{pmatrix} = \begin{pmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{pmatrix} \begin{pmatrix} x1 \\ x2 \\ x3 \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix} u$$
$$y = \begin{pmatrix} 1 & 0 & 0 \end{pmatrix} \begin{pmatrix} x1 \\ x2 \\ x3 \end{pmatrix}$$

19. Explain the working of PID controller of single link manipulator

OR

20. Describe the advantages of digital control of manipulators?