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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH DEGREE EXAMINATION

Electronics and Communication Engineering

(M.Tech Robotics And Automation)

04EC6909—Advanced Control Systems

Time: 3 hrs Max. Marks: 60

PART A

Answer All Questions

Each question carries 3 marks

1. List the different types of systems with suitable mathematical equations
2. For a non-unity feedback system as shown below (Figure 1) evaluate steady state error for an input r (t) =10e (t)

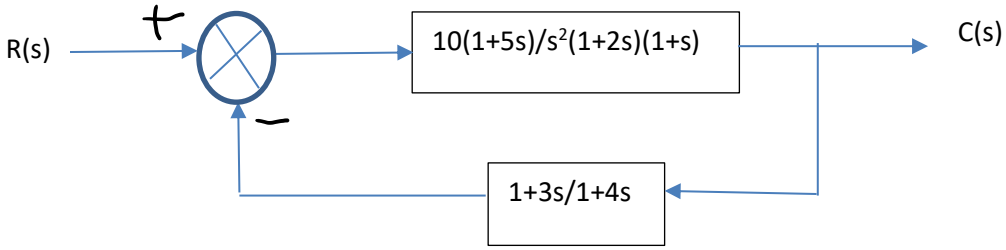

Figure 1

3. Explains the stability analysis using BODE plot?
4. Write the properties of state transition matrix.
5. Construct the state model of the following system.

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + \frac{dy}{dt} + 6y + u = 0$$

6. Explain controllability and observability test using Kalman's test.
7. Derive the transfer function of the conventional PID controller.
8. Write short notes on MPC.

PART B

Each question carries 6 marks

9. Obtain the transfer function of quarter car model suspension system with two masses and two springs and one despot.

OR

10. Derive the transfer function of armature controlled DC motor.

11. Draw the step and impulse response of a first order system with suitable equation.

OR

12. The closed loop poles of a feedback control system are (-2+j3) and (-2-j3) respectively. Determine the undamped natural frequency and percentage of overshoot damping ratio of the system subject to unit step input.

13. Consider the closed loop feedback control system as shown in Figure 2.

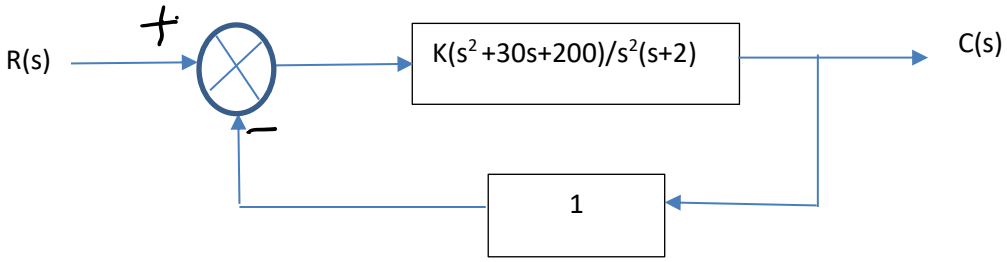

Figure 2

Using RH criterion, find the range of K for the closed loop stability. Also determine the number of roots of the characteristic equation in the Right hand side of the plane when k=0.5.

OR

14. Sketch the root locus plot for the system GH (s) =k (s^2 - 4s+20) /((s+2) (s+4)).

15. Find the phase variable model of the following system.

$$Y(s)/U(s)=10/(s^3+4s^2+2s+1)$$

OR

16. Obtain the canonical model of the given system.

$$Y(s)/U(s)=10(s+4)/s(s+1)(s+3)$$

17. Check the observability of the following system using Kalman's test.

$$dx_1/dt=x_2;$$

$$dx_2/dt=-2x_1-3x_2+u;$$

$$Y=x_1+x_2$$

OR

18. Obtain state transition matrix of the following system using Cayley Hamilton theorem.

A= [0 1;-2 -3]

19. Write down the design steps of PID controller implementation in single link manipulator.

OR

20. Implement the digital controller for single link manipulator with suitable example.