Exam. Code: 0935
Sub. Code: 6985

1079

B. Engg. (Electrical & Electonics Engg.)

5th Semester

EE-509: Control Engg.-II

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt **five** questions in all, including Q. No. 1 (Part-A) which is compulsory and selecting atleast two questions each from Part-B & C. Assume and specify any missing data.*

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Part- A

I a) Explain the terms: state, state variables and pulse transfer function. 5x2 =(10)

b) Give block diagram of Digital Control system.

c) Compare the characteristics of P,I and D controllers.

d) Give the significance of sampling theorem.

e) Explain why the compensators are required?

Part- B

II (a) The state equations of LTI system are as given below: (5)

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-2 & 0\\ 1 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u(t);t>0$$

(i) Compute state transition matrix.

(ii) Compute $x_1(1)$ under zero initial conditions and a unit step input.

(b) Explain the terms: controllability and observability. Explain necessary and sufficient conditions for the system to be controllable and observable. (5)

III (a) Derive expression for steady state error for Proportional- Integral Controller and give their advantages and limitations. (5)

(b) A unity Feedback control system with Proportional plus derivative control is shown in Fig 1. Calculate the value of Kd so that system is critically damped. Also for a ramp input calculate values of ess, Mp and ts with and without control action. (5)

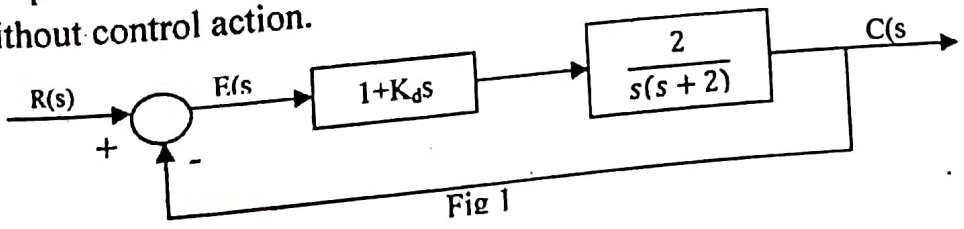

Fig 1

P.T.O.

IV (a) Explain the procedure for compensation design using root locus technique. (3)

(b) A control system is represented by open loop transfer function (7)

$$G(s) = \frac{K}{s(s+2)}$$

The damping ratio has to be made 0.5 and velocity error constant restricted to 18. Design a lead compensator.

Part- C

V (a) Determine the causal signal x(n) having the z-transform (5)

$$X(z) = \frac{1 - z^{-1}}{(1 + z^{-1})(1 + 0.5z^{-1})^2}$$

(b) Explain how the stability region of s-plane is mapped to z-plane to study the stability of digital control system. (5)

VI (a) The characteristic equation of a sampled data system (5)

$$z^4 - 0.9z^3 + 0.14z^2 + 0.216z + 0.032 = 0$$

Investigate the stability of the system by Jury's test.

(b) Determine the causal sequence x(n) using convolution for : (5)

$$X(z) = \frac{1}{(1 - \frac{1}{2}z^{-1})(1 + \frac{1}{4}z^{-1})}$$

VII(a) Give the hardware features of Temperature control system. Explain the difficulties in implementation of digital control scheme. (5)

(b) Explain the benefits of PLC. Explain its two applications in the industry. (5)

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