

Scheme – E

Sample Question Paper

Course Name : Electronics engineering group

12270

Course Code : ET/EN/EX/EJ/IE/IS/IC/EV/DE/IU/ED/EI

Semester : Sixth for ET/EN/EX/EJ/IE/IS/IC/EV/DE and Seventh for IU/ED/EI

Subject : Control System

Marks : 100

Times: 3 Hrs.

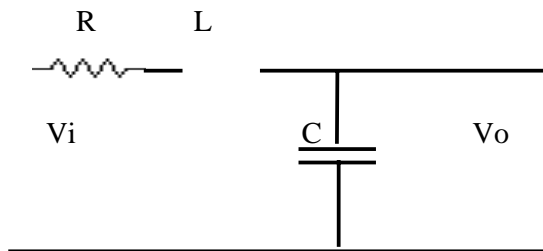
Instructions:

1. All questions are compulsory.
2. Illustrate your answers with neat sketches wherever necessary.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.

Q.1 a) Attempt any THREE of following.

12 Marks

- a) What do you mean by stability
Define stable control system.
- b) Define Poles and zeros with respect to Control system.
- c) Derive the transfer function for the given series RLC circuit.

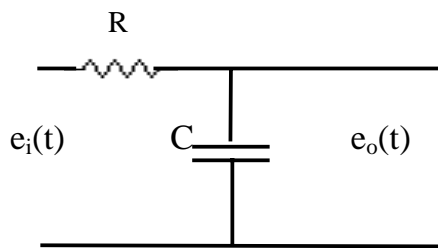


- d) Give the classification of Robotics.

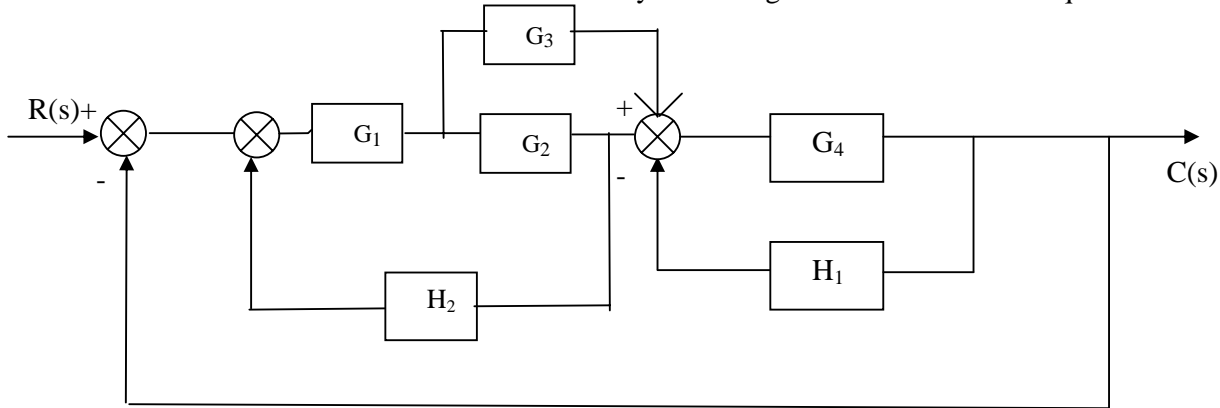
Q.1b) Attempt any one of following.

06 Marks

- i. Find out the response of given system for a unit step input.



ii. Derive the transfer function of system using block reduction techniques.



Q.2 Attempt any Two of following.

16 Marks

a) Determine the stability of the system whose characteristic equation is given as

$$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$

b) Derive the transfer function of an armature controlled DC servomotor.

c) A system has $G(s)H(s) = \frac{K}{S(S+2)(S+4)(S+8)}$

where K is positive. Determine the range of 'K' for the system to be stable.

Q.3 Attempt any Four of following.

16 Marks

a) A system is represented by differential equation.

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5 = \frac{dx}{dt} + 4x$$

where x is i/p and y is o/p. Derive the transfer function of the system.

b) Explain the following terms with respect to Robotics.

i) DOF ii) End effector

c) State the principle of proportional control action with mathematical expression and its characteristics.

d) Explain the controller with characteristic which can not be used alone.

e) Derive steady state error expression in terms of open loop transfer function G(s) having unity f/b system. Obtain ess for unit step input.

Q.4 a) Attempt any Three of following.

12 Marks

i. For the given transfer function

$$\text{T.F.} = \frac{K(S+6)}{S(S+2)(S+5)(S^2+7S+12)}$$

Find out

1) Poles

- 2) Zeros
 - 3) Characteristic equation
 - 4) Locate Poles & Zeros on s-plane.
- ii. For a system having closed loop transfer function for unit step i/p determine
- 1) ω_n
 - 2) damping factor
 - 3) ω_d
 - 4) %Mp

$$f_n = \frac{64}{S^2 + 5S + 64}$$

- iii. Define transfer function and derive the transfer function for a general closed loop control system.
- iv. Describe synchro as an error detector.

Q.4 b) Attempt any ONE of following.

06 Marks

- i. Draw electronic PID controller. State its equation and explain it.
- ii. Draw and explain variable reluctance type of stepper motor and state its application.

Q.5 Attempt any FOUR of following.

16 Marks

- a) Define the following frequency response specifications.
 - i) Resonance peak ii) Bandwidth iii) Cutoff frequency iv) gain margin.
- b) Define and write mathematical expression for a step and a ramp signal with their Laplace transform.
- c) Differentiate between open loop and closed loop systems. (any four points)
- d) What are important mechanical parts in industrial robot? Draw its block diagram and explain its working.
- e) Compare ac and dc servomotors.
- f) Explain ON-OFF control action with example.

Q.6 Attempt any FOUR of following.

16 Marks

- a) What is offset with respect to Control action? How it is eliminated?
- b) List two applications and two drawbacks of ON-OFF controller.
- c) Derive K_p , K_v and K_a for first order control system.
- d) Explain the effect of damping on response of control system.
- e) Explain potentiometer as an error detector.