

## Scheme - I

### Sample Question Paper

**Program Name** : Diploma in Instrumentation / Instrumentation & Control

**Program Code** : IS / IC

**Semester** : Fifth

**Course Title** : Control System

**Marks** : 70

**22541**

**Time: 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 Attempt any FIVE of the following.

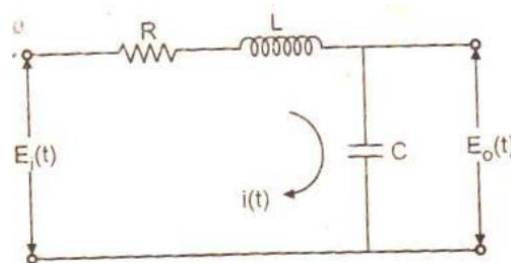
**10 Marks**

- a. Define time variant and time invariant control system
- b. Define i) Steady state error ii) 'Type' of control system
- c. Draw the Location of the Poles in the S-plane for stable and unstable systems
- d. State the equation of ON-OFF controller. Explain "Neutral Zone" in ON-OFF controller.
- e. Define servo system. Draw and label block diagram of servo system
- f. Draw the time response of 1<sup>st</sup> order system for unit step input. Label time constant in it.
- g. Compare AC 2-phase induction motor & AC servo motor. (any 4 points).

#### Q.2 Attempt any Three of the following.

**12 Marks**

- a. Find the transfer function of the RLC network



- b. For a given TF  $\frac{C(S)}{R(S)} = \frac{(S^2+4)}{(S^2+7S+12)}$  Find: i) Pole ii) zero iii) pole zero plot iv) characteristic equation
- c. Compare stepper motor & DC servo motor. (any 4 points)
- d. A unity feedback control system has  $G(S) = \frac{40(S+2)}{S(S+1)(S+4)}$   
Find i. Type of the system ii. Error coefficients

**Q.3) Attempt any Three of the following. 12 Marks**

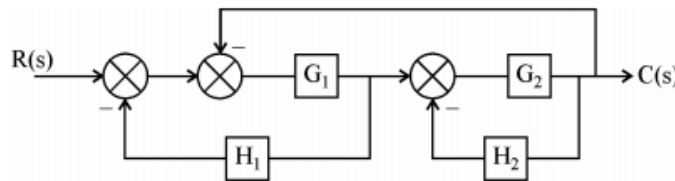
- Find the state space representation for Transfer Function  $\frac{C(S)}{R(S)} = \frac{9}{(S^2+6S+9)}$
- List standard test inputs. Draw graphical representation of them & give their Laplace transform.
- Draw polar plot for  $G(S)H(S) = \frac{1}{(1+TS)}$
- Compare integral and derivative control action on the basis of: i) output ii) equation iii) stability iv) speed of response

**Q.4) Attempt any Three of the following. 12 Marks**

- Derive transfer function of close loop control system with negative feedback.
- Define Damping. Show effect of damping in response of 2<sup>nd</sup> order control system.
- State Nyquist stability criteria. State its significance
- Explain proportional controller action with equation and response. Define Proportional Band.
- Examine stability by Routh criterion for Characteristic equation  $S^4 + 10S^3 + 35S^2 + 50S + 24 = 0$

**Q.5) Attempt any Two of the following. 12 Marks**

- Derive the transfer function of the below system using block diagram reduction techniques



- Draw bode plot for the system with open loop transfer function  $G(S)H(S) = \frac{2}{s(1+s)(1+0.1s)}$
- Draw the circuit diagram of electronic PID controller and state its equation. State its advantages (any 2)

**Q.6) Attempt any Two of the following. 12 Marks**

- A second order system is given by  $\frac{C(S)}{R(S)} = \frac{25}{S^2+6S+25}$  Find out settling time and peak overshoot. Draw its response.
- Using Routh's criteria, determine the range of K values for system to be stable.  $G(S)H(S) = \frac{K}{s(s+2)(s+4)(s+5)}$
- Identify which servo component can be used as error detector in AC servo system. Draw and describe it's working.

## Scheme - I

### Sample Test Paper - I

Program Name : Diploma in Instrumentation / Instrumentation & Control

Program Code : IS / IC

Semester : Fifth

Course Title : Control System

Marks : 20

**22541**

Time: 1 Hour.

#### 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 Attempt any FOUR.

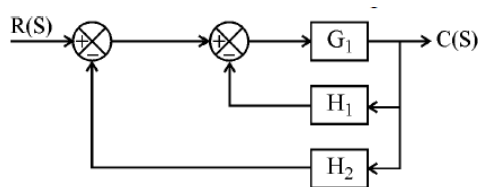
8 Marks

- a. Find transfer function of following differential equation  $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y(t) = 8x(t)$
- b. Compare open loop and closed loop system (4 points)
- c. Draw the time response of a second order system and indicate transient response and steady state response in it.
- d. Define i) rise time ii) peak overshoot. State their equations
- e. Derive the position and velocity error coefficients for step input for type '0' system
- f. Define marginally stable system. Show the location of poles of such system in the S - plane.

#### Q.2 Attempt any THREE.

12 Marks

- a. Define state variable. State any two advantages of State space representation over classical representation of control system.
- b. Transfer function of system is given by  $\frac{C(S)}{R(S)} = \frac{100}{(S^2+5S+100)}$   
Calculate: i) Damped frequency of oscillations.  
ii) Settling time
- c. Find out the type of the system and steady state error for a unity feedback system with  $G(S) = \frac{10}{s(1+2s)}$  for input  $r(t) = 5t$
- d. Examine stability by Routh criterion for Characteristic equation  $S^3 + 4S^2 + S + 6 = 0$
- e. Derive the transfer function of the below system using block diagram reduction techniques



## Scheme - I

### Sample Test Paper - II

**Program Name** : Diploma in Instrumentation / Instrumentation & Control  
**Program Code** : IS / IC  
**Semester** : Fifth  
**Course Title** : Control System  
**Marks** : 20

**22541**

**Time: 1 Hour.**

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#### 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 Attempt any FOUR.

**8 Marks**

- a. State any 2 advantages & 2 disadvantages of frequency response analysis
- b. Define gain margin & phase margin
- c. Define offset in proportional controller. State the 3 methods to eliminate it
- d. Draw the circuit diagram of op-amp based PI controller.
- e. Draw and label block diagram of DC servo system.
- f. State the classifications and applications (any two) of stepper motor.

#### Q.2 Attempt any THREE.

**12 Marks**

- a. Draw the Bode plot for  $G(S)H(S) = \frac{10}{S}$
- b. State the name of the controller which cannot be used alone. State the reasons why it cannot be used alone.
- c. Describe the integral control action with equation.
- d. Compare AC & DC servo motor (4points)
- e. Draw and explain potentiometer as an error detector.