17538

21718

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any THREE : **12**

(a) Differentiate between open loop and closed loop systems (4 points).

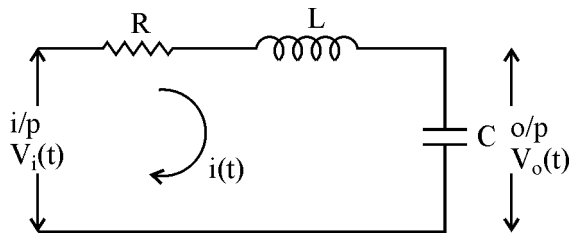
(b) Name the standard test signals. Write the transfer function and draw their response.

(c) Define servo system. Draw the block diagram of servo system.

(d) Identify the controller which can eliminate the drawback of proportional controller. Draw response graph with equation.

(B) Attempt any ONE : **6**

(a) Define transfer function. Derive the transfer function of the circuit in fig.



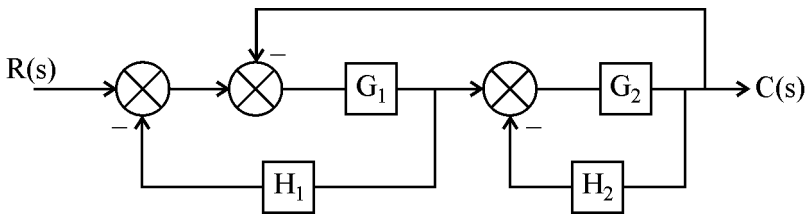
(b) Draw Bode plot for the system with open loop transfer function $G(s)\,H(s) = 20/s\,(1 + 2s)$

2. Attempt any TWO : **16**

(a) A system has $G(s)\,H(s) = \dfrac{K\,(s + 13)}{s(s + 3)\,(s + 7)}$. Determine the range of K for which the system is stable.

(b) The transfer function of a system is $\dfrac{C(s)}{R(s)} = \dfrac{25}{s^2 + 6s + 25}$. Find out Rise time, Peak time, Settling time and Peak overshoot.

(c) Find out the transfer function of the following system in fig. using block diagram reduction method.



3. Attempt any FOUR : **16**

(a) Find out the poles and zeros of the following transfer function :

$$\frac{C(s)}{R(s)} = \frac{s^2 + 9}{s\,(s^2 + 6s + 8)}$$

(b) State and explain the condition of marginal stability with location of poles on S-Plane.

(c) State two advantages and two disadvantages of frequency response analysis.

(d) Explain on-off controller with response graph and equation.

(e) Draw and explain the error detector used in DC servo system.

4. (A) Attempt any THREE : **12**

(a) Define time constant. State the effect of it on the response of the system.

(b) Determine stability by using Routh's criterion for

$$1 + G(s)\,H(s) = s^4 + 4s^3 + s^2 + 8s + 1 = 0$$

(c) State the name of the controller which cannot be used alone. State the reasons why it cannot be used alone.

(d) Describe the effect of damping for all 4 cases with the help of location of poles and output responses.

(B) Attempt any ONE : **6**

(a) Derive the Transfer Function of the closed loop system.

(b) Draw and explain synchro as error detector.

P.T.O.

5. Attempt any TWO : **16**

(a) (i) Compare DC servo motor with stepper motor. (4 points)

(ii) Draw and explain the constructions of AC servo motor.

(b) Draw op-amp based PID controller. Write its equation. State four advantages of PID controller over other composite controllers.

(c) (i) Derive steady state error and error co-efficients for step input for a type O system.

(ii) Find out the error co-efficients and steady state errors for a unity feedback system with

$$G(s) = \frac{40(s + 2)}{s(s + 1)(s + 4)}$$

6. Attempt any FOUR : **16**

(a) Define gain margin and phase margin. What should be the values of them for a stable system ?

(b) State any two advantages and two disadvantages of Routh's stability criteria.

(c) Draw and explain the block diagram of process control system.

(d) Draw and explain the generalized diagram of DC servo system.

(e) For the given differential equation

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y(t) = 8x(t)$$

Where y(t) = o/p, x(t) = input

Find out the transfer function and order of the system.
