17538

11920

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) Use of Non-programmable Electronic Pocket Calculator is permissible.

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

(8) Use of steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. (A) Attempt any THREE : **3 × 4 = 12**

(a) Compare open loop and closed loop systems.

(b) Define poles and zeros with respect to control system. Explain with example.

(c) State the advantages and disadvantages of Routh's stability criterion.

(d) Define 'Electrical Zero position of Synchro' and give its applications.

(B) Attempt any ONE : **1 × 6 = 6**

(a) Define transfer function. Derive the equation of transfer function for closed loop system.

(b) Draw and explain electronic PID controller using OP-Amp. List its two advantages.

2. Attempt any TWO : **2 × 8 = 16**

(a) Reduce the block diagram using reduction rule. Obtain C(S)/R(S).

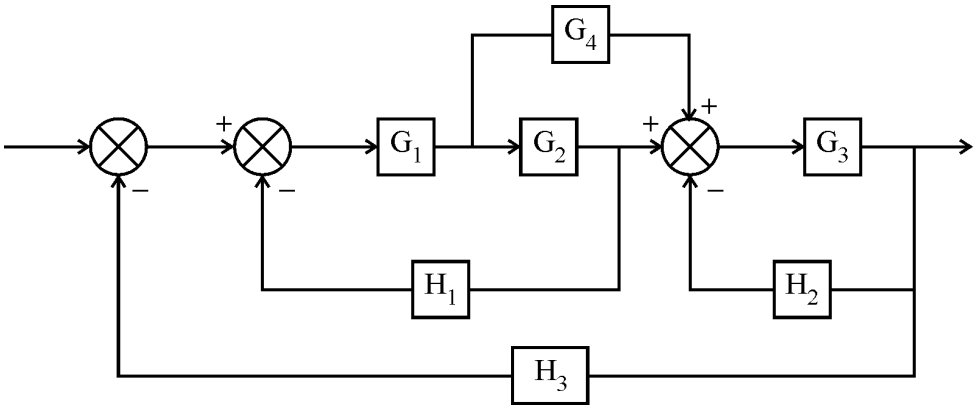

Fig. (1)

(b) 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. Using Routh's criteria.

(c) Describe working of variable reluctance type stepper motor with suitable diagram and write applications of stepper motor.

3. Attempt any FOUR : **4 × 4 = 16**

(a) Find the transfer function of network given in figure.

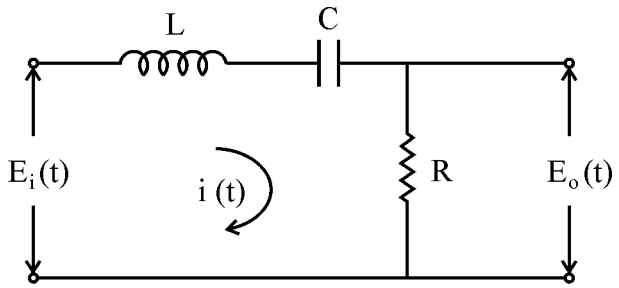

Fig. (2)

(b) Draw labelled time response of 2nd order control system and define rise time and settling time.

(c) Determine stability of the system using Routh's criterion.

$S^4 + 6S^3 + 26S^2 + 56S + 80 = 0.$

(d) Explain the procedure to draw Bode plot.

(e) (i) Define : (1) Offset, (2) Proportional band, (3) Neutral zone.

(ii) List control actions.

4. (A) Attempt any THREE : **3 × 4 = 12**

(a) T.F of second order system is given by

$\frac{C(S)}{R(S)} = \frac{64}{S^2 + 5S + 64}$, find T_S and Z_O M_P for unit step input.

(b) Define stability. Draw the location of poles for stable, unstable, critically stable system.

(c) Describe the principle of ON-OFF controller with its one application in detail.

(d) Describe potentiometer as an error detector with neat sketch.

(B) Attempt any ONE : **1 × 6 = 6**

(a) A unity feedback system has $G(S) = \frac{10(S + 1)}{S(S + 2)(S + 5)}$. Calculate the error coefficients K_p, K_v, K_a and steady state error, where $r(t) = 3 + 10\,t$.

(b) Draw Bode plot for a control system having unity feedback and open loop transfer function as $G(S) = \frac{80}{S(S + 2)(S + 20)}$.

5. Attempt any FOUR : **4 × 4 = 16**

(a) Name the standard test inputs. Draw them and give their Laplace transform.

(b) Find the range of value of K so that system with following characteristics equation will be stable. $F(S) = S(S^2 + S + 1)(S + 4) + K = 0$.

(c) Define the following frequency response specifications. (i) Resonance peak, (ii) Bandwidth, (iii) Cut off frequency, (iv) Gain margin.

(d) Draw the transient response of second order system for different values of ξ (zeta).

(e) Explain synchro as error detector with neat diagram.

(f) Draw and describe the block diagram of process control system.

P.T.O.

6. Attempt any FOUR : **4 × 4 = 16**

(a) For the given transfer function

$$\frac{C(S)}{R(S)} = \frac{10(S + 8)}{S\,(S + 4)\,(S^2 + 6S + 25)}$$

Find : Poles, Zeros, characteristics equation pole-zero plot on S-plane.

(b) Define marginal stability. Draw the neat sketch to represent its location of poles on S-plane.

(c) Compare proportional and integral controller on the basis of (i) Nature of O/P, (ii) Response to error, (iii) O/P equation, (iv) Application.

(d) Define steady state and transient response of a system. Give the expression for steady state error.

(e) Compare stepper motor and DC servo motor. (any 4 points)
