

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-IV Remedial Examination Nov/ Dec. 2010****Subject code: 141701****Date: 06 / 12 / 2010****Subject Name: Control Theory****Time: 03.00 pm – 05.30 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain Standard Test Signals used in control system. **04**
 (b) Compare Open Loop versus Closed Loop control systems. **03**
 (c) Derive the transfer function for armature controlled DC motor. **07**

- Q.2** (a) For a RLC circuit, derive the state model of the system. **04**
 (b) Explain Force current analogy. **03**

OR

- (a) Explain types of the system and steady state error constants for the same. **04**
 (b) Explain with example the first order system. **03**
 (c) Derive the closed loop transfer function using block diagram reduction technique for the fig.1. **07**

- Q.3** (a) By means of Routh criterion, determine the stability of the system described by characteristic equation, **04**

$$S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$$

 (b) Define following terms. **03**
 1) State variable 2) State trajectory 3) State vector
 (c) Find the transfer function for the fig.2 using signal flow graphs. **07**

OR

- Q.3** (a) By means of Routh criterion, determine the range of K for stability of the system described by characteristic equation, **04**

$$S^3 + 8S^2 + 2S + 4K = 0$$

 (b) Explain the effect of derivative control action on system performance. **03**
 (c) A servo system is represented by the signal flow graph shown in fig.3, the variable T is Torque and E as error. Determine **07**
 • The overall transfer function if $K_1 = 1$, $K_2 = 2$ and $K_3 = 5$.

- Q.4** (a) Explain following terms with necessary diagrams. **07**
 • Delay Time
 • Rise Time
 • Peak Time
 • Steady state error
 • Settling Time
 (b) Explain two position ON-OFF control action with example. **07**

OR

- Q.4** (a) Explain with necessary equation and diagram, second order step response of the system. **07**
 (b) Sketch the direct and reverse polar plots for unity feedback system with an open loop transfer function, **07**

$$G(s) = 1/S(1+S)^2$$

Q.5 (a) Plot the root locus for given transfer function. **07**

$$G(s) = K/s(s+1)(s+4).$$

Find the value of gain k at $S = -1 \pm 2j$.

(b) Draw the bode plot for **07**

$$G(s) = 10(1+0.5s)/s(1+0.1s)(1+0.2s).$$

Also find phase and gain margin.

OR

Q.5 (a) Draw the bode plot for **07**

$$G(s) = 10 e^{-0.1s}/s(1+10s)(1+4s).$$

Also find phase and gain margin.

(b) Sketch the Nyquist plot for a system with transfer function, **07**

$$G(s)H(s) = K(1+0.5s)(1+s) / (1+10s)(s-1)$$

Fig. 1 Que. 2 (C)

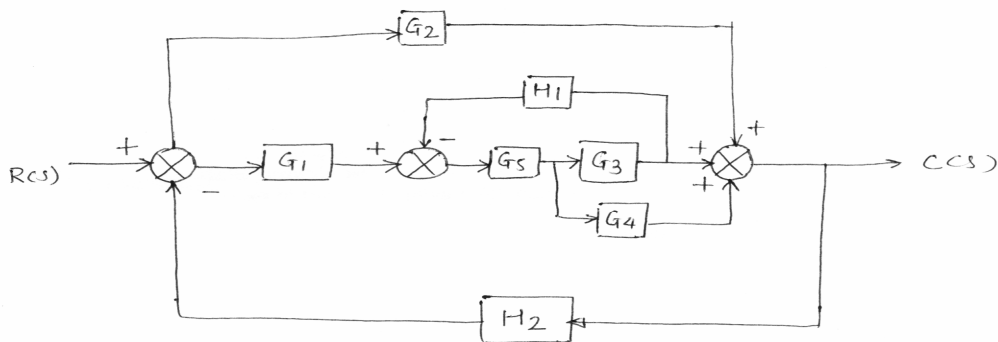


Fig. 2. Que. 3 (C)

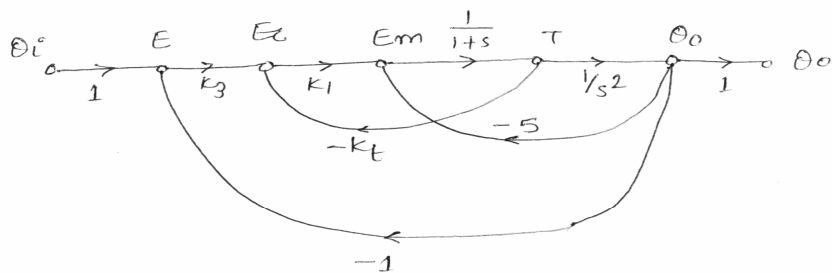
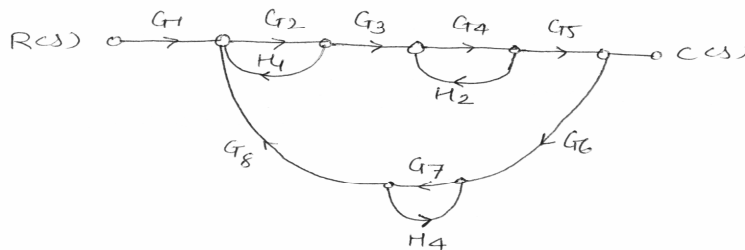


Fig. 3. Que. 3 (C) OR