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Paper Code: EE-503/EEE502	Roll No.										

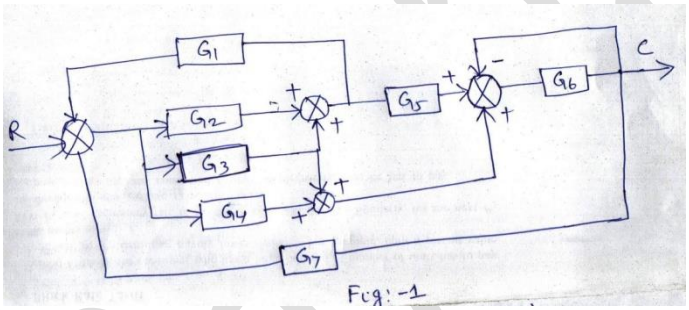
B.TECH
(SEM V) ODD SEMESTER THEORY EXAMINATION, 2016-17
CONTROL SYSTEM

[Time: 3 Hours] **[Max. Marks: 100]**

Note: - *Attempt all questions. All questions carry equal marks.*

1. **Attempt any FOUR parts:-** **(5 x 4 = 20)**

a) Compare the Closed loop feedback System & Open loop Feedback System.
b) Find C/R using block diagram reduction technique for the figure:-1.



c) Through the Mathematical modeling develop block diagram of a field controlled DC motor.
d) Briefly write about historical development of Control system engineering.
e) Discuss the effect of feedback on (i) Stability (ii) Noise (iii) Overall gain.

2. **Attempt any FOUR parts:-** **(5 x 4 = 20)**

a) Define the following terms: (i) Delay Time (ii) Rise Time (iii) Peak time (iii) Peak over Shoot (iv) Steady state error.
b) For the system represented by the following equations, find the transfer function X(s)/U(s) by signal flow graph technique ,

$$x = x_1 + \beta_3 u\ , \qquad x_1' = -a_1 x_1 + x_2 + \beta_2 u \quad , x_2' = -a_2 x_1 + \beta_1 u$$

c) Measurement conducted on a servomechanism show the system response to be $c(t)=1+0.2e^{-60t}-1.2e^{-10t}$; when subjected to a unit step input.(a)Obtain the expression for the closed-loop transfer function.(b) Determine the undamped natural frequency and the damping ratio of the system.
d) Explain the following Test Signals (i) Unit Impulse signal (ii) Unit Parabolic Signal
e) Derive the expression for rise time and peak time for second order system.

3. Attempt any TWO parts:- **(10 x 2 = 20)**

a) (i) Test whether the following polynomial by Routh's criterion; also comment on its stability $P(s) = S^5+2S^4+3S^3+6S^2+2S+1=0$.
(ii) Using Routh's criterion, investigate the Stability of a unity feedback system whose open loop transfer function is $G(s) = e^{-sT}/S(S+1)$.

b) Draw the root locus of

$$G(s) = \frac{K}{S(S+3)(S^2+3S+3)}; K > 0.$$

c) Explain the working principle of Synchros. Develop its block diagram and write various applications.

4. Attempt any TWO parts:- **(10 x 2 = 20**

a) Establish the correlation between time domain and frequency domain second order system and draw it various diagram.

b) Sketch the Bode Plot for the system having

$$G(s)\,H(s) = \frac{20}{S(0.1S+1)}$$

Also find the gain margin and phase margin.

c) The forward path transfer function of a unity feedback is

$$G(S)\frac{K}{S(S+6)}$$

Find the resonant peak M_r, resonant frequency ω_r and bandwidth of the closed loop system for the K=5.

5. Attempt any two parts:- **(5 x 4 = 20)**

a) Show that lead compensation is suitable for systems having unsatisfactory transient response, and it provides a limited improvement in steady-state performance.

b) An uncompensated control system with unity feedback has a plant transfer function

$$G(s) = \frac{K}{S(1+0.1S)(1+0.2S)}$$

The system must satisfy the following performance specifications:
(a) The magnitude of the steady-state error of system due to unit ramp function input is 0.01.
(b) Phase margin≥40°.
Use two identical cascaded lead to compensate the system .Justify the use of two-stage lead compensator.

c) Define the following (i)State (ii)state variables (iii) State Vector (iv) State space (v) Controllability (vi) Observability