Paper Code: EE-503	Roll No.										

B. Tech.
(SEM V) ODD SEMESTER EXAMINATION 2015-16
CONTROL SYSTEM

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

Note- ***Attempt All Questions. All Questions carry equal marks*:-**

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

a. Discuss the working principle of the armature controlled DC servomotor with its block diagram.
b. Discuss the effect of feedback on the following :-(i) Sensitivity (ii) Stability (iii) Error.
c. Write note on historical development of control system engineering.
d. Compare the open loop control system and closed loop control system.
e. For the system represented by the following equations, find the transfer function X(s)/U(s) by signal flow graph technique

$X= X_1+\beta_3 U$

$X_1= -a_1X_1+X_2\beta_2 U$

$X_2= -a_2X_1+\beta_1 U$

2. Attempt any four parts:- **(4 x5 = 20)**

a. For the system shown in the Fig.2 (i) determine ξ and ω_n without K_D (ii) K_D for ξ=0.60 with controller.

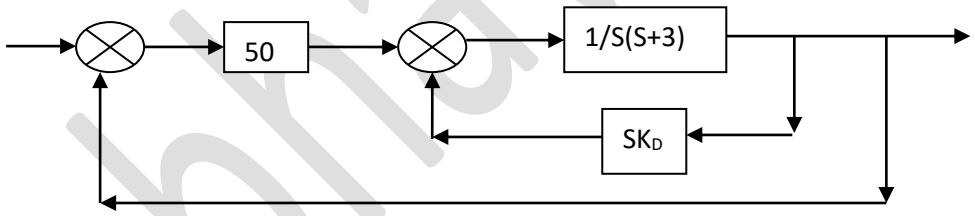

Figure:-2

b. Derive the formula for Peak over shoot, Settling time and Peak time.
c. Discuss the PI & PID controllers with their applications and their error constant.
d. A unity feedback system is characterized by the open loop transfer function

$$G(S) = \frac{1}{S\left(\frac{S}{2}+1\right)\left(\frac{S}{5}+1\right)}$$

Determine the steady state errors for unit step & unit ramp input. Also determine the damping ratio and natural frequency of the dominant roots.
e. For a general second order systems find the c (t), when input is unit step.

3. Attempt any TWO parts: - **(2x10 = 20)**

a. Determine the values of K>0 and a>0, so that system having

$$G(s) = \frac{K(S+2)}{S^3+aS^2+5S+1}$$

H(s)=1, so that system oscillates at a frequency 2rad/s and find the stability of the following polynomial by Hurwitz criterion $S^5+4S^4+2S^3+5S^2+2S+1$.

b. Discuss the constructional feature and working principle of stepper motor.
c. Draw the root locus plot of

$$1 + \frac{K}{S(S+2)(S^2+2S+2)}$$

and also comment on its stability.

4. Attempt any two parts: - **(2x10 = 20)**

a. Establish the correlation between time response & frequency response analysis and suitably explain with diagrams.
b. Draw the bode plot of the given function

$$G(j\omega) = \frac{3(1+j\omega/2)}{j\omega\left(1+\frac{j\omega}{9}-\left(\frac{\omega}{9}\right)^2\right)}$$

c. Sketch the Nyquist plot for the following transfer function

$$G(S)H(S) = \frac{K}{S(1+\tau S)}$$

For K>0, τ>0.

5. Attempt any two parts: - **(2 x10 =20)**

a. Express the following transfer function in CCF form. Draw the signal flow graph.

$$\frac{C(s)}{R(s)} = \frac{3}{S^4+2S^3+3S+2}$$

b. Design the lead compensator for a unity feedback control system with open loop transfer function

$$G(S) = \frac{K}{S(2S+1)(0.5S+1)}$$

Such that velocity error constant K_v=10 and phase margin of the system be at least 35°.
c. Discuss the working of the Lag-Lead Compensator. Sketch the Bode Plot of Lag-Lead compensator. Give the design steps of a lag compensator.