

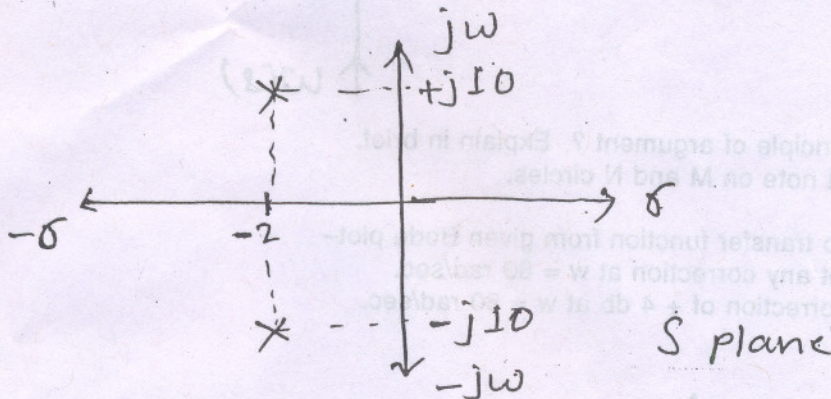
2/6/2006

(3 Hours)

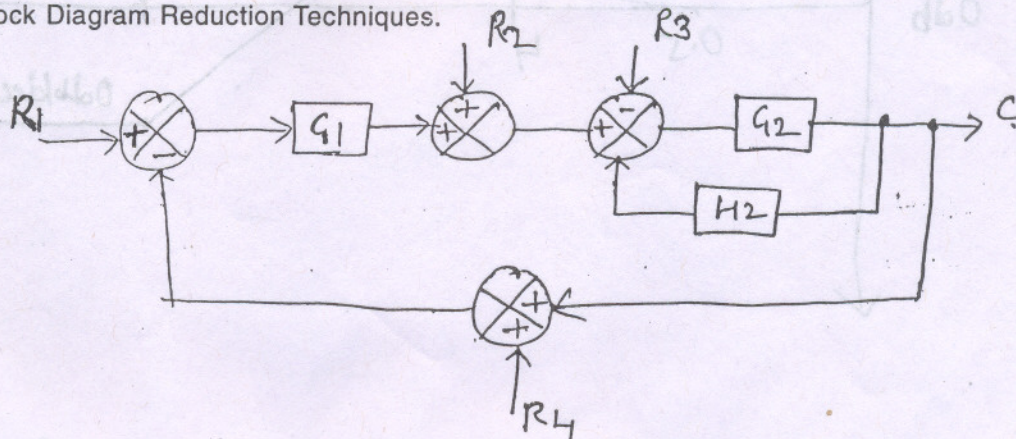
[Total Marks : 100

- N.B.** (1) Question No. 1 is compulsory.
 (2) Answer any **four** out of remaining **six** questions.
 (3) Assume suitable data wherever **necessary**.
 (4) Figures to the **right** indicate marks.

1. (a) Explain how to find K_p , K_v and K_a from Bode plot. 4
 - (b) List the types of static error constants and comment on its value as the type of system increases. 4
 - (c) Plot polar plots for the following open loop transfer function. 4
 (1) K/S (2) KS^2 (3) $KS/S + 1$ (4) $K/S (S + 1)$
 - (d) The transfer function and impulse response function of a linear time in variant system contain the same information about the system dynamics. Verify the statement. 4
 - (e) Show the pole-zero location and the unit step response for the following second order control system. 4
 (i) Under damped.
 (ii) Over damped.
 (iii) Critically damped.
 (iv) Undamped.
2. (a) Obtain W_r , M_r and W_b from the given pole-zero plot. 10



- (b) Draw Nyquist plot for $G(s) H(s) = \frac{20}{s(s+4)(s-2)}$ and hence comment on stability. 10
3. (a) If $G(s) H(s) = \frac{K(s+1)}{s^2(s+2)(s+4)}$. Using polar plot determine the range of K for stability. Verify your results by Routh criterion. 10
 - (b) Find C using Block Diagram Reduction Techniques. 10



4. (a) Discuss the effect of following controllers on the 11nd order control system. 10
- (i) PI controller
 - (ii) PD controller
 - (iii) Rate Feedback controller. 10
- (b) Sketch the Bode plot—

$$G(s)H(s) = \frac{K(1+0.2s)(1+0.025s)}{s^3(1+0.001s)(1+0.005s)}$$

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Show that system is conditionally stable. Find the range of K for which the system is stable. (Use Bode plot).

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5. (a) Plot Root Locus-

$$G(s)H(s) = \frac{K}{s(s+4)(s^2 + 4s + 20)}$$

hence obtain.

- (i) K for } = 0.707
- (ii) K for } = 0.866
- (iii) K for } = 1.

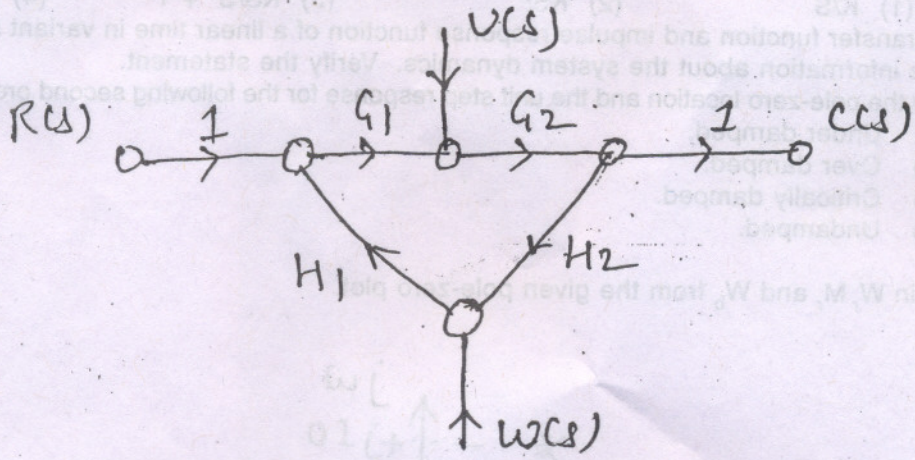
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- (b) (i) Explain in short 'synchros'.
- (ii) Explain in short 'servomechanisms'.

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6. (a) Find the value of C(s) using Mason's Gain Formula-

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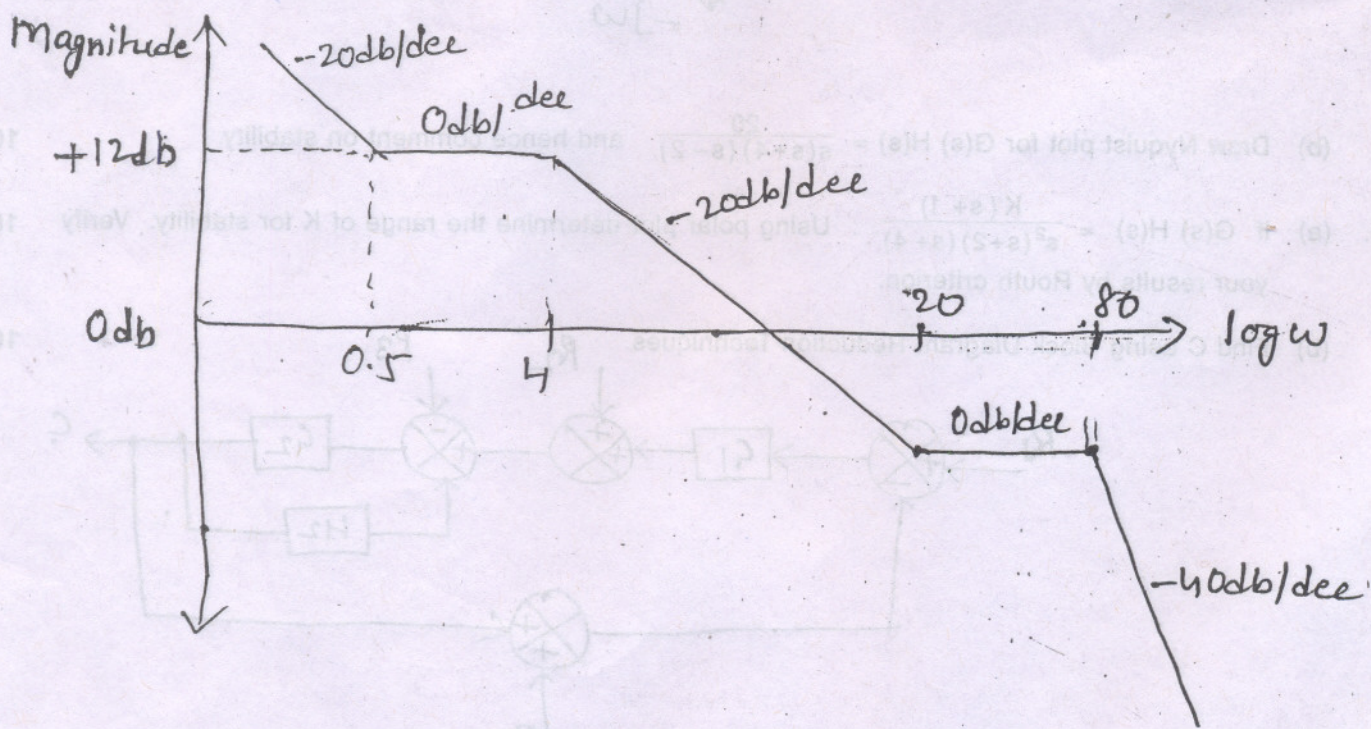
- (b) (i) What is principle of argument ? Explain in brief.
- (ii) Write short note on M and N circles.

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7. (a) Find open loop transfer function from given Bode plot-

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- (i) Without any correction at $w = 80$ rad/sec.
- (ii) With correction of + 4 db at $w = 80$ rad/sec.



(b) A feedback control system is represented by the differential equation $\frac{d^2c}{dt^2} + 6.4 \frac{dc}{dt} = 160e$ where $e = r - 0.4 C$. C denotes the output variable. Find the value of damping ratio and what information does this convey about the transient behaviour of the system.

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