2015

M.Sc.

3rd Semester Examination

ELECTRONICS

PAPER—ELC-302

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(Control System and Instrumentation)

Answer *Q. No. 1* and any *three* questions from the rest.

1. (a) Show the use of feedback in control system reduces the sensitivity of the system to parameter variation.

   (b) What is called an 'Offset' in a proportional controller ? How is offset eliminated with the help of integral control mode ?

   (c) Calculate the dynamic range of a spectrum analyzer with a third order intercept point of 20 dBm and a noise level of 100 dBm.

(d) How damping ratio affects the tune response of a second order system ?

(e) What are the necessary conditions to have all the roots of a characteristic equation in the left half of S-plane ?

2. (a) The output of a system is given by

$$C(t) = 2 + 0 \cdot 2\, e^{-60t} - 1 \cdot 2\, e^{-10t}$$

when subjected to a unit step unit :

(i) Obtain the expression for the closed loop transfer function.

(ii) Determine the undamped natural frequency & damping ratio of the system.

(b) The open loop transfer function of unity feedback system is given by

$$G(S) = \frac{50}{(1+0 \cdot 1S)(S+10)}$$

Determine the static error co-efficients K_p, K_v and K_a.

5+5

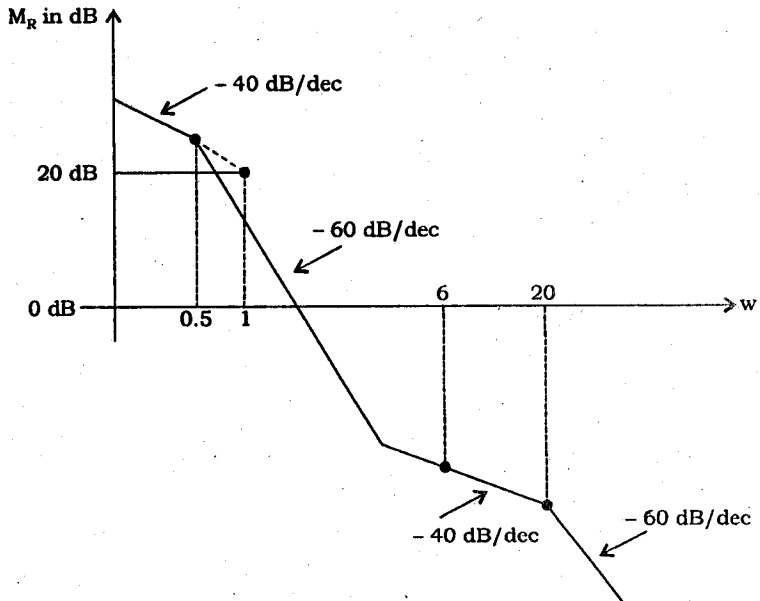3. (a) Sketch the Bode plot of the system :

$$G(S) = \frac{1}{(S+3)^3}$$

(b) The open loop transfer function of a unity feedback system is given by

$$G(S)\, H(S) = \frac{5}{S(S+1)(S+2)}$$

Draw the Nyquist plot & hence find out whether the system is stable or not.

4+6

4. (a) Determine the transfer function from the magnitude plot shown below :

(b) The characteristics equation for certain feedback control system is given below. Determine the range of K for which the system is stable :

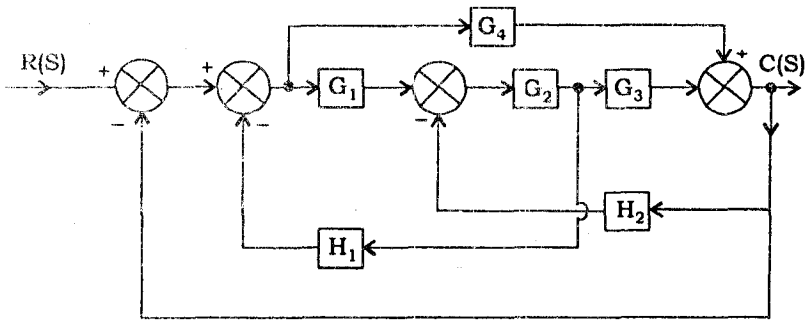$$S^3 + 2KS^2 + (K+2)S + 4 = 0$$

6+4

5. (a) What is an instrumentation amplifier ? How a basic differential amplifier is modified to a grounded load instrumentation amplifier ?

(b) For a Unity feedback system

$$G(S) = \frac{10}{S(S+1)(S+4)}$$

Obtain analytically the gain margin and phase margin.

(1+3)+6

6. (a) Use block diagram reduction rules to obtain the transfer function of the block diagram shown below :

(b) Briefly explain the working principle of Dual-trace oscilloscope of a CRO.

5+5

[Internal Assessment — 10]