PG/IIIS/EL-2102/10

M.Sc. 3rd Semester Examination, 2010

ELECTRONICS

(*Control System and Instrumentation*)

PAPER—EL-2102

Full Marks : 50

Time : 2 hours

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

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

1. (*a*) Define the terms 'Gain Margin' and 'Phase Margin' related to the stability of the system.

(*b*) Find the z-transform of $\sin \omega t$.

(*c*) What are advantages of digital instruments over analog instruments ?

(*d*) For the system having

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

Find the characteristic equation.

(*e*) What do you mean of integral and derivative control? 2×5

2. A system is described by the following set of algebraic equations :

$$X_2 = 8X_1 + 2X_3 + 3X_4 + X_5$$
$$X_3 = 4X_2$$
$$X_4 = 5X_3 + 2X_4$$
$$X_5 = 2X_3 + 3X_4$$

where, X_1 is the input node and X_5 is the output node.

(*a*) Draw complete signal flow graph.

(*b*) Using the results of (*a*), find the overall gain of the system. Using Mason's gain formula. 4 + 6

3. Draw the signal flow graph of the circuit as shown in *Fig*.1 and then find (V_3/V_1). 10

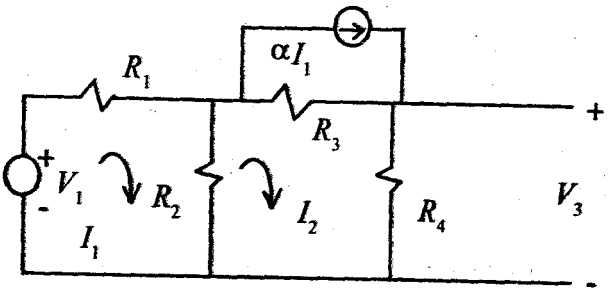

Fig. 1

4. (*a*) The open loop transfer function of a feedback control system is given by

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

Using Routh stability criteria, determine the range of K for which system will be stable.

(*b*) Draw the labelled block diagram model of a Cathode Ray tube.

(*c*) Explain the working principle of an Audio frequency wave analyser using necessary block diagram. 5 + 2 + 3

5. (*a*) What do you mean by CMRR of a differential amplifier ?

(*b*) A balanced output source provides a signal of 30 mV from each terminal to ground. This provides a difference signal of 60 mV for a differential amplifier. The noise signal common to both terminals is 600 mV. The difference gain of the amplifier is 150, while the common mode gain is 0·04. What is the ratio of signal to noise ratio at the output ? Find % reduction in noise signal.

(*c*) Explain working principle of a function generator using block diagram. 2 + 4 + 4

6. Write the working principle and the functioning of wave and spectrum analyzers after drawing the block diagrams. 5 + 5

[*Internal Assessment* : 10 Marks]