M.Sc. 3rd Semester Examination 2009

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. Answer *all* questions : 5×2

(*a*) For the system having

$$G(s)\, H(s) = \frac{S+2}{(S+1)(S+3)}$$

Find the characteristic equation.

(Turn Over)

(b) A system is described by following differential equation:

$$\frac{5 d^2 y}{dt^2} + \frac{3 dy}{dt} + 2y = \frac{dx}{dt} + 2x$$

where 'x' is input and 'y' is output. Find the transfer function of the system.

(c) Find the z transform of a^k.

(d) Define the terms:
'Gain Margin' and 'Phase Margin'.

(e) What is the function of 'Astigmatism' in CRO ?

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

$$X_2 = 10X_1 - 5X_3 - 2X_4 - X_5$$
$$X_3 = 5X_2$$
$$X_4 = 2X_3 + 2X_4$$
$$X_5 = 3X_3 + X_4$$

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

(Continued)

(a) Draw complete flow graph.

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

3. (a) Sketch the Bode plot of $H(s)$ given by

$$H(s) = \frac{S}{(S+1)(S+10)}.$$

(b) For the operational amplifier circuit as shown in *Fig.* Q. 3 (b) show with an example that same circuit could be used as multiplier as well as divider.
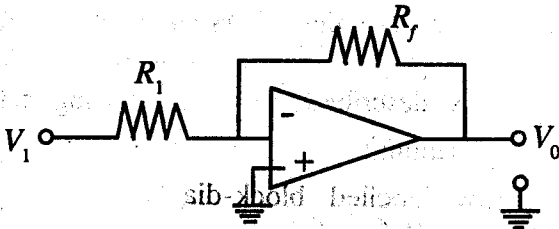

Fig. Q. 3 (b)

6 + 4

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

$$G(s)\ H(s) = \frac{1}{S(S+2)(S^2+2S+1)}.$$

Using Hurwitz criteria, test whether the system is stable or not.

(b) For the closed loop control system as shown in *Fig.* Q. 4 (b), determine the value of '*K*' such that, the system will have a damping ratio of 0·8 and undamped natural (angular) frequency of 4 rad/sec.
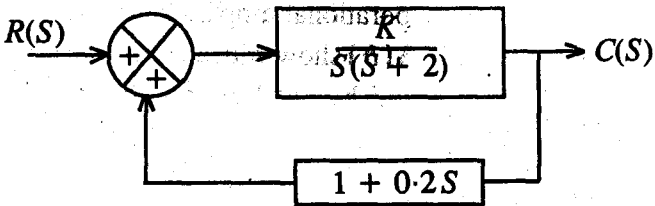

Fig. Q. 4 (b)

5 + 5

5. (a) Draw labelled block-diagram model of a Cathode Ray tube.

(b) What is the difference between micro-wave and milli-meter wave signal generators ?

(c) Draw the block diagram model of a function generator and explain its operation. 3 + 2 + 5

(*Continued*)

6. (*a*) What is wave analyser ? Mention its field of application. Explain the operation of a heterodyne type wave analyser with necessary block diagram.

(*b*) What is spectrum analyser ? Explain its working principle with a block diagram.

$(1 + 1 + 2 + 2) + (1 + 3)$

[*Internal Assessment* : 10 Marks]

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