M.Sc. 3rd Semester Examination, 2012

ELECTRONICS

(*Control System and Instrumentation*)

[Theory]

PAPER—ELC-302

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) Find the Z-transform of cos *wt*.

   (b) What are advantages of digital instruments over analog instruments ?

(c) Define the terms : 'Gain Margin' and 'Phase Margin' related to the stability of the system.

(d) For a closed loop control system the characteristics equation is given by

$q(s) = s^2 + s (2 + 0.225 K) + K$
$= 0$

If the natural frequency of this system is 4 rad/s, find the damping ratio.

(e) What is the function of 'Astigmatism' in CRO. 2×5

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

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

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

(i) Draw the complete signal flow graph.

(ii) Determine the overall gain of the system using Mason's gain formula. $4 + 6$

(Continued)

3. (a) Draw the Bode-plot of the system given by   6

$$H(s) = \frac{10s(s+2)}{(s+1)(s+5)}$$

(b) Draw the lebelled block diagram model of a Cathode Ray tube.   2

(c) What is the difference between dual beam and dual trance Cathode Ray oscilloscopes ?   2

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 values of 'K' for which the system will be stable.   5

(b) The Fig Q. 4 (b) shows the unity feedback control system without derivative control. For this system damping ratio has to be made 0·8 using

derivative control. Find the value of $T\alpha$ and the steady state error. 5
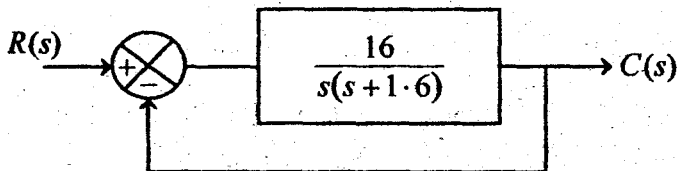

Fig Q. 4 (b)

(a) State the name of the analyser that can be used to measure and analysis of noise and vibration signals generated by the machines and apparatus of the industries. Explain with block diagram model of this type of analyser. 1 + 4

(b) A balanced output source provides a signal of 30 mV from each terminal to ground of a differential amplifier. The noise signal common to both terminals of this amplifier is 600 mV. The difference gain of the amplifier is 200, while common mode gain is 0·05. Find (*i*) the signal to noise ratio at the output and (*ii*) % reduction in noise signal. 3 + 2

(*Continued*)

6. (a) Explain with block diagram, the working principle of a function generator. State the types of signals generated and its field of application. 3 + 1 + 1

(b) What is the function of distortion analyser ? 2

(c) Explain with block diagram model the working principle of a spectrum analyser. 3

[*Internal Assessment* = 10 Marks]

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MV—50