2008

ELECTRONICS

[1st Semester]

PAPER—EL-1103

Full Marks : 50

Time : 2 hours

Answer **Q. No. 1** and any **three** 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

[University written examination—40 Marks
Internal Assessment—10 Marks]

1. Answer *all* questions: 2x5

(*a*) What do you mean by the characteristic impedance of a network ?

(*b*) Obtain the Laplace transform of $e^{-at} \sin \omega t$.

(*c*) The system function of a network is given by

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

Test whether it is a positive real function or not.

(*d*) What do you mean by resonance? Define Q factor in a series LCR circuit.

(*e*) Distinguish between active and passive filters.

2. (*a*) Draw the pole-zero diagram of the system function

$$H(s) = \frac{s(s+3)}{(s+1)(s^2+4s+13)}.$$

(*b*) For the circuit as shown in Fig. **Q. 2 (*b*)**, find the current I using superposition theorem.

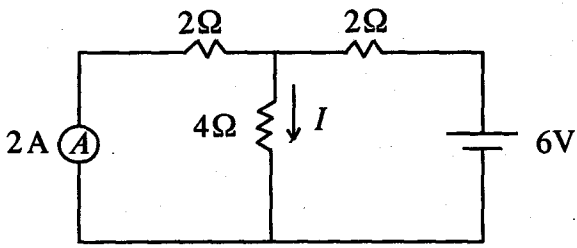

Fig. **Q. 2 (*b*)**

5 + 5

3. (*a*) Derive an expression for the cut-off frequency of a constant *k*-high-pass filter.

(*b*) Design a *T* and π section constant *k*–high pass filter having cut–off frequency 10 kHz, and design impedance (R_0) is 500 Ω. Also find (*i*) its characteristic impedance at 25 kHz (*ii*) attenuation at 6 kHz. 4 + (4 + 1 + 1)

4. (*a*) Write down the necessary condition of stability of a network function [$F(s)$].

(*b*) The driving point impedance of a LC network is given by

$$Z(s) = \frac{6s^3 + 2s}{12s^4 + 8s^2 + 1}.$$

Develop the Cauer first form network for given function.

(*c*) What do you mean by Bode diagram? 3 + 5 + 2

5. (*a*) Write down the difference between 'Band-pass' and 'Band-stop' filters.

(*b*) A simple RC low pass filter is to be design that the output voltage be attenuated at 3 dB. at 50 Hz. Calculate the time constant and the suitable values of R and C.

(*c*) Calculate the upper and lower cut-off frequencies and voltage amplification between these two frequencies for a band-pass active filter.

Given: $R_1 = R_2 = 10\ \text{k}\Omega$

$R_{f1} = R_{f2} = 100\ \text{k}\Omega$

$R_L = R_H = 10\ \text{k}\Omega$

$C_L = 1\mu\text{F},\ C_H = 1\text{pF}$.

2 + 4 + 4

6. (*a*) What are the condition of a polynomial is said to be Hurwitz?

(*b*) Check whether the following polynomial are Hurwitz:

$$P(s) = s^5 + s^3 + 5.$$

(c) Find the second Foster form of the driving point admittence function

$$Y(s) = \frac{s(s^2 + 4)}{2(s^2 + 1)(s^2 + 9)}.$$

2 + 3 + 5