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Question Paper Code : 11233

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth Semester

Electrical and Electronics Engineering

080280038 — NETWORK ANALYSIS AND SYNTHESIS

(Common to 080280015 – Network Analysis and Synthesis for B.E. (Part – Time), Second Semester, Electrical and Electronics Engineering)

(Regulation 2008)

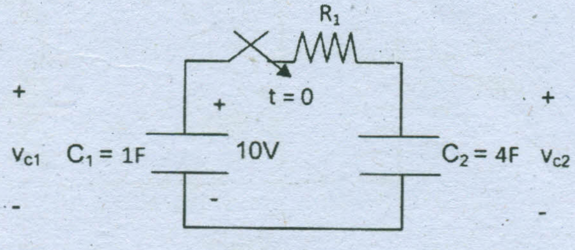
Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the natural resonant frequency, $|\beta|$ of a series RLC circuit with $R = 200\,\Omega$, $L = 0.1H$, $C = 5\mu F$.

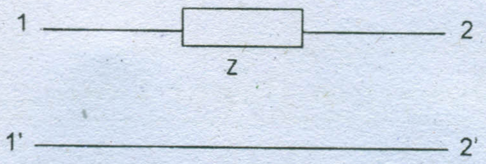
2. A charged capacitor C_1 is connected to a series combination of R_1 and C_2 at $t = 0$ as shown below. Find the voltages V_{C1} and V_{C2} at $t = 0^+$ if $R_1 = 0\,\Omega$.



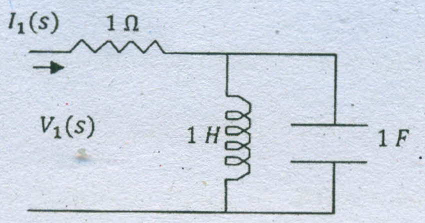
3. A phasor current $25\angle 40^\circ$ A has complex frequency $s = -2 + j3s^{-1}$. What is the magnitude of $i(t)$ at $t = 0.2s$?

4. Find the average power in a resistor $R = 10\,\Omega$, if the current in Fourier series form is $i = 10\sin\omega t + 5\sin 3\omega t + 2\sin 5\omega t(A)$.

5. Find the z and y parameters if they exist for the two-port network shown below.



6. Find the driving point admittance function for the network shown.



7. Define cut-off frequency and image impedance of a filter network.

8. What is constant k filter? Why it is called prototype filter section?

9. Test whether the polynomial $P(s) = s^4 + 3s^2 + 2s + 12$ is Hurwitz.

10. Where will be the location of poles and zeros of an LC immittance function?

PART B — (5 × 16 = 80 marks)

11. (a) (i) In the circuit of Fig. 1, the switch has been in position 1 for sufficient time to establish steady-state conditions. The switch is then moved to position 2. Find the current transient and the energy dissipated in the resistors during the transient. (10)

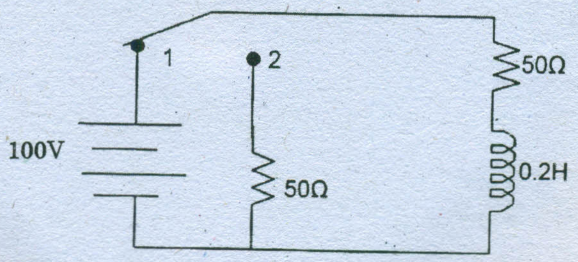


Fig.1

(ii) A transient that increases from zero toward a positive steady-state magnitude is 49.5 at $t_1 = 5.0ms$ and 120 at $t_2 = 20.0ms$. Obtain the time constant τ. (6)

Or

(b) (i) A series RC circuit with $R = 100\,\Omega$ and $C = 25\mu F$ has sinusoidal voltage 200 sin 500t applied at t = 0. Find the expression for current. The initial charge on capacitor is zero. (8)

(ii) A series RLC circuit with $R = 100\,\Omega$, $C = 100\,\mu F$ and $L = 0.1H$ has a constant voltage 200 V applied at $t = 0$. Find the current transient, assuming zero initial charge on the capacitor. (8)

12. (a) Find poles and zeros of $H(s) = 10/\left(s^2 + 2s + 26\right)$. Place them in the s-domain and use the pole-zero plot to sketch $H(i\omega)$. (16)

Or

(b) Find the Fourier series for the waveform shown in Fig. 2. (16)

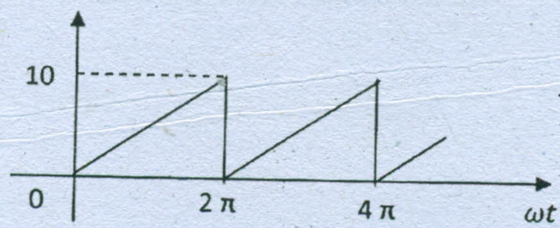


Fig.2

13. (a) (i) Determine the open-circuit impedance parameters of the two-port network shown in Fig.3. (10)

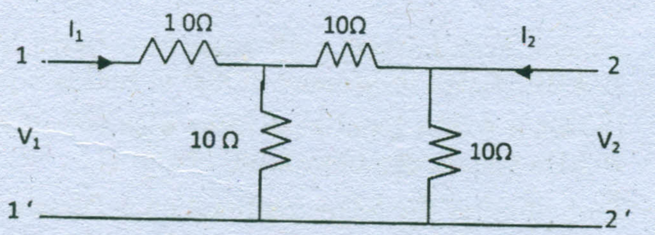


Fig.3

(ii) The two currents of a two-port network are

$I_1 = 2V_1 - V_2$

$I_2 = -V_1 + 4V_2$

What is the equivalent π – network? (6)

Or

(b) (i) The following equation gives the voltage and current at the input port of a two-port network. Determine the transmission parameters. (6)

$V_1 = 5V_2 - 3I_2$

$I_1 = 6V_2 - 2I_2$

(ii) Determine the image parameters of the T network shown in Fig. 4. (10)

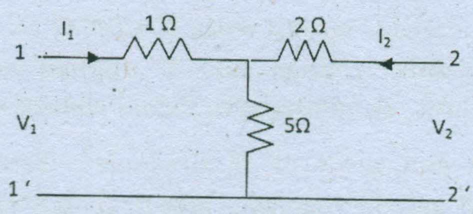


Fig.4

14. (a) (i) Obtain the characteristic impedance of the symmetrical T network shown in Fig. 5. (8)

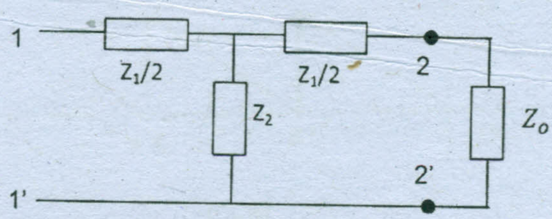


Fig.5

(ii) Design a constant k low pass filter with a cut-off frequency of 1 kHz, and design impedance of 500 Ω. (8)

Or

(b) (i) Design a m-derived high pass filter with a cut-off frequency of 10 kHz, design impedance of 600 Ω and $m = 0.3$. (8)

(ii) Design a k-type band pass filter with cut-off frequencies 1 kHz and 10 kHz and design impedance of 500 Ω. (8)

15. (a) (i) Test whether the following function is Positive real. (6)

$$Z(s) = \frac{s^2 + 2s + 25}{(s+4)}$$

(ii) Synthesize the following RC impedance function in Foster forms. (10)

$$Z(s) = \frac{2(s+2)(s+4)}{(s+1)(s+3)}$$

Or

(b) (i) Syntheize the following LC impedance function in Cauer II form. (8)

$$Z(s) = \frac{s^3 + 2s}{s^4 + 4s^2 + 3}$$

(ii) Synthesize the following RL impedance function in Cauer I form. (8)

$$Z(s) = \frac{(s+1)(s+4)}{(s+5)(s+3)}.$$