A 234

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Third Semester

Electronics and Communication Engineering

EC 231 — NETWORK ANALYSIS AND SYNTHESIS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Give example of a 2–port network for which the z–parameters do not exist.

2. A series RLC network consists of R = 1 Ω, L = 1 h and C = 0.25 farad. Is the network under damped, over damped or critically damped?

3. Given the state matrix A, how do you define the state transition matrix?

4. Define tree and co–tree of a network graph.

5. What are the different forms of realizing an immittance function?

6. Show whether the given polynomial is Hurwitz or not $P(s) = 4s^3 + 2s^2 + 2s + 1$.

7. Show how you can transform a low–pass filter transfer function to a high–pass filter transfer function.

8. What is the necessity for frequency and impedance denormalization?

9. Define Biquad sensitivity of an active filter?

10. What is the effect of the quality factor on the selectivity of a filter?

PART B — (5 × 16 = 80 marks)

11. Discuss the merits of an Op-Amp based active filter. Design a seventh order active low-pass RC sallen-key filter for a load of 20 kΩ and having a pass band upto 10 N/rad/sec. (4 + 12)

12. (a) Find the sinusoidal steady state voltage across the capacitor for the circuit shown in Figure 12 (a). Let W = 10 rad/sec, R = R_L = 1 Ω, L = 0.1 h, C = 0.025 f and Rc = 2 Ω. (16)

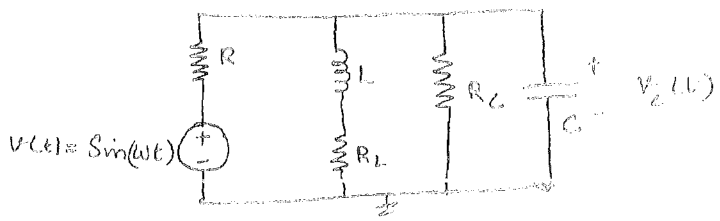

Figure 12 (a)

Or

(b) For the network shown in Figure 12 (b), set up a differential equation and solve for the voltage $v_L(t)$. (16)

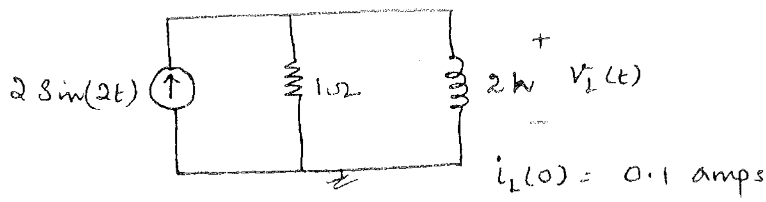

Figure 12 (b)

13. (a) Realize the given two port transfer function $T(s) = \frac{s^2}{(s+1)(s+3)}$. (16)

Or

(b) Realize the given impedance function using Caner forms I and II $Z(s) = \frac{s^2+2}{s(s^2+4)}$. (16)

14. (a) Find the solution of the state equation $\dot{X} = AX + bu$, where [illegible] and $u(t)$ is a unit step function $A = \begin{bmatrix} 0 & -w \\ -w & 0 \end{bmatrix}$; $b = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$; $X_0 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$. (16)

Or

(b) For the network shown in Figure 14 (b), $v_2(0) = 1$ V, $i_3(0) =$ [illegible] and $v_4(0) = 0$. Set up matrix equations using graph theory, to solve for branch currents and branch voltages. (16)

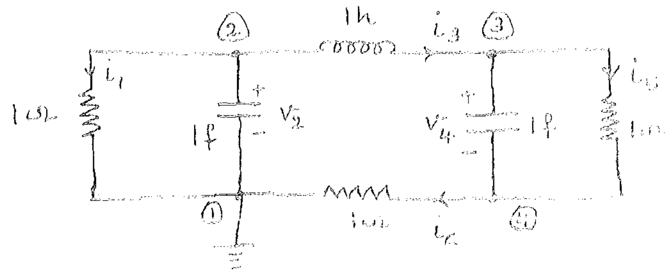

Figure 14 (b)

15. (a) Obtain an approximate transfer function having a maximally flat characteristics for the given specifications. $w_p = 1$ rad/sec, $w_s = 4$ rad/sec. (16)

$w \geq w_p$; $\alpha \leq 3\,\text{dB}$

$w \leq w_s$; $\alpha \geq 60\,\text{dB}$

Or

(b) Discuss with proper justification, how you can transform a low–pass transfer function to a high–pass, band–pass and band–reject transfer functions. (16)
