

EECS70A / CSE 70A Network Analysis I
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Midterm II solution

Grading criteria: for all questions, no credits for answers without units and -5pts for each wrong unit.

Problem 1:

Criteria: (a) $V_o / V_s = 0.05$ and (b) $R_{eq} = 40 \text{ k}\Omega$

From the circuit, $R_{eq} = R_1 + R_2 \parallel 5 \text{ k}\Omega = 40 \text{ k}\Omega$

Using voltage divider: $V_o = V_s \cdot (R_2 \parallel 5 \text{ k}\Omega) / (R_1 + R_2 \parallel 5 \text{ k}\Omega)$

$$V_o / V_s = (R_2 \parallel 5 \text{ k}\Omega) / (R_1 + R_2 \parallel 5 \text{ k}\Omega) = 0.05$$

$$(R_2 \parallel 5 \text{ k}\Omega) = 0.05 \times 40 \text{ k}\Omega = 2 \text{ k}\Omega$$

$$(R_2 \times 5 \text{ k}\Omega) / (R_2 + 5 \text{ k}\Omega) = 2 \text{ k}\Omega$$

$$R_2 = 0.4 R_2 + 2 \text{ k}\Omega$$

$$\therefore R_2 = 3.3 \text{ k}\Omega$$

$$\therefore R_1 = 40 \text{ k}\Omega - R_2 \parallel 5 \text{ k}\Omega = 38 \text{ k}\Omega$$

Grading criteria: -5pts for every incorrect equation
-2pts for each wrong substitution
-2pts for wrong final answers

Problem 2:

To have maximum possible power supplied to the load, $R_{Th} = R_L = 10 \Omega$

$$W_{max} = V_{Th}^2 / 4R_{Th} = (40)^2 / (4 \times 10) = 40 \text{ W}$$

Grading criteria: -5pts for incorrect equation
-5pts for wrong R_L
-5pts for wrong substitutions
-2pts for wrong final answer

Problem 3:

$$10\mu\text{F} + 1 / (1/C + 1/20\mu\text{F}) = 20\mu\text{F}$$

$$1/C + 1/20\mu\text{F} = 1/10\mu\text{F}$$

$$\therefore C = 20\mu\text{F}$$

Grading criteria: -5pts for incorrect equation
-2pts for wrong answer, with right equation

Problem 4:

$$R_{\text{Th}} = 10\Omega \parallel 40\Omega = 8\Omega$$

$$V_{\text{Th}} = 20\text{ V} \times (40\Omega / (40\Omega + 10\Omega)) = 16\text{ V}$$

Grading criteria: -10pts for each wrong answer without showing any derivations
-5pts for each wrong equation
-2pts for wrong answer, with right equations

Problem 5:

$$v_o = -1\text{ V}$$

Grading criteria: -5pts for incorrect KCL equation
-2pts for wrong answer
-10pts for wrong answer and without KCL equation