**EECE 210 – Quiz 1**

**October 31, 2009**

10%

1. The current in a 1 μF capacitor is shown in the figure as a function of time. The total energy stored in μJ is:



A. 40

B. 100

C. 200

D. 50

E. 25

**Solution:** *q* at 4 ms is  μC. The energy in μJ is *W* = , where *C* is in μF.

Version 1: *C* = 1 μF, *W* = 200 μJ

Version 2: *C* = 2 μF, *W* = 100 μJ

Version 3: *C* = 4 μF, *W* = 50 μJ

Version 4: *C* = 5 μF, *W* = 40 μJ

Version 5: *C* = 8 μF, *W* = 25 μJ

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2. If *VSRC* = 10 V, determine *Rx* so that *Ix* = 0.

A. 5 Ω

B. 1.25 Ω

C. 2.5 Ω

D. 1 Ω

E. 1.67 Ω

**Solution:** When *Ix* = 0, , or  Ω.

Version 1: *VSRC =* 10 V*, Rx =* 5 Ω

Version 2: *VSRC =* 15 V*, Rx =* 2.5 Ω

Version 3: *VSRC =* 20 V*, Rx =* 5/3 Ω

Version 4: *VSRC =* 25 V*, Rx =* 1.25 Ω

Version 5: *VSRC =* 30 V*, Rx =* 1 Ω

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3. If *R* = 10 Ω, determine the ratio *ρ*/*α* so that *I*1 = *I*2.



A. 4 Ω

B. 10 Ω

C. 6 Ω

D. 5 Ω

E. 8 Ω

**Solution:** , , or

, which gives *ρ*/*α* *= R.*

Version 1: *R =* 10 Ω*, ρ*/*α* *=* 10

Version 2: *R =* 8 Ω*, ρ*/*α* *=* 8

Version 3: *R =* 6 Ω*, ρ*/*α* *=* 6

Version 4: *R =* 5 Ω*, ρ*/*α* *=* 5

Version 5: *R =* 4 Ω*, ρ*/*α* *=* 4

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4. In the figure shown, the 24 V source having a source resistance of 1 Ω is replaced by the equivalent current source, the load resistance *RL* being the same. If *RL* = 5 Ω, the ratio of the power delivered by the **ideal** current source to the power delivered by the **ideal** 24 V source is:

A. 5

B. 11

C. 7

D. 14

E. 9

**Solution:** The power delivered by the ideal voltage source is . The equivalent current source is an ideal current source of 24 A in parallel with 1 Ω. The power

delivered by the current source is . The ratio of the powers is numerically equal to *RL*.

Version 1: *RL =* 5 Ω*,* ratio is5

Version 2: *RL =* 7 Ω*,* ratio is7

Version 3: *RL =* 9 Ω*,* ratio is9

Version 4: *RL =* 11 Ω*,* ratio is11

Version 5: *RL =* 14 Ω*,* ratio is14

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5. Determine *VO* in the circuit shown if *R* = 1 Ω

A. 18 V

B. 12 V

C. 30 V

D. 6 V

E. 24 V

**Solution:** The current through *R* is 6 A, so that *VO* = 6*R*.

Version 1: *R =* 1 Ω*, VO* =6 V

Version 2: *R =* 2 Ω*, VO* =12 V

Version 3: *R =* 3 Ω*, VO* =18 V

Version 4: *R =* 4 Ω*, VO* =24 V

Version 5: *R =* 5 Ω*, VO* =30 V

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6. Given the source connections shown. Determine the actual power delivered or absorbed by each source. (Six grade points for each answer plus 1 bonus grade).

**Solution:** *IX* = 0.8×20 = 16 A. Current in 20 V source is 6 A in the direction of a voltage rise. Voltage across dependent voltage source is 0.5×16 = 8 V. Voltage across dependent current source is 20 – 8 = 12 V. It follows that:

Power delivered by 20 V source is 20×6 = 120 W

Power delivered by 10 A source is 20×10 = 200 W

Power absorbed by dependent current source is 12×16 = 192 W

Power absorbed by dependent voltage source is 8×16 = 128 W

25%



7. Determine *VSRC*, *ISRC*, and the voltages across the four resistors in the circuit shown. (Four grade points for each answer plus 1 bonus grade).

**Solution:** Going CCW around the upper mesh:



4 +12*I*1 – 8*I*2 = 0

Going CW around the lower mesh:

4 – 6(*I*1 + 1.5) + 22(*I*2 – 1.5) = 0

The two equations reduce to:

3*I*1 – 2*I*2 = -1

-3*I*1 + 11*I*2 = 19

This gives: *I*1 = 1 A; *I*2 = 2 A. Hence,

Voltage across 12 Ω resistor: 12 V

Voltage across 6 Ω resistor: 15 V

Voltage across 8 Ω resistor: 16 V

Voltage across 22 Ω resistor: 11 V

*VSRC* = 27 V

*ISRC* = 3 A.