ECE-202
Final Exam
December 19, 2008

Babak Ziaie 10:30 MWF | Chin-Lin Chen 12:30 MWF

Section 00001 | Section 0002

Name: ________________________________
(Please print clearly)

Student ID: ________________

INSTRUCTIONS

- This is a closed book, closed notes exam. No scrap paper or calculators are permitted. A transform tables will be available.
- Carefully mark your multiple choice answers on the scantron form. Work on multiple choice problems and marked answers in the test booklet will not be graded. Nothing is to be on the seat beside you.
- When the exam ends, all writing is to stop. This is not negotiable. No writing while turning in the exam/scantron or risk an F in the exam.
- All students are expected to abide by the customary ethical standards of the university, i.e., your answers must reflect only your own knowledge and reasoning ability. As a reminder, at the very minimum, cheating will result in a zero on the exam and possibly an F in the course.
- Communicating with any of your classmates, in any language, by any means, for any reason, at any time between the official start of the exam

and the official end of the exam is grounds for immediate ejection from the exam site and loss of all credit for this exercise.

1. The inverse Laplace transform of $F(s) = \frac{4s^2 - 9}{s(s-9)}$ includes a term of Ae^{9t}, A is given by

(1) 37 (2) 2

(3) 35 * (4) 4

(5) –1 (6) 6

(7) None of these.

2. The Laplace transform of the following function f(t) is

(1) $\frac{3}{s}-\frac{5e^{-s}}{s}+\frac{2e^{-2s}}{s}$ *

(2) $\frac{3}{s}+\frac{3e^{-s}}{s}+\frac{2e^{-2s}}{s}$

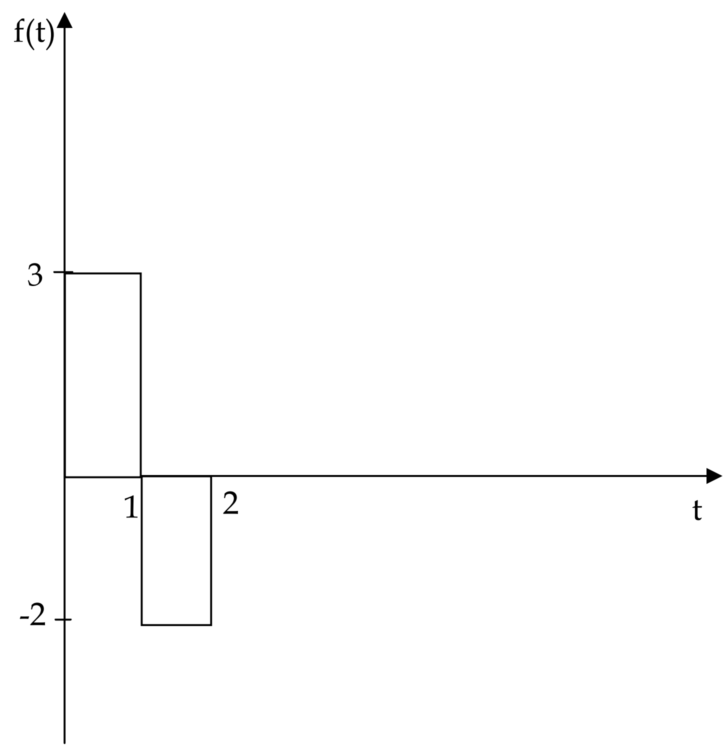
(3) $3-3e^{-s}+2e^{-2s}$

(4) $5-3e^{-s}+2e^{-2s}$

(5) $\frac{3}{s}-\frac{3e^{-s}}{s}+\frac{2e^{-2s}}{s}$

(6) $\frac{3}{s}+\frac{5e^{-s}}{s}-\frac{2e^{-2s}}{s}$

(7) None of these



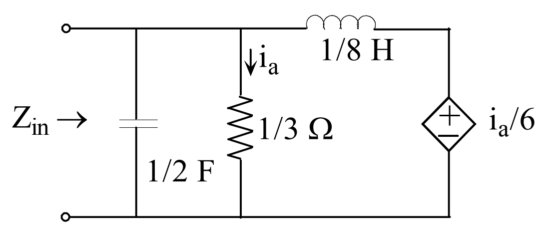
3. For the circuit shown below, $Z_{in}(s)$ is

(1) $\frac{2s}{s^2+6s+16}$ (2) $\frac{2}{s^2+6s+16}$

(3) $\frac{2s}{s^2+6s+8}$ * (4) $\frac{2}{s^2+6s+8}$

(5) $\frac{2s}{s^2+8s+6}$ (6) $\frac{2s}{s^2+8s+6}$

(7) None of the above



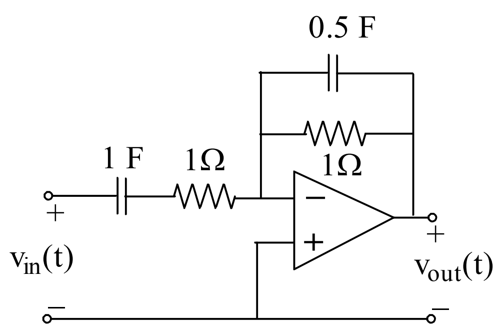
4. The transfer function $H(s) = V_{out}(s)/V_{in}(s)$ of the RC op. amp. circuit shown is

(1) $\frac{s}{(s+1)(s+2)}$ (2) $-\frac{s}{(s+1)(s+2)}$

(3) $\frac{2s}{(s+1)(s+2)}$ (4) $-\frac{2s}{(s+1)(s+2)}$ *

(5) $\frac{2s}{(s+2)^2}$ (6) $-\frac{2s}{(s+2)^2}$

(7) None of the above



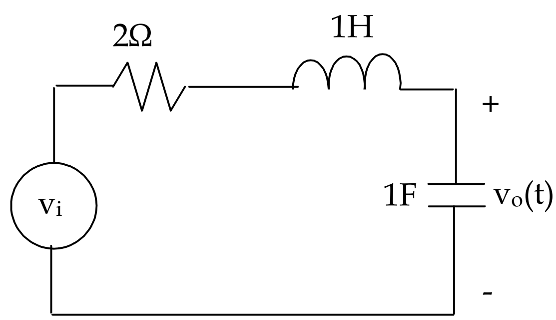
5. The impulse response of the circuit shown below is

(1) u(t) (2) ∞

(3) $te^{-t}\cos(t)u(t)$ (4) tsin(t)u(t)

(5) $te^{-t}u(t)$ * (6) tcos(t)u(t)

(7) None of the above



6. The response the circuit below to the following waveform $v_i(t)$ can be written as

(1) $[2-2te^{-t}-2e^{-t}]u(t)$

(2) $[-2te^{-t}-2e^{-t}]u(t)-[-2(t-1)e^{-(t-1)}-2e^{-(t-1)}]u(t-1)$

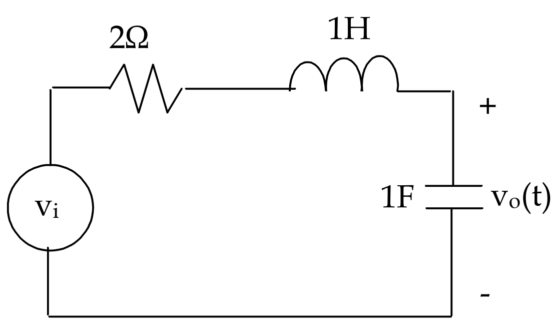
(3) $[2+2te^{-t}-2e^{-t}]u(t)-[2+2(t-1)e^{-(t-1)}-2e^{-(t-1)}]u(t-1)$

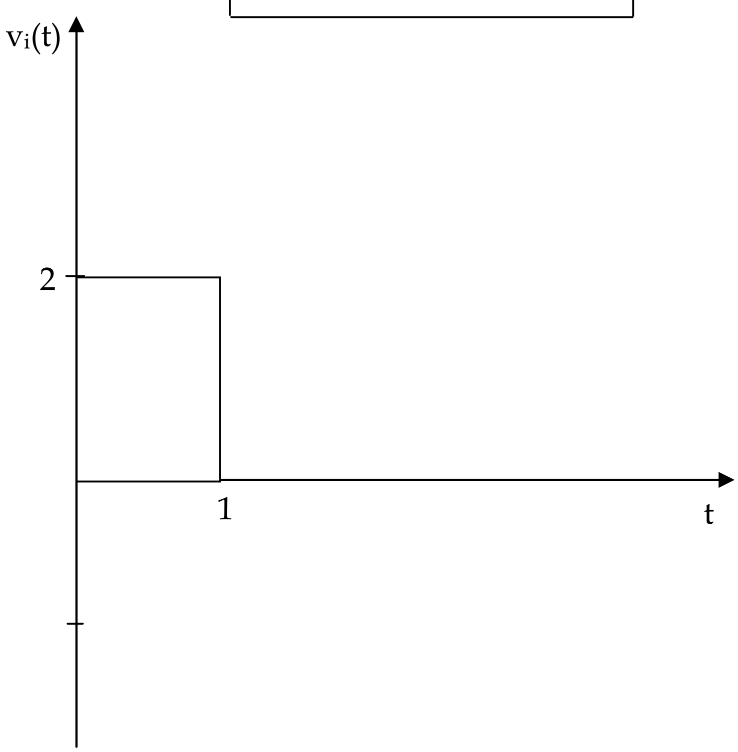
(4) $[2-2te^{-t}-2e^{-t}]u(t)-[2-2(t-1)e^{-(t-1)}-2e^{-(t-1)}]u(t-1)$ *

(5) $[2+2te^{-t}+2e^{-t}]u(t)-[2+2(t-1)e^{-(t-1)}+2e^{-(t-1)}]u(t-1)$

(6) $[2+2(t-1)e^{-(t-1)}+2e^{-(t-1)}]u(t-1)$

(7) None of the above





7. For the circuit shown below if the input is given by $v_s(t) = 2\sin(0.5t + 30^o)$, then the output is

(1) $v_o = 0$

(2) $v_o(t) = 2\cos(0.5t + 30^o)$

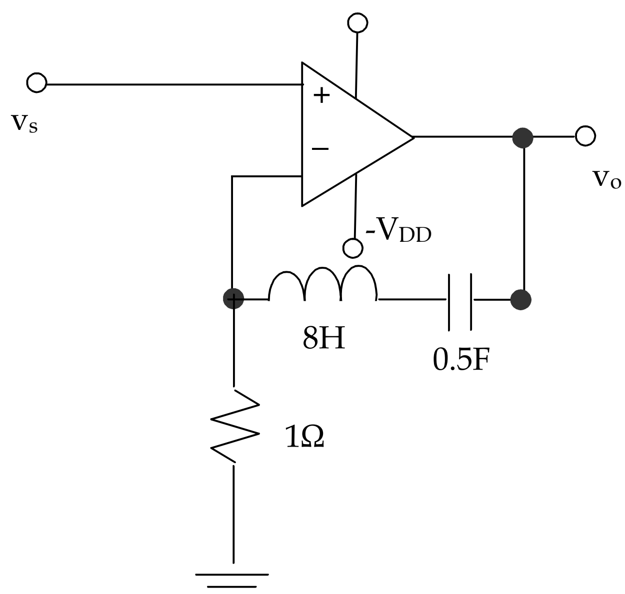
(3) $v_o(t) = \infty$

(4) V_{DD}

(5) $v_o(t) = 2\sin(0.5t+30^o)$ *

(6) $-V_{DD}$

(7) None of the above



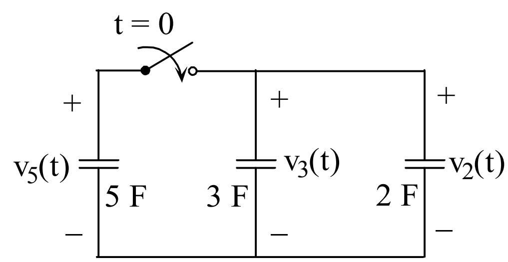
8. The switch has been opened for a long time and it closes at $t = 0$ and remains closed for $t > 0$. Prior to the switch closing, $v_5(t) = 8V$, $v_3(t) = v_2(t) = 0$ V. For $t > 0$, $v_5(t)$, in volts, is

(1) 1 (2) 2

(3) 3 (4) 4 *

(5) 5 (6) 6

(7) None of the above



9. The switch has been opened for a long time and it closes at t = 0 and remains closed for t > 0. The output voltage $V_{out}(s)$ for t > 0 is

(1) $\frac{16}{s(s+2)(s+4)}$ *

(2) $-\frac{16}{s(s+2)(s+4)}$

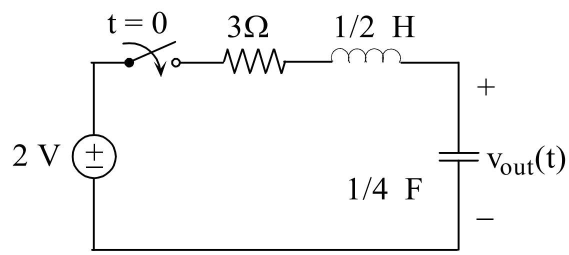
(3) $\frac{8}{s(s+2)(s+4)}$

(4) $-\frac{8}{s(s+2)(s+4)}$

(5) $\frac{16}{(s+2)(s+4)}$

(6) $-\frac{8}{(s+2)(s+4)}$

(7) None of the above



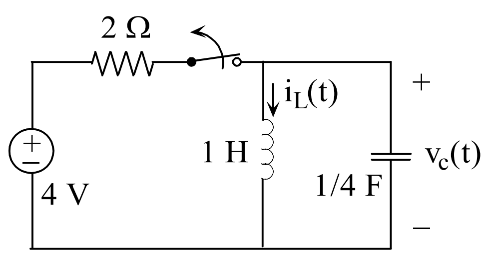
10. The switch has been closed for a long time and it opens at t = 0 and remains opened for $t > 0$. The capacitor voltage $v_c(t)$, in volts, is

(1) $-8\sin(2t)\,u(t)$ (2) $+8\sin(2t)\,u(t)$

(3) $-8\cos(2t)\,u(t)$ (4) $+8\cos(2t)\,u(t)$

(5) $-4\sin(2t)\,u(t)$ * (6) $+4\cos(2t)\,u(t)$

(7) None of the above



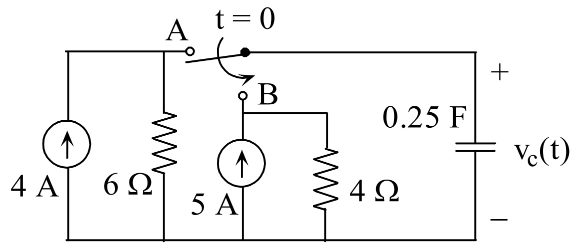
11. The switch has been at position A for a long time and it turns to position B at t = 0 and remains there for t > 0. The capacitor voltage $v_c(t)$ is the output. The zero input response of the circuit for t > 0 is

(1) $[20 + 4e^{-t}]\,u(t)$ (2) $[20 - 20\,e^{-t}]\,u(t)$

(3) $[20 + 44e^{-t}]u(t)$ (4) $4e^{-t}\,u(t)$

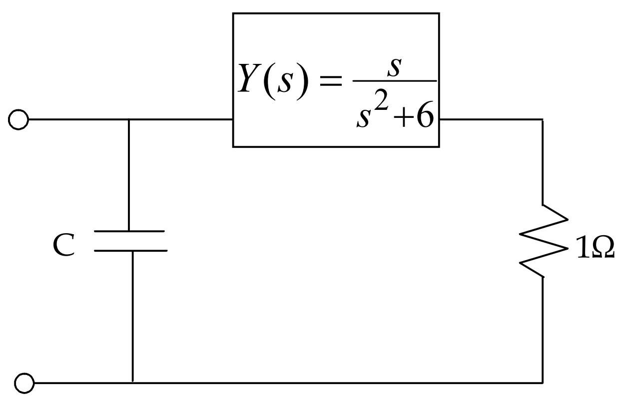
(5) $44e^{-t}\,u(t)$ (6) $24\,e^{-t}\,u(t)$ *

(7) None of the above



12. For the circuit shown below, the value of C such that the circuit is resonant at ω = 3 rad/s.

(1) 8 F
(2) 1/6 F *
(3) 0.125 F
(4) 0.25 F
(5) 1 F
(6) 1/9 F
(7) None of the above



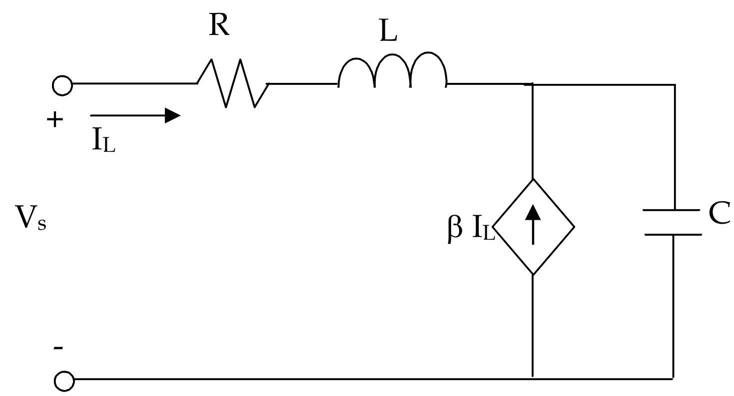
13. For the circuit shown below, the resonant frequency is given by

(1) $\sqrt{\frac{\beta}{LC}}$ (2) $\sqrt{\frac{1}{LC}}$

(3) $\sqrt{\frac{\beta^2}{LC}}$ (4) $\sqrt{\frac{\beta-1}{LC}}$

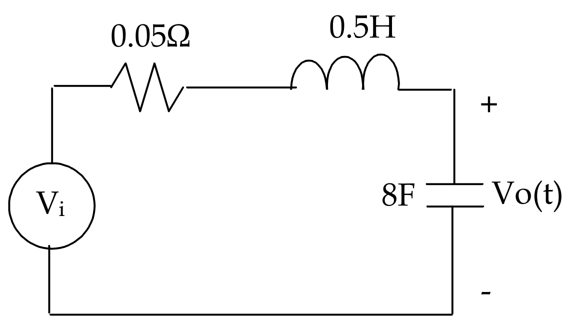
(5) $\sqrt{\frac{1}{(\beta+1)LC}}$ (6) $\sqrt{\frac{\beta+1}{LC}}$ *

(7) None of the above



14. For the band pass circuit shown below, after scaling the resistance is to be 50 Ω and resonant frequency is to be 100 rad/s. After scaling the value of C^{new} is

(1) 0.4 μ F
(2) 40 μ F*
(3) 1.6 mF
(4) 0.8 mF
(5) 8 μ F
(6) 80 μ F
(7) None of the above



15. The circuit shown below is:

(1) High pass filter with a high frequency gain of 10

(2) Low pass filter with a DC gain of –5 *

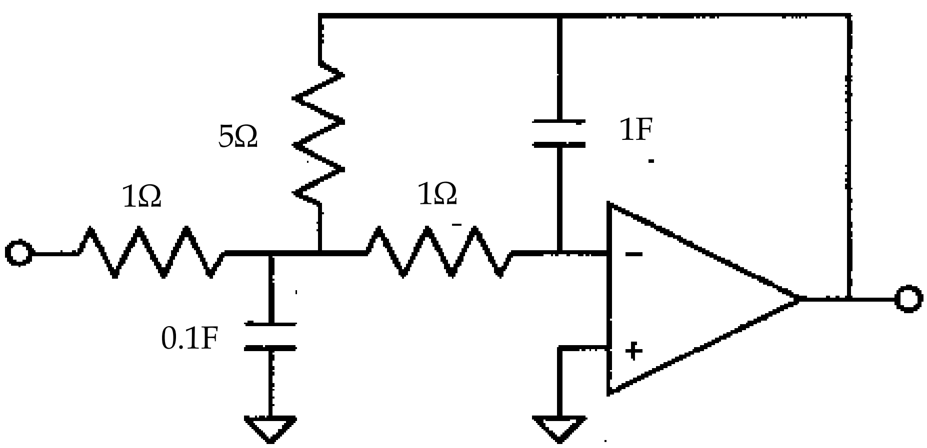
(3) Band pass filter with a mid-band gain of –5

(4) Low pass filter with a DC gain of 1

(5) High pass filter with a high frequency gain of 5

(6) Band reject filter with a DC gain of 5

(7) None of the above



16. The circuit below consists of a resistor, a capacitor and two coupled coils. The input impedance $Z_{in}(s)$ is

(1) 5 + 12s + (6/s)

(2) 5 + 10s + (6/s)

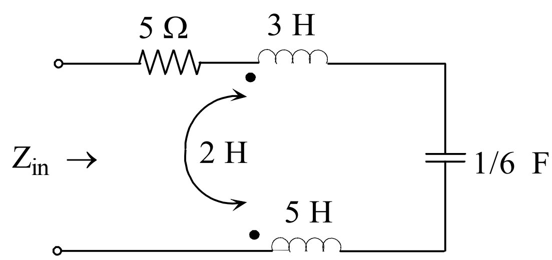
(3) 5 + 8s + (6/s)

(4) 5 + 6s + (6/s)

(5) 5 + 4s + (6/s)*

(6) 5 + 2s + (6/s)

(7) None of the above



17. Let f(t) = 3 u(t) and h(t) = t^2 [u(t) – u(t – 2)]. The convolution of f(t) and h(t) is

(1) $f(t) * h(t) = \begin{cases} 0 & t < 0 \\ t^3 & 0 \le t \le 2 \\ 8 & t \ge 2 \end{cases}$ *

(2) $f(t) * h(t) = \begin{cases} 0 & t < 0 \\ t^2 & 0 \le t \le 2 \\ 4 & t \ge 2 \end{cases}$

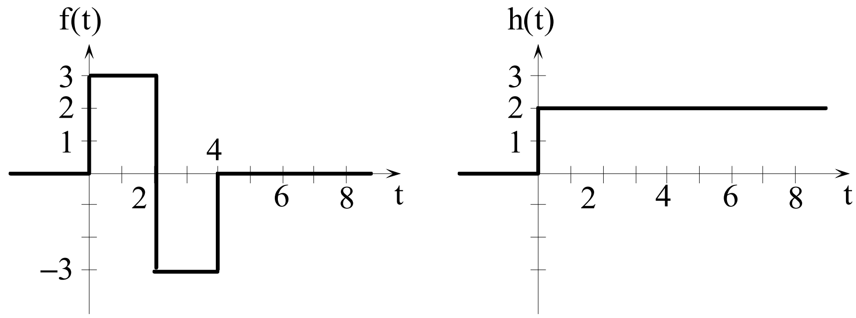
(3) $f(t) * h(t) = \begin{cases} 0 & t < 0 \\ 3t^3 & 0 \le t \le 2 \\ 24 & t \ge 2 \end{cases}$

(4) $f(t) * h(t) = \begin{cases} 0 & t < 0 \\ \frac{3}{2}t^2 & 0 \le t \le 2 \\ 6 & t \ge 2 \end{cases}$

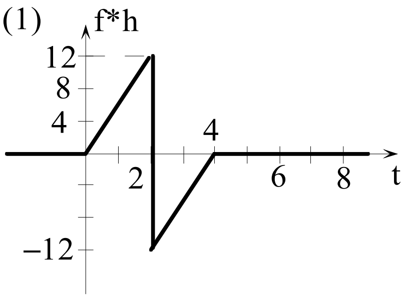
(5) $f(t) * h(t) = \begin{cases} 0 & t < 0 \\ \frac{3}{2}t^3 & 0 \le t \le 2 \\ 12 & t \ge 2 \end{cases}$

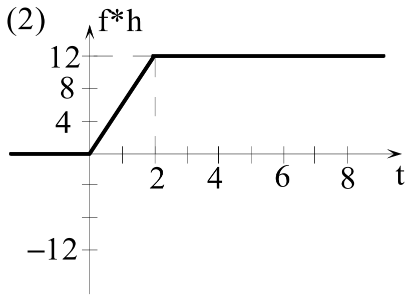
(6) $f(t) * h(t) = \begin{cases} 0 & t < 0 \\ \frac{2}{3}t^2 & 0 \le t \le 2 \\ \frac{8}{3} & t \ge 2 \end{cases}$

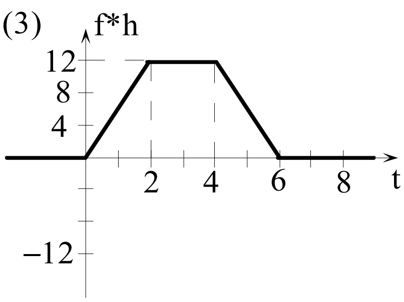
(7) None of the above

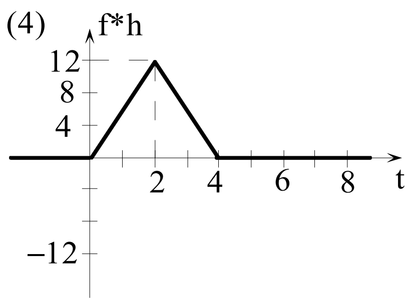


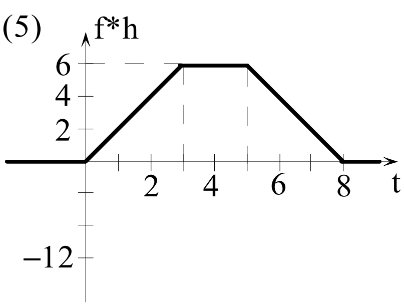
18. Sketched above are f(t) and h(t). A plot of f(t)*h(t) as a function of t is

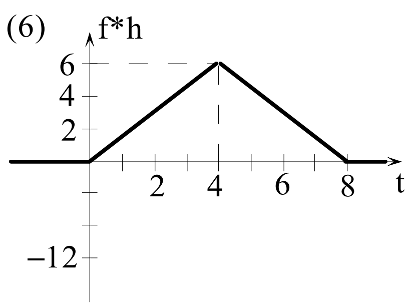
(1)


(2)


(3)


(4)


(5)


(6)


(7) None of the above

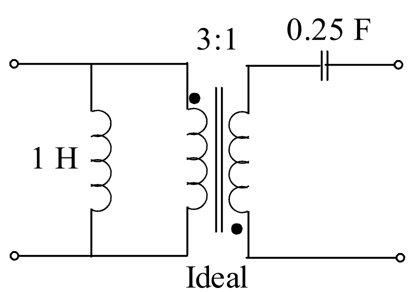
19. The two-port shown below consists of an inductor, a capacitor and an ideal transformer. h_{11} and h_{22} of the hybrid parameters of the two-port in s-domain are

(1) $h_{11} = \frac{9s}{s^2+36}$ and $h_{22} = \frac{36s}{s^2+36}$ (2) $h_{11} = \frac{36s}{s^2+36}$ and $h_{22} = \frac{9s}{s^2+36}$ *

(3) $h_{11} = \frac{3s}{s^2+12}$ and $h_{22} = \frac{12s}{s^2+12}$ (4) $h_{11} = \frac{12s}{s^2+12}$ and $h_{22} = \frac{3s}{s^2+12}$

(5) $h_{11} = \frac{s}{s^2+4}$ and $h_{22} = \frac{4s}{s^2+4}$ (6) $h_{11} = \frac{4s}{s^2+4}$ and $h_{22} = \frac{s}{s^2+4}$

(7) None of the above



20. For the circuit shown below, t_{12} is,

(1) 1

(2) 0

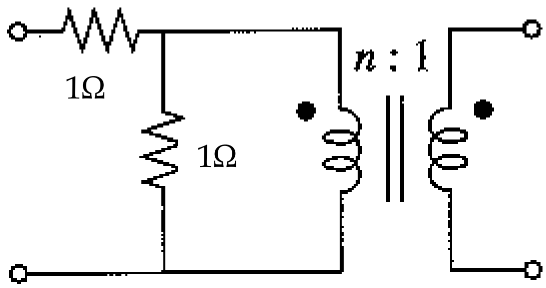
(3) $\frac{1}{n}$ *

(4) n

(5) $n+\frac{1}{n}$

(6) n^2

(7) None of the above



Ideal

21. The transmission parameters, in standard units, of networks A and B are

$$[T_A] = \begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix} \qquad [T_B] = \begin{bmatrix} 1+s & s \\ 1 & 1 \end{bmatrix}$$

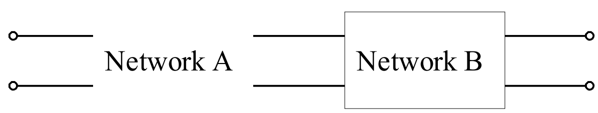
The two networks are connected as shown below. The transmission parameters [T] of the overall or composite network are, in standard units,

(1) $[T] = \begin{bmatrix} 2+s & 2+s \\ 2 & 3 \end{bmatrix}$ (2) $[T] = \begin{bmatrix} -s & 2-s \\ 0 & 1 \end{bmatrix}$

(3) $[T] = \begin{bmatrix} s & 12+s \\ 0 & -1 \end{bmatrix}$ (4) $[T] = \begin{bmatrix} 2+s & 2+s \\ 2 & 3 \end{bmatrix}$

(5) $[T] = \begin{bmatrix} 1+2s & 2+4s \\ 2 & 4 \end{bmatrix}$ (6) $[T] = \begin{bmatrix} 3+s & s+2 \\ 3+s & s+2 \end{bmatrix}$ *

(7) None of the above



22. If the maximum power is transferred to the load Z_L, what must be the value of Z_L?

(1) 12Ω
(2) 6Ω
(3) 3Ω *
(4) 1Ω
(5) 2Ω
(6) 18Ω
(7) None of the above