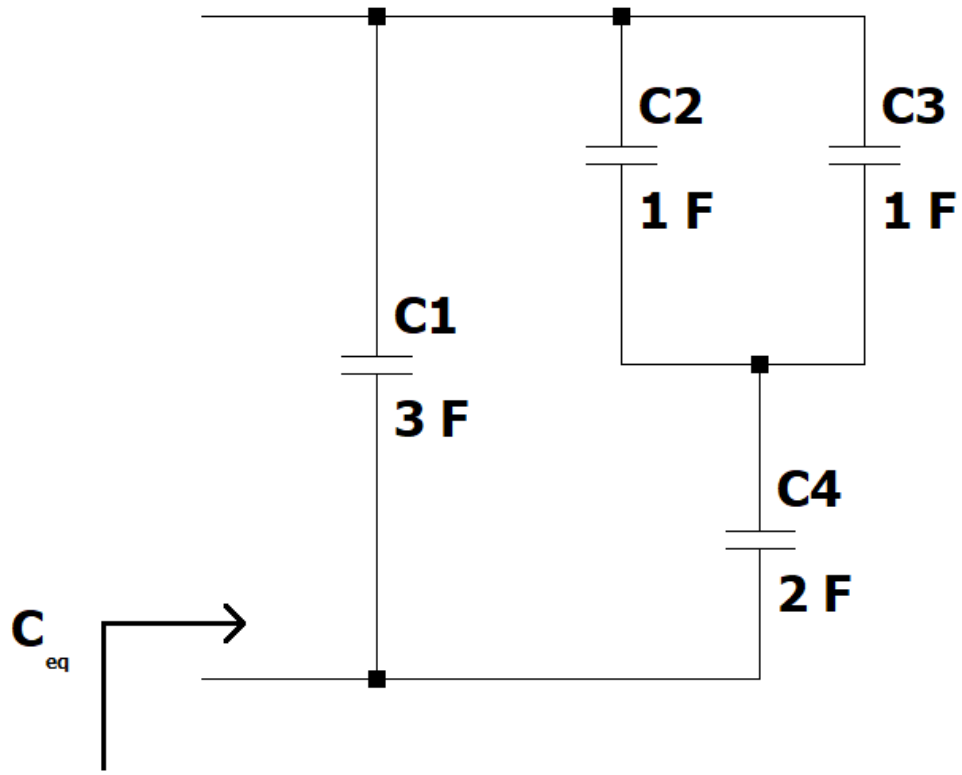
ECE 20001 Spring 2021
Test 2, Version 1

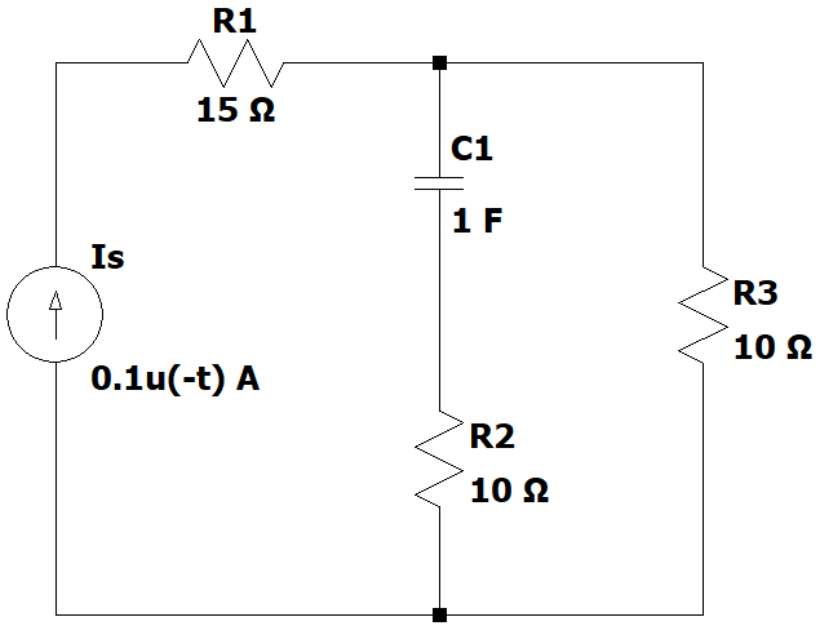
Q1: Find the equivalent capacitance of the two-terminal network below.



1. 1 F
2. 1.36 F
3. 2 F
4. 3 F
5. 4 F
6. 5 F
7. 8 F
8. None of the above

Q2: Find the time constant of the following first order circuit.

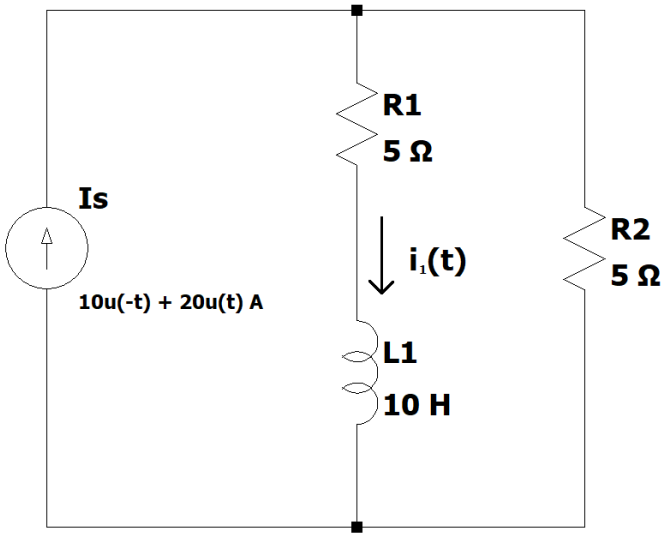
[u(t) is the step function as discussed in lecture]



1. 10 s
2. 20 s
3. 5 s
4. 0 s
5. 100 s
6. 0.1 s
7. 1 s
8. None of the above

Q3: Find $i_1(t)$ for $t > 0$ sec.

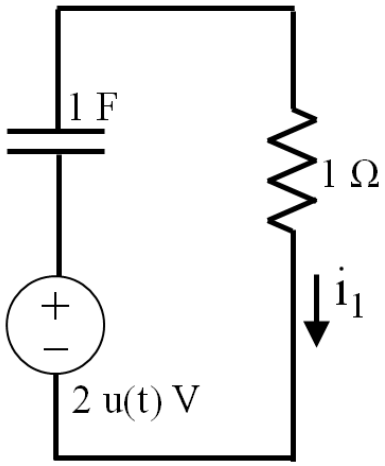
[u(t) is the step function as discussed in lecture]



1. 20exp(-t) A
2. 10exp(-t) A
3. 5exp(-t) A
4. 0 A
5. 5-5exp(-t) A
6. 10-5exp(-t) A
7. 10+5exp(-t) A
8. None of the above

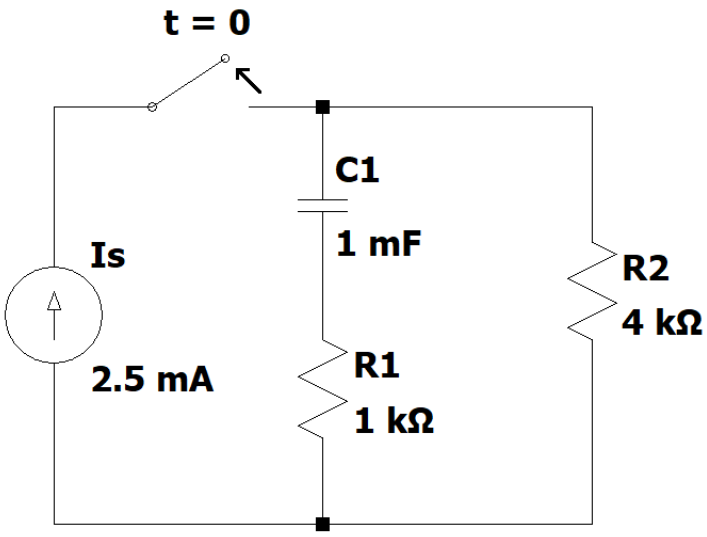
Q4: Find $i_1(t)$ for $t > 0$ sec.

[u(t) is the step function as discussed in lecture]



1. -exp(-t) A
2. exp(-t) A
3. -2exp(-t) A
4. 2exp(-t) A
5. 0
6. 2-2exp(-t) A
7. 2exp(-t)-2 A
8. None of the above

Q5: The switch has been closed for a long time. At time t = 0 the switch is opened. Find the total energy delivered by the capacitor C1 from time 0 to ∞ seconds.

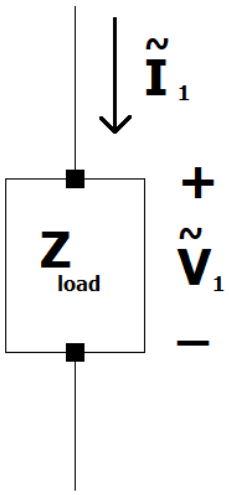


1. -100 mJ
2. -50 mJ
3. -40 mJ
4. -10 mJ
5. 10 mJ
6. 40 mJ
7. 50 mJ
8. None of the above

Q6: The sinusoidal steady state voltage and current values are given below. Find the impedance value Z_{load}.

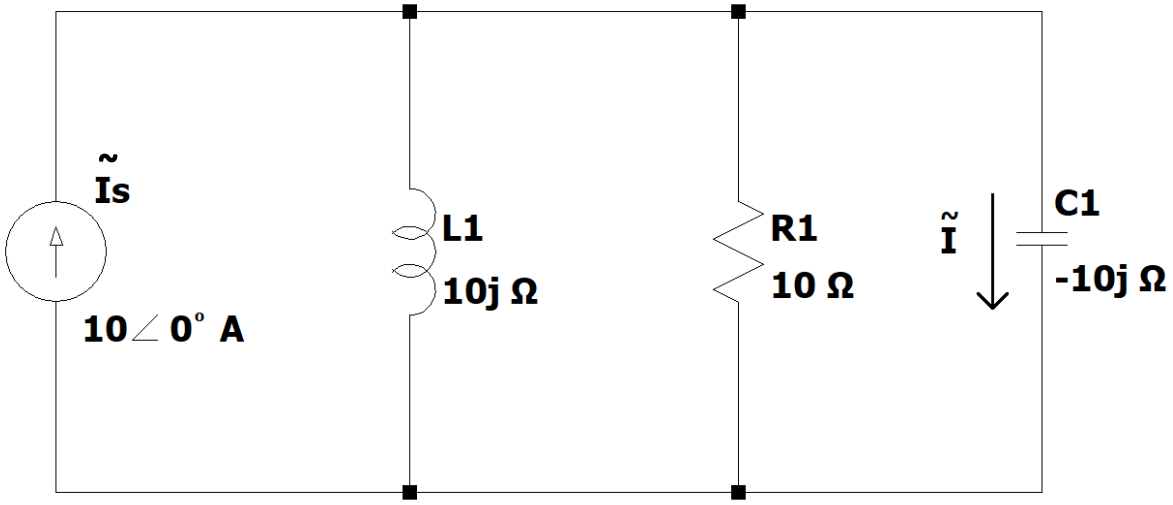
$v_1(t) = 2\cos(120\pi t)$ V

$i_1(t) = -2\sin(120\pi t)$ A



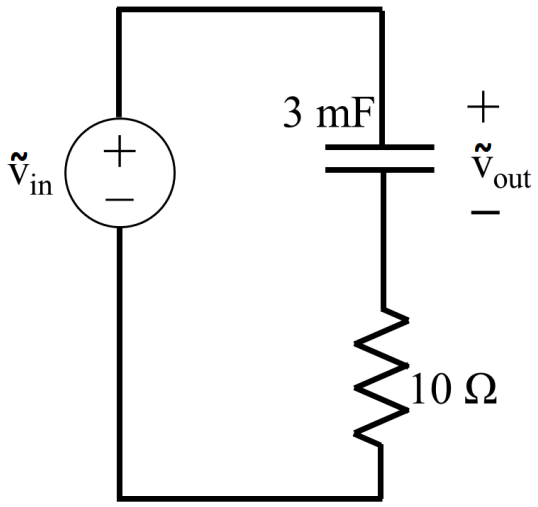
1. 1 Ω
2. -1 Ω
3. j Ω
4. -j Ω
5. 1+j Ω
6. 2j Ω
7. 2 Ω
8. None of the above

Q7: The circuit below has reached steady state. Find the current, I(t), through C1 in time domain given that $\omega = 120\pi$ rad/s.



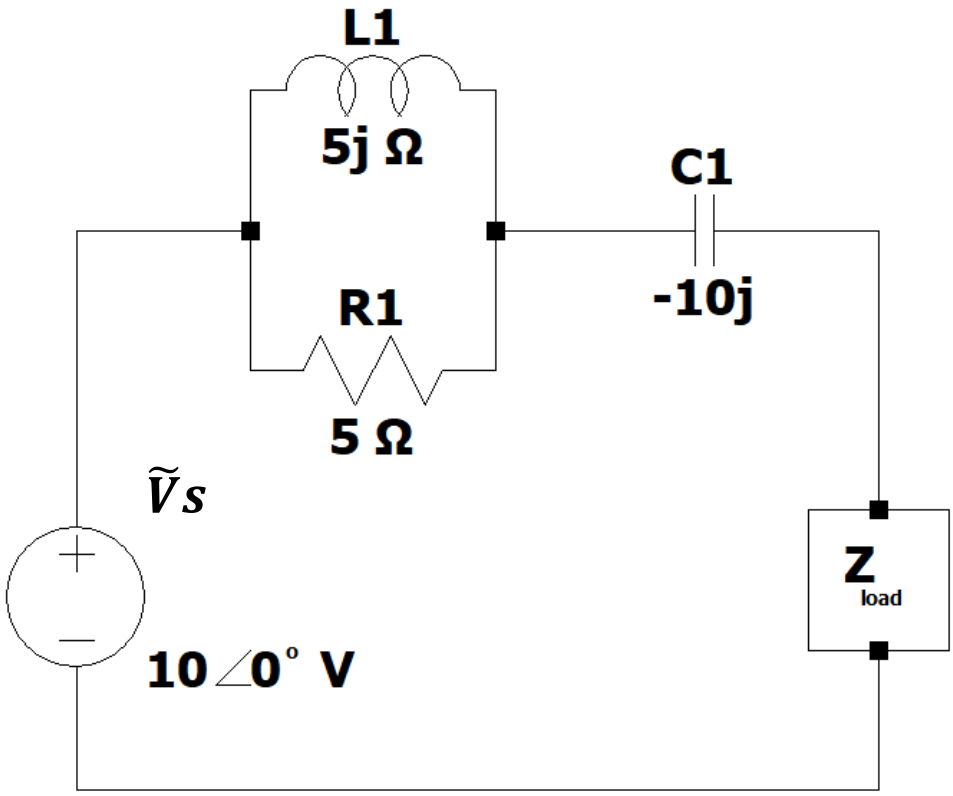
1. 3.33 A
2. 3.33 sin(120πt) A
3. -3.33 cos(120πt) A
4. 10 sin(120πt) A
5. 10 cos(120πt) A
6. -10 cos(120πt) A
7. -10 sin(120πt) A
8. None of the above

Q8: Find the maximum value of ω (in unit of rad/s) at which the magnitude of V_{out} is no less than 80% of the magnitude of V_{in}.



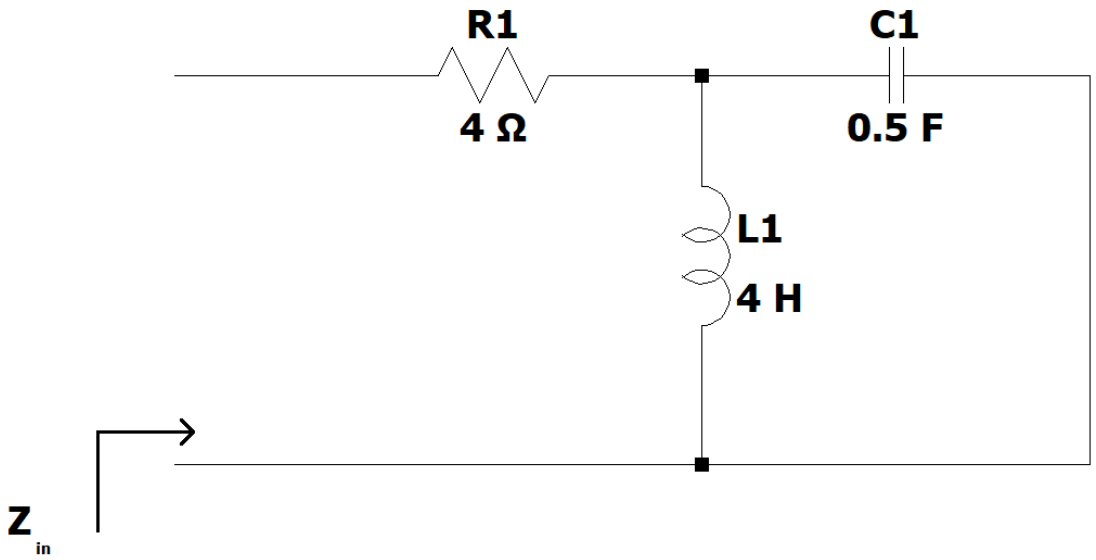
1. 0 rad/s
2. 5 rad/s
3. 10 rad/s
4. 15 rad/s
5. 20 rad/s
6. 25 rad/s
7. 33.33 rad/s
8. 44.44 rad/s
9. None of the above

Q9. Find the maximum possible power that can be delivered to Z_{Load}. You may find it helpful to find the Z_{load} that absorbs the maximum possible power first.



1. 5 W
2. 2 W
3. 1.25 W
4. 10 W
5. -10 W
6. 100 W
7. 0 W
8. None of the above

Q10: Find the input impedance (Z_{in}) of the circuit in the figure below. Assume $\omega = 1$ rad/s.



1. 4 - 4j Ω
2. 8j Ω
3. 4 + 0.5j Ω
4. 8+4j Ω
5. 4.5j Ω
6. -4j Ω
7. 0.5 Ω
8. None of the above