**EECS / CSE 70A MIDTERM #1**

**GRADING RUBRIC**

**Problem 1.**

| **Step** | **Points** |
|---|---|
| Recognize/use/state $V_+ = V_-$ (2pts.) and no current $i_+ = i_- = 0$ (2pts.) | 4 |
| Finding $V_o$ in terms of $V_1$ and $V_-$ (Correct attempt 2pts. Result 2pts.) | 4 |
| Finding $V_+$ in terms of $V_2$ (Correct attempt 2pts. Result 2pts.) | 4 |
| Find $V_o$ in terms of $V_1$ and $V_2$ | 3 |
| Total for part (a) 15pts | |
| Substitute $V_1$ and $V_2$ values in $V_o$ | 2 |
| Find $i_1$ (Correct expression 2pts. Correct value 1pt) | 3 |
| Find $i_2$ (Correct expression 2pts. Correct value 1pt) | 3 |
| Total for part (b) 8pts | |
| Units (Initial equations 1pt. Final results 1pt.) | **2** |
| **Total** | **25** |

**Problem 2.**

| Step | **Points** |
|---|---|
| Recognize that the inductor is short circuit at $t = 0^-$ | 2 |
| Recognize that 12Ω is short circuited at $t = 0^-$ | 2 |
| Find $i_L(t = 0^-)$ (Correct expression 2pts, result 1pt.) | 3 |
| Total for steps regarding $t = 0^-$ 7pts | |
| For transient period, writing the correct time constant equation | 2 |
| After switch is open, using/recognizing correct resistance | 2 |
| Finding the correct time constant value | 2 |
| Total for steps regarding transient period 6pts | |
| Recognize source free discharge<br>or<br>Reason justify $i_L(\infty) = 0$ | 2 |
| Give the generic formula for $i_L(t)$ when $t>0$ | 2 |
| Correct final result for $i_L(t)$ (If the numbers are wrong due to a mistake in previous steps, still given 1pt) | 2 |
| Total for steps regarding $i_L(t)$ 6pts | |
| Attempt calculating $v_L$ using $i_L$ and/or recognize $v_L(\infty) = 0$ | 2 |
| Use $v_L = L\, di_L/dt$, or $v_L = (-1/\tau)L\, i_L$ | 1 |
| Formula for $v_L(t)$ | 1 |
| Final correct result for $v_L(t)$ | 1 |
| Total for steps regarding $v_L(t)$ 5pts | |
| Units | 1 |
| **Total** | **25** |

**Problem 3.**

**Approach 1: First finding V, then I**

| Step | Points |
|---|---|
| Finding the source voltage phasor $V_s$ | 3 |
| Impedance terms (R & jωL) | 3 |
| Voltage division expression $V = (j\omega L/(R + j\omega L))V_s$ | 3 |
| Some simplifications/manipulations toward polar/exponential or rectangular/Cartesian form for V | 4 |
| Arriving at a polar/exponential or rectangular/Cartesian form | 2 |
| Correct final expression for the phasor V (answer to part (a)) | 1 |
| Applying Ohm's law $I = V/Z_L$ | 2 |
| Some simplifications/manipulations toward polar/exponential or rectangular/Cartesian form for I | 4 |
| Arriving at a polar/exponential or rectangular/Cartesian form | 2 |
| Correct final expression for the phasor I (answer to part (b)) | 1 |
| **Total** | 25 |

**Approach 2: First finding I, then V**

| Step | Points |
|---|---|
| Finding the source voltage phasor $V_s$ | 3 |
| Impedance terms (R & jωL) | 3 |
| Equivalent impedance $Z_{eq} = R + j\omega L$ (series combination) | 1 |
| Applying Ohm's law $I = V_s/Z_{eq}$ | 2 |
| Some simplifications/manipulations toward polar/exponential or rectangular/Cartesian form for I | 4 |
| Arriving at a polar/exponential or rectangular/Cartesian form | 2 |
| Correct final expression for the phasor I (answer to part (b)) | 1 |
| Applying Ohm's law $V = IZ_L$ | 2 |
| Some simplifications/manipulations toward polar/exponential or rectangular/Cartesian form for V | 4 |
| Arriving at a polar/exponential or rectangular/Cartesian form | 2 |
| Correct final expression for the phasor V (answer to part (a)) | 1 |
| **Total** | 25 |

**Problem 4.**

| Step | Points |
|---|---|
| Impedance of capacitor = $1/(j\omega C)$ | 3 |
| Impedance of inductor = $j\omega L$ | 3 |
| Equivalent impedance expression for series combination<br>$Z_{eq}(\omega) = R + 1/(j\omega C) + j\omega L$ | 4 |
| Simplifications/manipulations toward x + jy form | 3 |
| Arriving at an x + jy form | 2 |
| Correct value of x (answer to part (b)) | 1 |
| Correct value of y (answer to part (c)) | 1 |
| Equating the imaginary part to zero, $\text{Im}(Z_{eq}(\omega)) = 0$ | 3 |
| Obtaining some equation equivalent to $\omega = 1/\sqrt{(LC)} = \sqrt{(10^6/4)}$ | 3 |
| Calculating numerical value of ω, 500 | 1 |
| Correct unit of ω, rad/s | 1 |
| **Total** | 25 |