**Prelab 2**

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**Part 1 – Integrator**

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Figure 1: Integrator in Multisim

R = 1kΩ, C = 0.1 µF, f = 1 kHZ

VIN = 2Vpp sinusoidal, triangle, square

1. *Plot the input and output waveforms on the same graph for two complete cycles.*

* **See Figures 2-4**

1. *Comment on the gain and input-output phase relationship.*
2. Figure 2 – Gain is 1.635 V/v – Input is sine and output is gain \* cosx
3. Figure 3 – Gain is 1.239 V/v – On max / min input, output is 0.
4. Figure 4 – Gain is 2.472 V/v – When input changes direction, output is max / min.
5. Figure 5 – Gain is 0.164 V/v – Input is out of phase wrt output.
6. Figure 6 – Gain is 0.133 V/v – On max / min input, output is 0.
7. Figure 7 – Gain is 0.234 V/v – When the input is changing, output is max / min.
8. ***Repeat for C =*** 1 ***μF and compare to your results with C = 0.1 μF.***

* ***See Figures 5-7***

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Figure 2: Integrator with sine wave R = 1kΩ, C = 0.1µF Figure 3: Integrator with triangle wave R = 1kΩ, C = 0.1µF

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Figure 4: Integrator with square wave R = 1kΩ, C = 0.1µF Figure 5: Integrator with sine wave R = 1kΩ, C = 1µF

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Figure 6: Integrator with triangle wave R = 1kΩ, C = 1µF Figure 7: Integrator with square wave R = 1kΩ, C = 1µF

**Part 2 – Differentiator**

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Figure 8: Differentiator in Multisim

R = 1kΩ, C = 0.1 µF, f = 1 kHZ

VIN = 2Vpp sinusoidal, triangle, square

1. *Plot the input and output waveforms on the same graph for two complete cycles.*

* **See Figures 9-11**

1. *Comment on the gain and input-output phase relationship.*
2. Figure 9 – Gain is 0.73 V/v – When input is sin, output is gain \* cos
3. Figure 10 – Gain is 1.07 V/v – When input inc / dec, output is damped oscillator.
4. Figure 11 – Gain is 5.60 V/v – When input changes direction, output is max / min.
5. Figure 12 – Gain is 5.41 V/v – The input is out of phase with output.
6. Figure 13 – Gain is 5.18 V/v – When input is at a minimum, output is decreasing.
7. Figure 14 – Gain is 5.48 V/v – Output decreases as a reaction to the input gaining.
8. **Repeat for C =** 1 **μF and compare to your results with C = 0.1 μF.**

* **See Figures 12-14**

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Figure 9: Differentiator with sine wave R = 1kΩ, C = 0.1µF Figure 10: Differentiator with triangle wave R = 1kΩ, C = 0.1µF

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Figure 11: Differentiator with square wave R = 1kΩ, C = 0.1µF Figure 12: Differentiator with sine wave R = 1kΩ, C = 1µF

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Figure 13: Differentiator with triangle wave R = 1kΩ, C = 1µF Figure 14: Differentiator with square wave R = 1kΩ, C = 1µF