Drexel University  
Office of the Dean of the College of Engineering  
**ENGR 232 – Dynamic Engineering Systems**

**Section: \_\_ \_\_ Name: \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_**

*First Last*

**Winter 2022**

**Lab 9 Answer Template: Matrix Laplace Method and Linear Systems**

**Part A: Undamped Harmonic Oscillator 2/2**

**TA will randomly pick two of these to grade.**

**a.** Find the resolvent for the harmonic oscillator. One component has been given for you.

**b.** Find the state-transition matrix . One component has been given for you.

**c.** Find the solution at any time *t* using the state-transition matrix and the initial condition .

The top component has been given for you.

**d.** Paste your plot of the circle here.



**Part B: Falling Apple, Nonhomogeneous Equation (No friction) 3/3**

**TA will randomly pick three of these to grade.**

**a.** Find the **resolvent** for the falling apple. One component has been given for you.

**b.** Find the **state-transition matrix** for the falling apple. One component is free!

**c.** Find the transform of the forcing vector .

**d.** Give the **zero-input solution** in the **time** domain only.

Leave *h*, *g* and as symbolic quantities. One component given for free.

**e.** Give the **zero-state solution** in the **time** domain only.

Leave *h*, *g* and as symbolic quantities. One component given for free and g has been factored outside.

**f.** Combine the zero-input and zero-state solution to obtain the **total solution** in the time domain.

Leave *h*, *g* and as symbolic quantities. One component given for free.

**Part C: Two Tanks – Laplace Matrix Method 2/2**

**TA will randomly pick two of these to grade.**

**a.** Find the **resolvent** for the two-tank system. A common denominator and one component have been given for you.

**b** Give the **state-transition matrix** for the two-tank system. The first column has been given for you.

**c.** Give the **zero-input solution** in the **time** domain only. One component given for free.

**d.** Give the **zero-state solution** in the **time** domain only. One component given for free and k has been factored outside.

**e.** Give the **total solution** in the **time** domain only. Fill in all the missing components.

**Part D: The Rose of Venus 3/3**

**TA will randomly pick three of these to grade.**

**a.** Find the **resolvent** for the Rose of Venus. A common factor and the first row has been given for you. Express answers here using *s* and π.

**b.** Find the Laplace transform of the forcing vector

**c.** Find the **zero-input** solution (in the *s* domain) using

**d.** Find the **zero-state** solution (in the s domain) using

**e.** Find the value of , half-way thru the rose.

You do not need to plot the **Rose of Venus**!

**Ready to Submit?**

Be sure all ten questions are answered. When your lab is complete, be sure to submit three files:

1. Your **completed Answer Template** as a PDF file
2. A copy of your **MATLAB Live Script**
3. A **PDF** copy of your **MATLAB Live Script** (Save-Export to PDF…)

The due date is the day after your lab section by **11:59pm** to receive full credit. You have one more day, to submit the lab (but with a small penalty), and then the window closes for good and your grade will be zero.