Final Exam

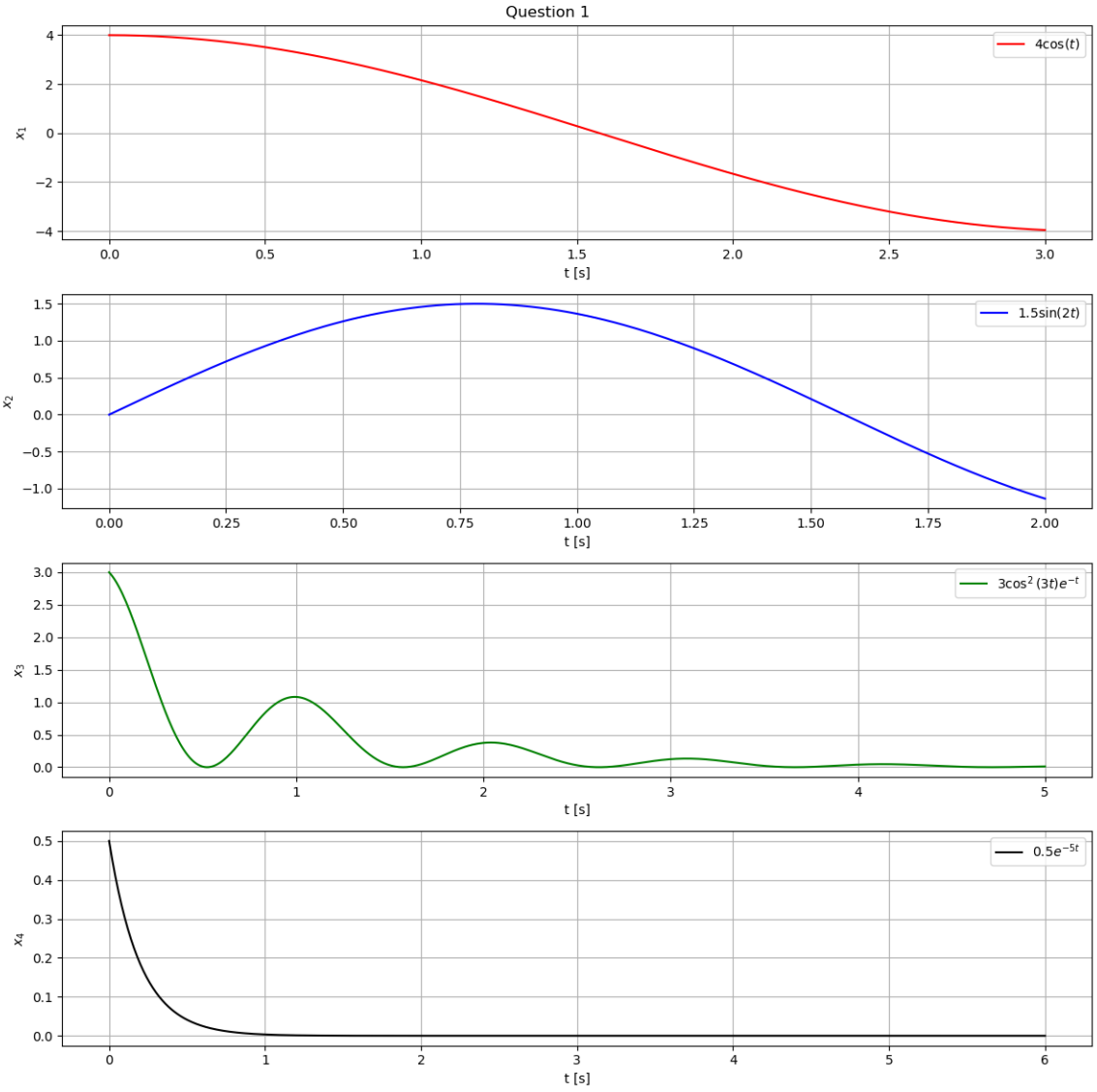
ECE 351

Spring 2024

- Answers to all questions must be coded in Python 3.x
- You may use any previous code you have written for this class, the internet to reference the Python documentation, a calculator, and your textbook from ECE 350.
- You may ask the instructor questions during the exam period. You **may not** ask another student during this period. Any suspected teamwork or use of reference material not included previously will be turned in to the Dean of Students for investigation.
- If your code requires explanation or does not fully function use comments appropriately to earn partial credit.
- If a question asks for an explanation of some code and not implementation use triple quotes or a markdown cell to format your answer.
- All plots and outputs must be labeled, formatted, and scaled appropriately to receive full credit.
- When you are finished upload the .py or .ipynb file to Canvas.
- Name the file you turn in "LastName_FirstName_ECE_351_Section_51_Final".
- **Do not** include any code unrelated to the final exam, I will not sift through unnecessary code to grade your exam.
- You have two hours to complete this exam.

Question 1 (10 points)

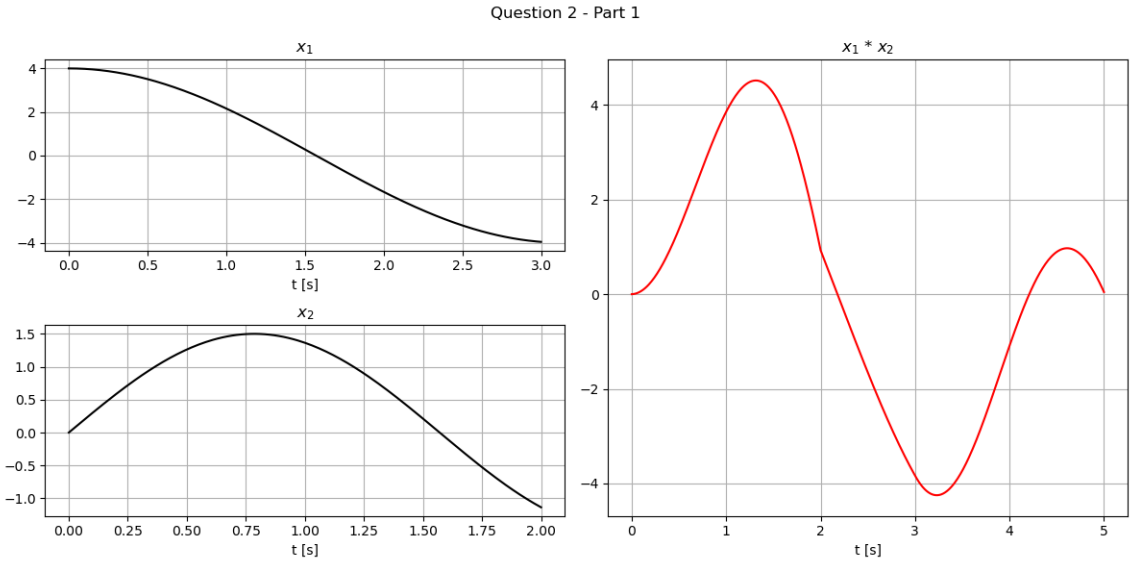
Reproduce the following plot including **all** formatting in a 12in x 12in figure.



Question 2

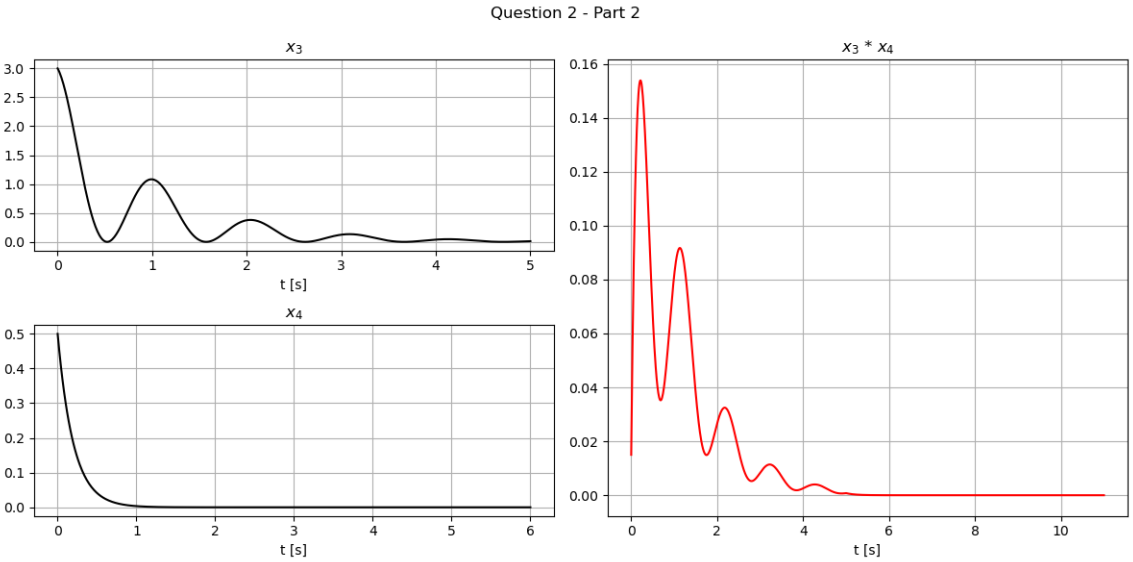
Part 1 (10 points)

Reproduce the following convolutions and plot including **all** formatting in a 12in x 6in figure.



Part 2 (10 points)

Reproduce the following convolutions and plot including **all** formatting in a 12in x 6in figure.



Question 3 (10 points)

A system is described by the following differential equation:

$$\frac{d^4y(t)}{dt^4} + 3\frac{d^2y(t)}{dt^2} + 11\frac{dy(t)}{dt} = \frac{d^2x(t)}{dt^2} - \frac{dx(t)}{dt} + 9x(t)$$

Print the zeros and poles labeled and formatted properly. Plot the impulse response with a solid red line and the step response with a dashed blue line on the same 12in x 8in plot from $0 \leq t \leq 10$s. Answer the following question in a markdown cell or using triple quotes: Is either response stable?

Question 4 (10 points)

Use either a markdown cell or triple quotes to explain the difference between `numpy.arange()`, `numpy.linspace()`, and `numpy.array()`. Then, use Python to print the following arrays using the corresponding built-in functions. *Hint: You may need to use other commands besides the corresponding arrays to fill them correctly.*

```
Using np.arange:  [5, 10, 15, 20, 25, 30, 35, 40, 80, 81, 82, 83, 84, 85, 86, 87, 88,
89, 90]

Using np.linspace:  [15.+0.j, 15.+1.j, 15.+2.j, 15.+3.j, ..., 15.+28.j, 15.+29.j, 15.+30.j]

Using np.array and a loop or a one-line command:  [ 0., 1.1, 2.2, 3.3, ..., 52.8, 53.9,
55.]
```