Week 5 Optional Assignment

Forced Harmonic Oscillations in RLC circuits

In problem 2 of this week's assignment, just include a voltage source in the circuit for the following 2 cases:

- ❑ DC Voltage Source: A battery supplying a constant voltage $V = V_0$ volts
- ❑ AC Voltage Source: A battery supplying an oscillating voltage $V = V_0 \cos(wt)$ volts

This addition of a battery has an effect of generating an additional driving force to the system. In both the cases, just one voltage term would get added to the differential Kirchoff circuit equation. Try simulating the same 6 plots as mentioned in problem 2, for both these cases, and then try to interpret the results.

Kepler problem

In classical mechanics, the two-body problem is to predict the motion of two massive objects which are abstractly viewed as point particles. The problem assumes that the two objects interact only with one another; the only force affecting each object arises from the other one, and all other objects are ignored. The Kepler problem is a special case of the two-body problem, in which the two bodies interact by a central force that varies in strength as the inverse square of the distance between them. The force may be either attractive or repulsive. The problem is to find the position and speed of the two bodies over time given their masses, positions and velocities. The most prominent case is the gravitational case arising in astronomy for predicting the orbits (or escapes from orbit) of objects such as satellites, planets and stars. A two-point-particle model of such a system nearly always describes its behavior well enough to provide useful insights and predictions.

Following is the link to a cool animation of dead stars orbiting each other every seven minutes:
https://www.youtube.com/watch?v=iZ0RqO4VCAk

This artist's animation depicts an "eclipsing binary", in which two extremely dense objects known as white dwarfs orbit each other roughly every seven minutes. Time has been sped up such that one second represents two minutes of real time. The smaller white dwarf is slightly larger than Earth, and is the heavier of the two, weighing 60 percent as much as the sun. Its larger companion weighs only around 20 percent as much as the sun. The orbital separation of these objects is shrinking by about 26 centimeters per day due to the emission of gravitational waves, depicted in green near the end of the movie.

Following is a link for the folks interested to know more details of this animation:
https://www.caltech.edu/about/news/dead-stars-found-whipping-around-each-other-minutes

Where do I fit in? Your job is to write a python program which can simulate planetary motion and can follow Kepler's laws with the Turtle module (or any other module you're comfortable with).

Following links will provide you with the much needed support with the code.
https://www.youtube.com/watch?v=v1GT0jGBR-I
https://www.youtube.com/watch?v=yzZeSEKx2O4
https://www.youtube.com/playlist?list=PLdCdV2GBGyXN01xMBSAZwietFjW0gmdt5
https://realpython.com/beginners-guide-python-turtle/

Good luck! :)