Assignment 3

Explanation:

Fixed-roof tanks are relatively easy to construct and therefore cheaper to build than floating-roof tanks. The main disadvantage of a fixed-roof tank is product losses due to the escape of vapour from the free space between the oil and the roof through vent openings in the roof. A typical fixed-roof tank consists of a cylindrical steel shell with a cone- or dome-shaped roof that is permanently affixed to the tank shell. Storage tanks are usually fully welded and designed for both liquid and vapor tight, while older tanks are often have a riveted or bolted construction and are not vapor tight.Floating-roof tanks are not intended for all products. In general, they are not suitable for applications in which the products have not been stabilized (vapors removed). The goal with all floating-roof tanks is to provide safe, efficient storage of volatile products with minimum vapor loss to the environment.Fixed roof tanks are simple cylindrical storage tanks that may have flat or (more commonly) shallow conical roofs welded to the shell. They are commonly used to store large quantities of petroleum distillates, petrochemicals, and other liquid chemicals at atmospheric pressure.

This code is a simulation of a two-tank system, which is a system that consists of two tanks containing water. The system is described mathematically by two differential equations: $\mathrm{d}x\#/\mathrm{dt} = w - v\#$ if $x\# > r\#$ and $\mathrm{d}x\$/\mathrm{dt} = w - v\$$ if $x\$ > r\$$. These equations describe the change in the volume of water in each tank over time, where $x\#$ and $x\$$ are the volumes of water in Tank 1 and Tank 2, respectively. w is the constant rate at which water is added to the system, $v\#$ and $v\$$ are the constant rates at which water leaks from Tank 1 and Tank 2, and $r\#$ and $r\$$ are the minimum levels of water that must be maintained in each tank.

In the code, the parameters $r\#$, $r\$$, $v\#$, $v\$$, and w are defined and assigned values. The function two_tank_system takes two inputs: x, an array of the current values of $x\#$ and $x\$$, and t, the current time. The function calculates the change in $x\#$ and $x\$$ over time and returns it as an array dxdt. The calculation of dxdt depends on the current values of $x\#$ and $x\$$: if $x\#$ is greater than $r\#$, then dxdt[0] is set to w - v1, otherwise dxdt[0] is set to 0. The same calculation is performed for dxdt[1] with respect to $x\$$ and $r\$$.

The initial conditions x0 are defined as an array with values [0, 1], meaning that the initial value of x# is 0 and the initial value of $x$$ is 1. The time t is defined as an array of 1000 evenly spaced values between 0 and 100 seconds. The function odeint from the scipy library is used to integrate the differential equations over time, given the initial conditions and the time array. The result is stored in the array x.

Finally, the results are plotted using the matplotlib library. The first column of the x array is plotted as a blue line and the second column is plotted as a red line. The x-axis is labeled as 'Time (s)' and the y-axis is labeled as 'Volume of Water'. A legend is added to the plot to distinguish between the two tanks. The plot is displayed using the show function from the matplotlib library.

Output: