# ME 542

## Assignment – 11

## ODE-RK Methods

- Students need to save all the programs in a zipped file and named after their roll number and submit on MS TEAMS.
- The programs are to be compiled and checked before submitting.
- Make a text file for providing input and your code should read data from the text file.
- Results obtained by your code should be written (do not copy image file of your run) in a pdf file and keep it in the same zipped folder.

If water is drained from a vertical cylindrical tank by opening a valve at the base, the water will flow fast when the tank is full and slow down as it continues to drain. As it turns out, the rate at which the water level drops is

$$\frac{dy}{dt} = -k\sqrt{y}$$

where $k$ is a constant depending on the shape of the hole and the cross-sectional area of the tank and drain hole. The depth of the water $y$ is measured in meters and the time t in minutes. If $k = 0.06$, determine how long it takes the tank to drain if the fluid level is initially 3m.

Solve it by applying RK4 formula. Use a step of 0.5 minutes.

1. Compare the results of RK4 with Heun's method at each step length.
2. Calculate the percentage relative error of RK4 method at each step length.
4. Calculate function evaluations for RK4 method.

5. Present results separately for different step lengths (0.1, 0.3, 0.5, 0.7, 0.8) and their effect on the percentage relative error.

Present results in a tabular form.