**QUESTION 1 [20 Marks]**

A flat plate of mass m falling freely in air with velocity V is subjected to a downward gravitational force and an upward frictional drag force due to air. If the drag force, FD, is given by Equation (1),

FD = - 0.02V ………………………………………………………….(1)

and the terminal velocity is reached when the drag force equals the gravitational force, that is,

FD = mg ………………………………………………………………… (2)

taking the values of m and g to be 3.5 kg and 9.8 m/s2 respectively, using a guess value of V0 = 0.5 m/s and employing fixed-point iteration method, develop a MATLAB program to estimate the terminal velocity. Take the absolute percentage relative error tolerance to be less than or equal to 1E-11.

**SOLUTION**

**Using fixed-Point iteration Method:**

since equation (1) = equation (2) = FD

Hence, FD = mg = (0.3V2/(500+(lnV)3)- 0.02V

m = 3.5 kg and g=9.8 m/s2

Hence, FD = mg = 3.5 X 9.8 = 34.3

Therefore,

FD =(0.3V2/(500+(lnV)3) - 0.02V = 34.3

making FD = 0

(0.3V2/(500+(lnV)3) - 0.02V - 34.3= 0

Making V as subject of formula

0.02V +34.3 = (0.3V2/(500+(lnV)3)

(0.02V +34.3) \*(500+(lnV)3 ) = 0.3V2

((0.02V +34.3) \* (500+(lnV)3 ))/0.3 = V2

V = (((0.02V +34.3) \*(500+(lnV)3 ))/0.3)^(0.5)

Vi+1 = (((0.02Vi +34.3) \* (500+(lnVi)3 ))/0.3)^(0.5)

**V = 304.0675323m/s**

