1. Using the multi-scale perturbation method, determine the large-time solution dynamics in the Van Der Pol equation

\[ x'' + \epsilon(x^2 - 1)x' + x = 0, \quad \epsilon \ll 1. \]

2. Using the multi-scale perturbation method, determine the large-time solution dynamics in the following equation:

\[ \frac{d^2 x}{dt^2} + x + \epsilon \frac{dx}{dt} \left[ 1 - \left( \frac{dx}{dt} \right)^2 + \beta \left( \frac{dx}{dt} \right)^4 \right] = 0, \quad \epsilon \ll 1, \]

where \( \beta \) is a constant parameter. How does the dynamics depend on \( \beta \)?

3. Using the multi-scale perturbation method, determine the large-time solution dynamics in the forced Duffing equation

\[ x'' + x + \epsilon cx' + \epsilon x^3 = \epsilon F \cos t, \quad \epsilon \ll 1, \]

where \( c \) and \( F \) are damping and forcing constants.