

Non linear dynamics(PH4104/PH5104) Mid Sem Exam

time 1hr

1. Find out the fixed points, stability of fixed points from linearization and draw the phase portrait in (x,y plane) of following equations:

$$\dot{x} = x(1 - x^2) \quad \dot{y} = -y$$

(2+4+2)

2. Consider the equation $\dot{x} = \cosh(x) - h$. Show that it undergoes a bifurcation as the constant h is increased from zero. Find out the (a)critical value of h , (b)fixed points and (c)the nature of the bifurcation. Draw the (d)flow before and after the bifurcation and from that (e)comment on the stability of the fixed points. When $h < h_c$, (f) obtain the time taken T to move from $-\infty$ to ∞ and (g) leading order behavior of T in terms of $h_c - h$ close to the bifurcation ($|h_c - h| \ll 1$).

(1+2+1+2+2+3.5+0.5)

Mathematical formula: $\cosh(x) = (e^x + e^{-x})/2$

