Project 1:-

→ Problem definations :-

Rocket State $x(t)$ is state vector and action variable $a(t)$ being control input.

$$\therefore S(t) = \begin{bmatrix} x(t) \\ y(t) \\ v_x(t) \\ v_y(t) \\ \theta \end{bmatrix} \qquad a(t) = \begin{bmatrix} \text{thrust} \\ \dot{\theta} \end{bmatrix}$$

Trajectory space $= \{S_0, S_1, \ldots S_n\}$

→ Dynamic System of model :-

$$S(t+1) = \begin{bmatrix} x(t+1) \\ y(t+1) \\ v_x(t+1) \\ v_y(t+1) \\ \theta(t+1) \end{bmatrix} = \begin{bmatrix} x(t) + (\Delta t) v_x \\ y(t) + (\Delta t) v_y \\ v_x(t) - \sin\theta \cdot \text{thrust} \\ v_y t + \cos\theta \, \text{thrust} - \text{gravity} - \text{drag} \\ \theta(t) + \Delta t \, \dot{\theta} \end{bmatrix}$$

Also, $\text{drag} = \dfrac{(\text{drag force})}{\text{mass}} (\Delta t) = \left(\dfrac{-1}{2} \rho v_y^2 A C_d \right) \left(\dfrac{1}{1} \right)$

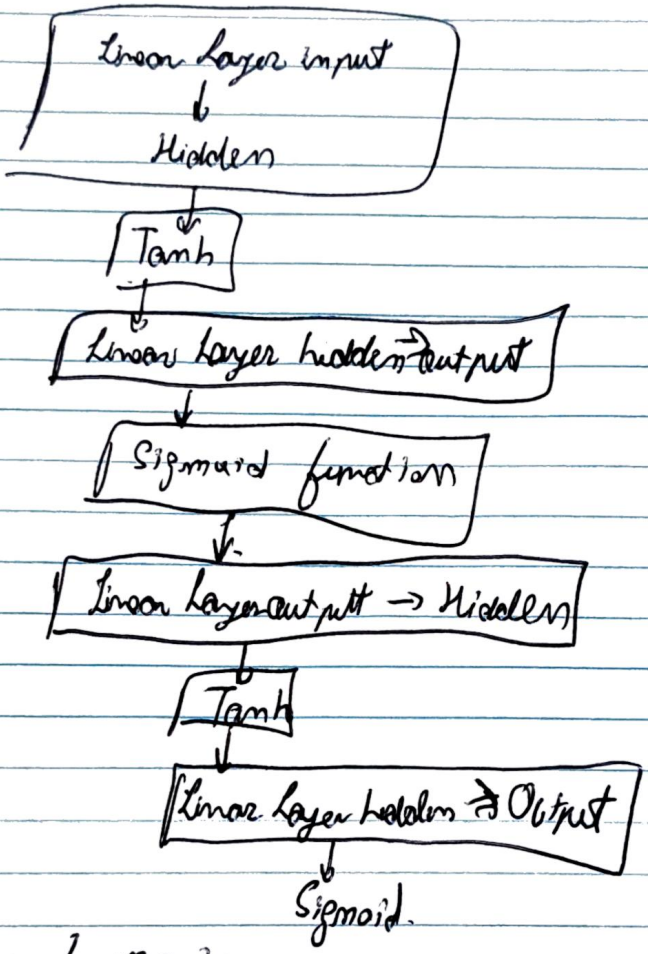
$$\boxed{\text{drag} = -\frac{1}{2} \rho v_y^2 A C_d \Delta t}$$

→ Controller design :-

→ We use controller to predict the values of action variable in close loop:

$$a(t) = C_\theta(s(t))$$

where $C_\theta(s)$ is the neural network in sequential controller with:



→ The Objective function cost

$$\min_{\{s,t\}} \| \text{cost}(s_0, s_1 \ldots s_n) \|^2.$$

Here, $\text{cost}(s_0, s_1 \ldots s_n) = \sum (\| s(t+1) - \text{final state} \|)^2$.

where, final state $= [0, 0, 0, 0, 0]$.