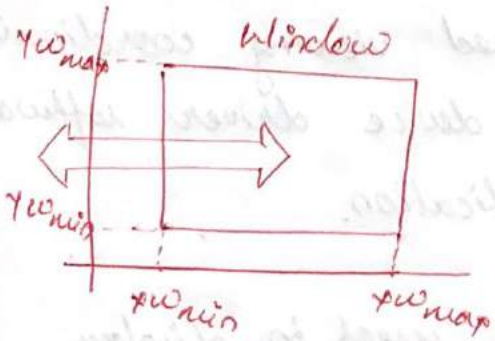
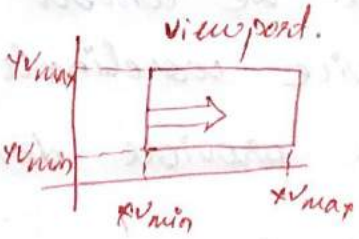
UNIT-4

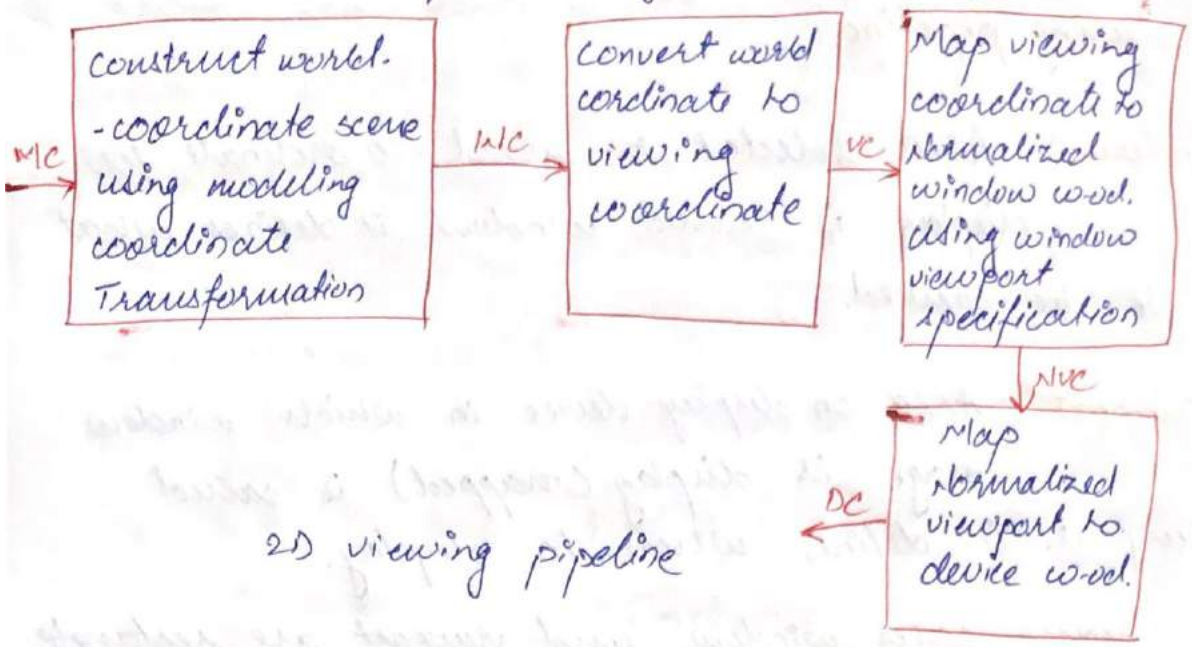
The viewing pipeline

- **window :-** Area selected in world-co-ordinate for display is called window. It defines what is to be viewed.
- **viewport :-** Area on display device in which window image is display (mapped) is called viewport. It defines where to display.
- In many cases window and viewport are rectangle, also other shape may be used as window and viewport.
- In general finding device co-ordinates of viewport from world coordinates of window is called as <u>viewing transformation.</u>
- Sometimes we consider this viewing transformations as window to viewport transformation but in general it involves more steps.





- Now we see steps involved in viewing pipeline.



2D viewing pipeline

- As shown in fig. above first of all we construct world coordinate scene using modeling coordinate transformation.
- After this we convert viewing co-ordinates from world coordinates using window to viewport transformation.
- Then we map viewing co-ordinates to normalized viewing coordinates in which we obtain values in blw 0 to 1.
- At last we convert normalized viewing coordinate to device coordinate using device driver software which provide device specification.
- Finally device co-ordinate is used to display image on display screen.

- By changing the viewport position on screen we can see image at different place on screen.

- By changing the size of window and viewport we can obtain zoom in and zoom out effect as per requirement.

- Fixed size viewport and small size window gives zoom in effect, and fixed size viewport and large size window gives zoom out effect.

Window to viewport co-ordinate Transformation

- Mapping of window co-ordinate to viewport is called window to viewport transformation.
- We do this using transformation that maintains relative position of window co-ordinate into viewport.
- That means center coordinates in window must be remains at center position in viewport.
- We find relative position by equation as follows.

$$\frac{x_v - x_{vmin}}{x_{vmax} - x_{vmin}} = \frac{x_w - x_{wmin}}{x_{wmax} - x_{wmin}}$$

$$\frac{y_v - y_{vmin}}{y_{vmax} - y_{vmin}} = \frac{y_w - y_{wmin}}{y_{wmax} - y_{wmin}}$$

- Solving by making viewport position as subject we obt

$$x_v = x_{vmin} + (x_w - x_{wmin}) s_x$$

$$y_v = y_{vmin} + (y_w - y_{wmin}) s_y$$

- where scaling factors are:

$$s_x = \frac{x_{vmax} - x_{vmin}}{x_{wmax} - x_{wmin}} \qquad s_y = \frac{y_{vmax} - y_{vmin}}{y_{wmax} - y_{wmin}}$$