7.1e) $H(z) = \frac{z - p^{-1}}{z - p}$ represents an all pass filter.

$H(z) = \frac{z}{z-p}$, if p is +ve, it is high pass.

, if p is -ve, it is lowpass.

7.1d) Two diff. impulse responses are possible,

One is causal & another is non-causal

The one which is generated is causal.

7.2 a) $H(z) = \frac{z}{z^2 - (2r\cos\theta)z + r^2}$

zeros $= 0$

poles : $z^2 - (2r\cos\theta)z + r^2 = 0$.

$$\frac{2r\cos\theta \pm \sqrt{4r^2\cos^2\theta - 4r^2}}{2}$$

$= r\cos\theta \pm ir\sin\theta$

7.3 a) $y[n] = 2.5\,y[n-1] - y[n-2] + x[n] - 5x[n-1] + 6x[n-2]$

Applying z- transform

$$z\left(Y[n-p]\right) = \sum_{n=-\infty}^{\infty} y[n-p]\, z^{-n}$$

$$= z^{-p} \sum y[n-p]\, z^{-(n-p)}$$

$$= z^{-p}\, Y(z)$$

$$Y(z) = 2.5z^{-1}Y(z) - Y(z)z^{-1} + X(z) - 5z^{-1}X(z) + 6z^{-2}X(z)$$

$$Y\left(1 - 2.5z^{-1} + z^{-2}\right) = X\left(1 - 5z^{-1} + 6z^{-2}\right)$$

$$\frac{Y}{X} = H = \frac{1 - 5z^{-1} + 6z^{-2}}{1 - 2.5z^{-1} + z^{-2}}$$

Poles :- $Z = 2,\ Z = \frac{1}{2}$ Zeroes : $Z = 2.$; $Z = 3$

$$H = \frac{(1-2z^{-1})(1-3z^{-1})}{(1-2z^{-1})(1-\frac{1}{2}z^{-1})} = \frac{1-3z^{-1}}{1-\frac{z^{-1}}{2}}$$

$$\frac{Y}{X} = \frac{1-3z^{-1}}{1-\frac{z^{-1}}{2}}$$

$$Y\left(1 - \frac{z^{-1}}{2}\right) = X\left(1 - 3z^{-1}\right)$$

7.3 b) Applying inverse $y[n] - \frac{y[n-1]}{2} = x[n] - 3x[n-1]$

This is the reduced eq^n because of concatenation.

Scanned by CamScanner

$$H = \frac{1 - 3z^{-1}}{1 - \frac{z^{-1}}{2}}$$

7.3c) $$H(z) = \frac{1}{1 - \frac{z^{-1}}{2}} - \frac{3z^{-1}}{1 - \frac{z^{-1}}{2}}$$

Inverse of this

$$h[n] = \left(\frac{1}{2}\right)^n u(n) - 3\left(\frac{1}{2}\right)^{n-1} u[n-1]$$

This is a Causal system