## SNS COLLEGE OF TECHNOLOGY



## (An Autonomous Institution) Coimbatore – 641 035 DEPARTMENT OF MATHEMATICS RANDOM PROCESSES, WIDE SENSE STATIONARY PROCESS



3]. Cirven a landom variable y with characteristic function  $\phi(w) = E[e^{i\omega y}]$  and a landom process is defined by  $x(t) = \cos(At + y)$ . Show that [x(t)] is Stationary on the uside sense of  $\phi(t) = \phi(a) = 0$ 

Caven  $\phi(\omega) = E[e^{i\omega y}]$  and  $\chi(t) = Cos(it + y)$ Since  $\phi(t) = 0$ 

 $\phi(n) = E[e^{iy}] = E[\cos y + isin y] = 0$ 

E[cor y] + i E[SPn y] = 0+i0

Equating the lead & imaginary parts,

E[ $\cos y$ ] = 0 and E[ $\sin y$ ] = 0  $\rightarrow \cos$ 

 $\phi(a) = E[e^{iay}] = E[\cos ay + isin ay] = 0$ 

E[cos 2y] + i E[SPn 2y] = 0+ i0

Equating the lead bimaginary pouts,

E[ $(\cos 2y) = 0$  and E[ $\sin 2y = 0 \rightarrow (2)$ ]
Now,  $X(t) = \cos(\lambda t + y)$ 

i). E[x(t)] = E[ cor ( 1+ 4)]

= E[ cos 2+ cos x - 890 2+ 890 x]

= E[Cos At Los y] - E[SPn At SPn y]

= Cord+ E[cary] - Sind+ E[sin X]

= cos at (0) - San at (0) flom (1)

E[x(t)] = 0

ii) E[x(t) x(t+t)] = E[Coc(1++4) (oc(1++7)+4)]

= E [ cos (1+4) cos (1+47+47)]

 $= \frac{1}{2} E \left[ \cos(3t+y+3t+3t+y) + \cos(3t+y-3t-3t-y) \right]$ 

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$$= \frac{1}{2} E \left[ \cos \left( 2 A t + A T + 2 y \right) + \cos \left( - A T \right) \right]$$

$$=\frac{1}{2}\left\{ E\left[\cos\left(2\lambda \pm + \lambda \tau + 2\gamma\right)\right] + E\left[\cos(\lambda \tau)\right]\right\}$$

$$= R_{XX}(\tau)$$