Reg. No. : | | | | | | | |

SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University)
Coimbatore – 641 035.

Internal Assessment Examination -III
Academic Year 2022-2023(Even)
Fourth Semester
19MAT203 – PROBABILITY AND RANDOM PROCESSES
(REGULATION 2019)

A

TIME: 1 1/2 HOURS **MAXIMUM MARKS: 50**

ANSWER ALL QUESTIONS

PART A — (5 x 2 = 10 Marks)

		CO	BL	
1.	Check whether the function $R_{XX}(\tau) = 36 + \frac{8}{1+4\tau^2}$ is a valid Autocorrelation?	CO4	Und	2
2.	State power spectral density.	CO4	Rem	2
3.	Define time invariant system.	CO5	Rem	2
4.	Examine whether the system Y(t) = t X(t) is linear.	CO5	Und	2
5.	Find the mean square value of the random process whose auto correlation function is $\frac{A^2}{2}\cos(\omega\tau)$.	CO5	Und	2

PART B — (13+13+14 = 40 Marks)

6.	(a)	(i)	Find the power spectral density of a random binary transmission process where auto correlation function is $$R(\tau) = \begin{cases} 1 - \frac{\lvert\tau\rvert}{T}, & \lvert\tau\rvert \le T \\ 0, & Otherwise \end{cases}$$	CO4	App	6
		(ii)	The power spectral density function of a zero mean WSS process {X(t)} is given by $S(\omega) = \begin{cases} 1 & \lvert\omega\rvert < \omega_0 \\ 0 & otherwise \end{cases}$. Find the auto correlation function. Show that X(t) and $X(t + \frac{\pi}{\omega_0})$ are uncorrelated.	CO4	Ana	7
(OR)						
	(b)		If the cross correlation of two processes {X(t)} and {Y(t)} is $R_{XY}(t, t+\tau) = \frac{AB}{2}[sin\omega_0\tau + cos(\omega_0(2t+\tau))]$ where A,B,ω_0 are constants. Find the cross power spectrum.	CO4	Ana	13
7.	(a)	(i)	Show that if the input {X(t)} is a WSS process then the output {Y(t)} is also a WSS process.	CO5	App	6

7.	(a)	(ii)	A WSS process X(t) with $R_{XX}(\tau) = Ae^{-\alpha\|\tau\|}$ where A and a are real constants is applied to the input of an linear time invariant systems with h(t) = $e^{-bt}u(t)$ where b is a positive real constant. Find the power spectral density of the output of the system.	CO5	App	7
(OR)						
	(b)		If {X(t)} is a WSS process and if $Y(t) = \int_{-\infty}^{\infty} h(u)X(t-u)du$, then prove that (i) $R_{XY}((\tau) = R_{XX}(\tau) * h(\tau)$ (ii)$R_{YY}((\tau) = R_{XY}(\tau) * h(-\tau)$ (iii) $S_{XY}(\omega) = S_{XX}(\omega) * H(\omega)$ (iv) $S_{YY}(\omega) = S_{XX}(\omega) * \|H(\omega)\|^2$	CO5	App	13
8.	(a)		State and prove Wiener-Khintchine theorem.	CO4	App	14
			(OR)			
	(b)		X(t) is the input voltage to a circuit and Y(t) is the output voltage. {X(t)} is a stationary random process with $\mu_X = 0$ and $R_{XX}(\tau) = e^{-\alpha\|\tau\|}$. Find μ_Y, $S_{YY}(\omega)$ and $R_{YY}(\tau)$, if the power transfer function is $H(\omega) = \frac{R}{R+iL\omega}$.	CO5	Ana	14

Rem/Und: Remember/Understand **App:** Apply **Ana:** Analyze **Eva:** Evaluate **Cre:** Create

Prepared by **Verified by** **HoD/DEAN**