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)

B

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

ANSWER ALL QUESTIONS
PART A — (5 x 2 = 10 Marks)

		CO	BL	
1.	Given the ACF for a stationary process with no periodic component is $R_{XX}(\tau) = 25 + \frac{4}{1+6\tau^2}$, find the mean and variance of the process $\{X(t)\}$.	CO4	Und	2
2.	Check whether the function $R_{XX}(\tau) = \tau^3+\tau^2$ is a valid Autocorrelation?	CO4	Und	2
3.	State any two properties of cross power density spectrum.	CO4	Rem	2
4.	Examine whether the system $y(t) = \alpha\, x(t)$ is linear.	CO5	Und	2
5.	A system has an impulse response $h(t) = e^{-\beta t}\, u(t)$, find the system transfer function.	CO5	Und	2

PART B — (13+13+14 = 40 Marks)

6.	(a)	(i)	The auto correlation function of WSS process is given by $R_{XX}(\tau) = \alpha^2\, e^{-2\lambda\,\lvert\tau\rvert}$. Determine $S_{XX}(\omega)$.	CO4	App	6
		(ii)	The power spectral density of a WSS process is given by $S_{XX}(\omega) = \begin{cases} \frac{b}{a}(a - \lvert\omega\rvert), & \lvert\omega\rvert \le a \\ 0, & otherwise \end{cases}$ Find the auto correlation function.	CO4	App	7
			(OR)			
	(b)		State and prove Wiener-Khintchine theorem.	CO4	App	13
7.	(a)		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 $R_{XX}(\tau) = e^{-\alpha\lvert\tau\rvert}$. 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	13

			(OR)			
7.	(b)	(i)	If the input X(t) and its output Y(t) are related by $Y(t) = \int_{-\infty}^{\infty} h(u)X(t-u)du$, then prove that the system is a linear time invariant system.	CO5	App	6
		(ii)	A system has an impulse response $h(t) = e^{-bt}u(t)$, find the power spectral density of the output Y(t) corresponding to the input X(t).	CO5	Ana	7
8.	(a)		Consider two random processes $X(t) = 3\cos(\omega t + \theta)$ and $Y(t) = 2\cos(\omega t + \phi)$, where $\phi = \theta - \frac{\pi}{2}$ and θ is uniformly distributed random variable over $(0, 2\pi)$. Verify that $\lvert R_{XY}(\tau)\rvert \leq \sqrt{R_{XX}(0)R_{YY}(0)}$.	CO4	Ana	14
			(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) $S_{YY}(\omega) = S_{XX}(\omega) * \lvert H(\omega)\rvert^2$	CO5	App	14

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

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