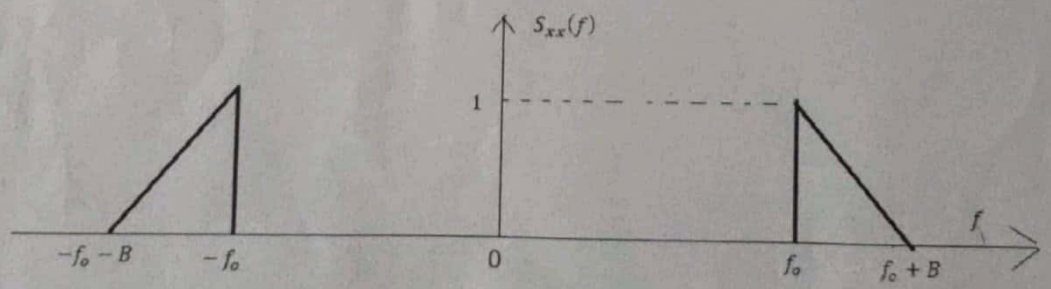
Continuous Assessment Test – II

Programme Name & Branch: B. Tech (ECE)

Course Name & Code: ECE 2005 Probability theory and Random Process

Slot: C2 **Exam Duration:90 mins** **Maximum Marks: 50**

General instruction(s): Answer all Questions

S. No	Questions	M
1.	Suppose $X(t)$ and $Y(t)$ are zero-mean, wide-sense stationary, continuous time random process. If $X(t)$ and $Y(t)$ are independent , find the auto correlation function for Z(t) in terms of the auto correlation functions for $X(t)$ and $Y(t)$ in each of the cases that follow. In each case, determine whether the random process $Z(t)$ is wide sense stationary. a) $Z(t) = cX(t)Y(t) + d$, Where c and d are deterministic constants b) $Z(t) = X(t)\cos(\omega_0 t) + Y(t)\sin(\omega_0 t)$, where ω_o is constant.	10
2.	a). A Gaussian random process has an autocorrelation function $$R_{XX}(\tau) = 6e^{\left(-\frac{\lvert\tau\rvert}{2}\right)}$$ Determine the covariance matrix for $X(t), X(t+1), X(t+2)$. b). A small store has two check-out lanes that develop waiting lines if more than two customers arrive in any one minute interval. Assume that a Poisson process describes the number of customers that arrive for check out .Find the probability of a waiting line if the average rate of customer arrivals is i) 2 per minute ii) 1 per minute	5 5
3.	a. A pass band signal is having a power spectrum density as $$S_{XX}(\omega) = \begin{cases} 1; & \omega_0 - \frac{W}{2} \le \lvert\omega\rvert \le \omega_0 + \frac{W}{2} \\ 0; & \text{elsewhere} \end{cases}$$ Find the RMS bandwidth of the signal. b. Random process $Y(t) = X(t - t_0)$ is a time delayed version of the WSS process $X(t)$. Find the cross spectral density $S_{XY}(\omega)$.	5 5
4.	Let $X(t)$ be a random process whose power spectral density is shown in the below figure. A new process is formed by multiplying $X(t)$ by a carrier to produce $Y(t) = X(t)\cos(\omega_o t + \theta)$ where θ is uniform random variable in the interval $(0, 2\pi)$ and independent of $X(t)$. Find and sketch the Power spectral Density of the process $Y(t)$. 	10