Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – October 2025

Date: 07-10-2025 **Time:** 02.00pm to 03.30pm

School: SOE	**Program:** B.Tech	
Course Code: ECE3033	**Course Name:** Adaptive Signal Processing	
Semester: V	**Max Marks**:50	**Weightage**:25%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	26	24	-	-	-

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	When modeling any system, it is important to follow a systematic sequence of steps to ensure accurate validation. In this context, **list and explain the steps involved in the working of an adaptive filter.**	2 Marks	L2	CO1
2	In adaptive filtering, system modeling often involves parameters that balance stability and convergence speed to achieve optimal performance. **Discuss how the choice of step size (μ) in the LMS algorithm affects both stability and convergence speed.**	2 Marks	L2	CO1
3	Certain adaptive algorithms are capable of updating their learning parameters automatically without manual intervention. **Write and explain an adaptive algorithm in which the step size is adjusted dynamically to ensure stable convergence and effective tracking, even under abrupt variations in the input signal with time.**	2 Marks	L2	CO1
4	In Weak-Sense Stationary (Wide-Sense Stationary), higher-order statistics may vary with time, but since DSP and communication system performance relies mainly on some parameters, WSS assumption is practically sufficient. **State any one property of a Weak-Sense**	2 Marks	L2	CO2

	Stationary (Wide-Sense Stationary) process.			
5	Real-world signals in time-series and signal processing depend on past values and random noise, so stochastic models are used to represent them. **Define the ARMA(p,q) model and distinguish it from AR(p) and MA(q) models.**	**2 Marks**	**L2**	**CO2**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	System: true plant has impulse response $h = [0.6, -0.4]^{T.}$ Given input vectors and no measurement noise, for n=1,2 compute LMS updates with $\mu=0.1$ and initial $w(0) = [0, 0]^{T.}$	**20 Marks**	**L3**	**CO 1**
		Or			
7.	**a.**	You want an LMS of length M=3 with white input variance $\sigma_x^2=0.5$ You want a reasonably fast but safe step-size. Suggest a value for μ using both the theoretical bound and a conservative practical choice.	**20 Marks**	**L3**	**CO 1**

8.	**a.**	Consider $X_t=0.7\,X_{t-1}-0.2\,X_{t-2}+\varepsilon_t$. Find the roots of the characteristic equation and decide whether the process is asymptotically stationary. *(Hint: characteristic equation for stationarity: $1-\phi_1 z-\phi_2 z^2=0$ solve for z and check $\|z\|>1$)*	**20 Marks**	**L3**	**CO 2**
		Or			
9.	**a.**	Consider an ARMA (1,1) model: $X_n=0.6X_{n-1}+\varepsilon_n+0.5\varepsilon_{n-1},\ \ \varepsilon_n\sim WN(0,1)$ (a) Compute the mean and variance of X_n. (b) Find the autocovariance at lag 1.	**20 Marks**	**L3**	**CO 2**