

Reg. No. :

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Question Paper Code: U1201

M.E. DEGREE EXAMINATION, DEC 2025

First Semester

Communication Systems

21PCM101-ADAPTIVE SIGNAL PROCESSING

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) Consider a First order AR process that is generated by the difference equation $y(n) = ay(n-1) + w(n)$ where $|a| < 1$ and $w(n)$ is a zero mean white noise random process with variance σ_w^2 . (20)
CO2- App
(a) Find the unit sample response of the filter that generates $y(n)$ and $w(n)$.
(b) Find the autocorrelation of $y(n)$.
(c) Find the power spectrum of $y(n)$.
Or
(b) The power spectrum of a WSS process $x(n)$ is $P_x(e^{j\omega}) = \frac{25 - 24 \cos \omega}{26 - 10 \cos \omega}$. Find the whitening filter $H(z)$ that produces unit variance white noise when the input is $x(n)$. (20)
CO2- App
2. (a) Find the linear convolution of the sequences $x(n)$ and $h(n)$ using DFT. (20)
CO3- App
 $x(n) = \{1, 0, 2\}$, $h(n) = \{1, 1\}$.
Or
(b) Design a two stage decimator for the following specifications $D = 100$, Pass band $0 \leq F \leq 50\text{Hz}$, Transition band $50 \leq F \leq 55\text{Hz}$ and Input sampling rate 10KHz Ripple $S1 = 1/10$ and $S2 = 1/1000$. (20)
CO3- App
3. (a) Explain about adaptive filter configuration. (20)
CO1- U
Or
(b) Explain about LMS adaptation algorithms (20)
CO1- U

4. (a) Determine the mean and the auto correlation of the sequence $x(n)$ generated by the MA(2) process described by the difference equation.
 $X(n) = w(n) - 2w(n-1) + w(n-2)$
Where $w(n)$ is the white noise process with variance σ_w^2
Or
- (b) Analyze how do different noise levels and noise types affect the estimation of spectral density in an AR model, ARMA model and what mitigation strategies can be employed? CO5-Ana (20)
5. (a) Explain the DSP techniques which are used in speech analysis and synthesis. CO1-U (20)
Or
- (b) Explain how the signal processing techniques is used to converts a signal in to coefficients that represent both time and frequency information. CO1-U (20)