

Unit 10 - Week 7- Signal Reconstruction from Sampled Signal ,Introduction to Pulse Amplitude Modulation, Spectrum of PAM Signal and Reconstruction, Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, Lloyd Max Quantization Algorithm, Non-uniform Quantizers

Course outline
How does an NPTEL online course work?
Week-0
Week 1-Basic tools for communication, Fourier Series/Transform, Properties, Parsevals Relation, Properties of Fourier Transform, LTI Systems
Week 2- Cross- and Auto-correlation, (ESD), Introduction to Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, (DSB-SC) Modulation and Demodulation
Week-3- Power Efficiency, (DSB-SC) Modulation and Demodulation, Carrier Phase Offset Example for (DSB-SC), Costas Receiver
Week-4 Quadrature Carrier Multiplexing (QCM) and Demodulation of QCM signals, Single Sideband Modulation (SSB), Hilbert Transform
Week-5 Generation of SSB , Complex pre-envelope of QCM, VSB , Introduction to AM
Week-6 Narrowband FM Generation, Spectrum of FM Signals, Carson's Rule for FM Bandwidth, Narrowband FM Generation, FM Demodulation, Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion
Week 7- Signal Reconstruction from Sampled Signal ,Introduction to Pulse Amplitude Modulation, Spectrum of PAM Signal and Reconstruction, Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, Lloyd Max Quantization Algorithm, Non-uniform Quantizers
<input checked="" type="radio"/> Lec 37- Ideal Impulse Train Sampling <input type="radio"/> Lec 38- Introduction to Pulse Amplitude Modulation (PAM) <input type="radio"/> Lec 39- Pulse Amplitude Modulation (PAM) <input type="radio"/> Lec 40- Introduction to Quantization and Quantizer <input type="radio"/> Lec 41- Quantization and Mid-rise quantizers <input type="radio"/> Lec 42- Introduction to Lloyd-Max quantization algorithm <input type="radio"/> Lec 43- Optimal Lloyd- Max quantizer design <input type="radio"/> Lec 44- Companding, Mu-law and A- Law compressors <input type="radio"/> Quiz : Assignment-7 <input type="radio"/> Feedback For Week 7 <input type="radio"/> Solution-7
Week 8- Delta Modulation, Differential Pulse Code Modulation, Frequency Mixing and Translation in Communication Systems, Heterodyne and Super Heterodyne Receivers, Frequency Division Multiplexing, Time Division Multiplexing, T1 TDM System: Case Study
Week 9 - Basics of Probability, Conditional Probability, Independent Events - Mary-PAM Example, Independent Events-Block Transmission, Independent Events-Multiantenna Fading
Text Transcripts
DOWNLOAD VIDEOS
Week 10- Bayes Theorem, Maximum Aposteriori Probability (MAP) Receiver, Random Variables and PDF, Power of Fading Wireless Channel, Mean & Variance of Random Variables and Application:Average & RMS Delay Spread
Week 11 - Transformation of Random Variables, Gaussian Random Variable ,Special Case: IID Gaussian Random Variables, Application: Uniform Linear Arrays, Random Processes and (WSS) and WSS Examlpe
Week 12- Power Spectral Density(PSD) for WSS Random Procss, PSD Application in Wireless, WSS Random Process Through LTI System, Special Random Processes and Gaussian Process Through LTI System

Assignment-7

The due date for submitting this assignment has passed. **Due on 2020-03-18, 23:59 IST.**
 As per our records you have not submitted this assignment.

1) Consider a message signal with maximum frequency f_m . The minimum sampling frequency f_s required to avoid distortion in the **1 point** spectrum of the sampled signal is

- f_m
- $2f_m$
- $\frac{1}{2}f_m$
- $(f_m)^2$

No, the answer is incorrect.
 Score: 0
 Accepted Answers: $2f_m$

2) Consider a signal $m(t)$ with spectrum $M(f)$, which is sampled with an ideal impulse train of sampling frequency f_s . The spectrum **1 point** of the resulting sampled signal is

- $\frac{f_s}{2}(M(f - f_s) + M(f + f_s))$
- $\frac{1}{2}M(f - f_s)(1 + \text{sgn}(f - f_s)) + \frac{1}{2}M(f + f_s)(1 - \text{sgn}(f + f_s))$
- $f_s \sum_{n=-\infty}^{\infty} M(f - nf_s)$
- $M(f)$

No, the answer is incorrect.
 Score: 0
 Accepted Answers: $f_s \sum_{n=-\infty}^{\infty} M(f - nf_s)$

3) Consider the signal $m(t) = \cos(100\pi t)$. What is the minimum sampling frequency required for no distortion? **1 point**

- 25 Hz
- 100 Hz
- 100π Hz
- 200 Hz

No, the answer is incorrect.
 Score: 0
 Accepted Answers: 100 Hz

4) Consider the signal $m(t) = 10 \times \text{sinc}(5t) = 10 \times \frac{\sin(5\pi t)}{5\pi t}$. What is the minimum sampling rate required for this signal to avoid **1 point** aliasing?

- 2.5 Hz
- 5 Hz
- 10 Hz
- 5π Hz

No, the answer is incorrect.
 Score: 0
 Accepted Answers: 5 Hz

5) Consider the signal $m(t) = \cos(160\pi t)$ to be sampled using an impulse train with sampling frequency $f_s = 180$ Hz. What is the range **1 point** of possible cutoff frequencies of the low pass filter required for perfect reconstruction of the signal $m(t)$ from the sampled signal? Consider the frequency response of an ideal low pass filter with cutoff frequency f_i to be 1 for $-f_i \leq f \leq f_i$ and 0 otherwise.

- $40 Hz < f_i < 120 Hz$
- $80 Hz < f_i < 100 Hz$
- $80 Hz < f_i < 180 Hz$
- $80 Hz < f_i < 160 Hz$

No, the answer is incorrect.
 Score: 0
 Accepted Answers: $80 Hz < f_i < 100 Hz$

6) Consider the sinusoidal signal $m(t) = \cos(2000\pi t)$. It is sampled using an impulse train with sampling frequency **1 point** $f_s = 1.8 kHz$, followed by low pass filtering with an ideal low pass filter of cutoff frequency $2kHz$. What are the frequencies of the sinusoids present in the resulting signal?

- 1 kHz only
- 1 kHz and 0.2 kHz only
- 1 kHz and 0.8 kHz only
- 1 kHz and 1.8 kHz only

No, the answer is incorrect.
 Score: 0
 Accepted Answers: 1 kHz and 0.8 kHz only

7) Consider a message signal $m(t)$ with maximum frequency f_m . The minimum sampling rate required to sample this signal to avoid **1 point** distortion of the spectrum is termed the

- Carsons rate
- Nyquist rate
- Costas rate
- Viterbi rate

No, the answer is incorrect.
 Score: 0
 Accepted Answers: Nyquist rate

8) Consider the signal $m(t) = \cos(400\pi t)$. What is the minimum sampling frequency required for no distortion? **1 point**

- 400 Hz
- 800 Hz
- 100 Hz
- 200 Hz

No, the answer is incorrect.
 Score: 0
 Accepted Answers: 400 Hz

9) Consider the signal $m(t) = \sin(300\pi t)$ to be sampled using an impulse train with sampling frequency $f_s = 400$ Hz. What is the range **1 point** of possible cutoff frequencies of the low pass filter required for perfect reconstruction of the signal $m(t)$ from the sampled signal? Consider the frequency response of an ideal low pass filter with cutoff frequency f_i to be 1 for $-f_i \leq f \leq f_i$ and 0 otherwise.

- $150 Hz < f_i < 250 Hz$
- $300 Hz < f_i < 400 Hz$
- $150 Hz < f_i < 400 Hz$
- $200 Hz < f_i < 400 Hz$

No, the answer is incorrect.
 Score: 0
 Accepted Answers: $150 Hz < f_i < 250 Hz$

10) Consider the sinusoidal signal $m(t) = \cos(10 \times 10^3 \pi t)$. It is sampled using an impulse train with sampling frequency **1 point** $f_s = 8 kHz$, followed by low pass filtering with an ideal low pass filter of cutoff frequency $6 kHz$. What are the frequencies of the sinusoids present in the resulting signal?

- 5 kHz only
- 5 kHz and 3 kHz only
- 5 kHz and 8 kHz only
- 5 kHz and 6 kHz only

No, the answer is incorrect.
 Score: 0
 Accepted Answers: 5 kHz and 3 kHz only