National Testing Agency

Question Paper Name :	Electronic Systems for Sensor Applications 15 September 2020 Shift 1
Subject Name :	Electronic Systems for Sensor Applications
Creation Date :	2020-09-15 13:26:35
Duration :	180
Total Marks :	50
Display Marks:	Yes
Share Answer Key With Delivery Engine :	Yes
Actual Answer Key :	Yes

Electronic Systems for Sensor Applications

Group Number :	1
Group Id :	89951444
Group Maximum Duration :	0
Group Minimum Duration :	120
Show Attended Group? :	No
Edit Attended Group? :	No
Break time :	0
Group Marks :	50
Is this Group for Examiner? :	No

Electronic Systems for Sensor Applications

Section Id :	89951446
Section Number :	1
Section type :	Online
Mandatory or Optional :	Mandatory

Number of Questions :	42
Number of Questions to be attempted :	42
Section Marks :	50
Display Number Panel :	Yes
Group All Questions :	Yes
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	89951459
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 8995143950 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The name of the data analysis technique to estimate optimal averaging time for achieving best resolution for a sensor output is:

A. Weibull distribution
B. Arrhenius plot
C. Allan variance
D. None of the above

Options :

89951415755. 1

89951415756. 2

89951415757. 3

89951415758. 4

Question Number : 2 Question Id : 8995143951 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In the low noise vs low power trade-off case study of the accelerometer used as tilt sensor, the specification to choose the most suitable sensor is:

A. Energy consumption
B. Power consumption
C. Averaging time
D. RMS noise

Options :

89951415759. 1
89951415760. 2
89951415761. 3
89951415762. 4

Question Number : 3 Question Id : 8995143952 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The random vibrations causes vibration rectification in an accelerometer causing a shift in:

A. RMS noise
B. Offset
C. Bandwidth
D. Sensitivity

Options :

89951415763. 1
89951415764. 2
89951415765. 3
89951415766. 4

Question Number : 4 Question Id : 8995143953 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In an application of an active sensor, which circuit may be used for maximizing the signal to noise ratio of the sensor output:

A. Trans-impedance amplifier
B. Auto-zero amplifier
C. Chopper amplifier
D. Lock-in amplifier

Options :

89951415767. 1
89951415768. 2
89951415769. 3
89951415770. 4

Question Number : 5 Question Id : 8995143954 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following is a highly linear capacitive transducer?

A. Comb-drive
B. Cantilever resonator
C. Folded flexure beam
D. Gap-closing capacitive actuator

Options :

89951415771. 1
89951415772. 2
89951415773. 3
89951415774. 4

Question Number : 6 Question Id : 8995143955 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following forms the operating principle of MEMS gyroscopes discussed in the course?

A. Euler force
B. Centrifugal force
C. Coriolis force
D. None of the above

Options :

89951415775. 1
89951415776. 2
89951415777. 3
89951415778. 4

Question Number : 7 Question Id : 8995143956 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Sampling an analog sensor output at less-than Nyquist sampling rate results in which of these errors:

A. Higher noise due to out-of-band signals
B. Non-linear output due to mixing
C. Reduced sensitivity due to sub-sampling
D. All of the above

Options :

89951415779. 1
89951415780. 2
89951415781. 3
89951415782. 4

Question Number : 8 Question Id : 8995143957 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following is an invalid boundary condition for a MEMS beam structure?

A. Fixed
B. Guided
C. Free
D. Bonded

Options :

89951415783. 1
89951415784. 2
89951415785. 3
89951415786. 4

Question Number : 9 Question Id : 8995143958 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The spring constant of a cantilever beam fixed at one end and subjected to a point load at the other end is given by: (Young's modulus = E, width = W, height = H, length = L)

A. $EWH^3/12L^3$
B. $EWH^3/4L^3$
C. $EWH^3/6L^3$
D. EWH^3/L^3

Options :

89951415787. 1
89951415788. 2
89951415789. 3
89951415790. 4

Question Number : 10 Question Id : 8995143959 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following circuits was introduced as a read-out circuit for a capacitively transduced accelerometer?

A. Lock-in amplifier
B. Switched-capacitor integrator
C. Chopper amplifier
D. Comb-drive

Options :

89951415791. 1
89951415792. 2
89951415793. 3
89951415794. 4

Question Number : 11 Question Id : 8995143960 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

A lock-in amplifier utilizes which of the following principles:

A. Phase sensitive detection
B. Synchronous demodulation
C. Narrow band filtering
D. All of the above

Options :

89951415795. 1
89951415796. 2
89951415797. 3
89951415798. 4

Question Number : 12 Question Id : 8995143961 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which MEMS transduction principle was not discussed in this course:

A. Capacitive transduction
B. Thermal transduction
C. Piezoelectric transduction
D. None of the above

Options :

89951415799. 1
89951415800. 2
89951415801. 3
89951415802. 4

Question Number : 13 Question Id : 8995143962 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

For a distribution of measurements with mean M and standard deviation S, the convention for the 'typical' specification is:

A. M ± 5S
B. M ± 5.5S
C. M ± 3S
D. M ± S

Options :

89951415803. 1
89951415804. 2
89951415805. 3
89951415806. 4

Sub-Section Number :	2
Sub-Section Id :	89951460
Question Shuffling Allowed :	Yes

Question Id : 8995143963 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (14 to 15)

Question Label : Comprehension

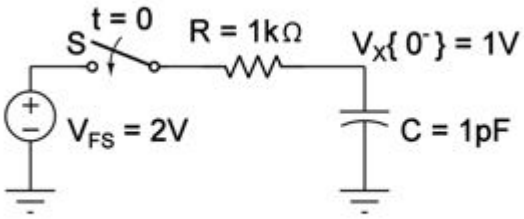

Figure 1. Capacitor charging.

Sub questions

Question Number : 14 Question Id : 8995143964 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In Figure 1, the capacitor C is charged to 1V at time t=0(-). Switch S closes at time t=0. What is the energy drawn by the voltage source V_{FS} from time $t = 0^+$ to time $t = \infty$?

A. 4 pJ

B. 2 pJ

C. 1 pJ

D. 0.5 pJ

Options :

89951415807. 1

89951415808. 2

89951415809. 3

89951415810. 4

Question Number : 15 Question Id : 8995143965 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In Figure 1, the capacitor C is charged to 1 V at time $t = 0^-$. Switch S closes at time t=0. What is the total charge stored on capacitor C at time $t = \infty$?

A. 6 pC

B. 4 pC

C. 2 pC

D. 1 pC

Options :

89951415811. 1

89951415812. 2

89951415813. 3

89951415814. 4

Sub-Section Number :	3
Sub-Section Id :	89951461
Question Shuffling Allowed :	Yes

Question Id : 8995143966 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (16 to 18)

Question Label : Comprehension

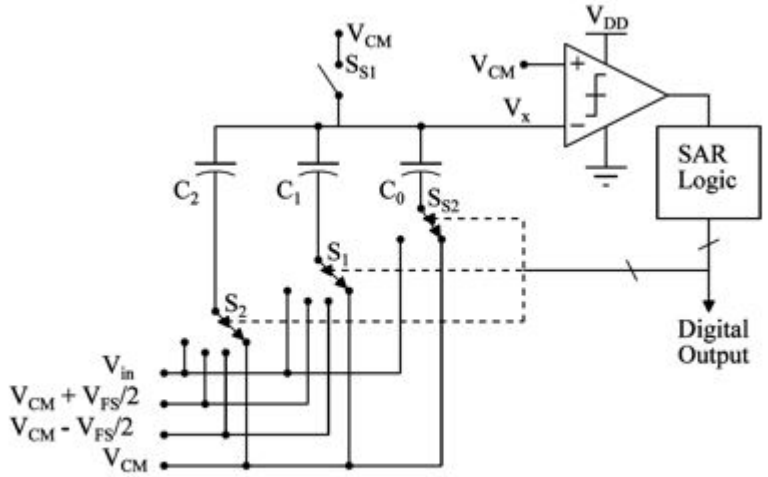

Figure 2. Traditional single ended 3-bit SAR ADC.

Sub questions

Question Number : 16 Question Id : 8995143967 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the value of V_X during MSB comparison?

A. $V_{CM} - V_{in}$

B. $V_{CM} + V_{in}$

C. $2V_{CM} - V_{in}$

D. $2V_{CM} + V_{in}$

Options :

89951415815. 1

89951415816. 2

89951415817. 3

89951415818. 4

Question Number : 17 Question Id : 8995143968 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the value of LSB in terms of V_{FS}?

A. $V_{FS}/2$

B. $V_{FS}/4$

C. $V_{FS}/8$

D. $V_{FS}/16$

Options :

89951415819. 1
89951415820. 2
89951415821. 3
89951415822. 4

Question Number : 18 Question Id : 8995143969 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Consider $V_{FS} = 2$ V, $V_{CM} = 1$ V, $C_0 = 5$ fF. Large signal DC input $V_{in} = 1.6$ V is applied. Find the value of V_X during each bit conversion ($B_2\,B_1\,B_0$) of the 3-bit SAR ADC shown in Figure 2.

A. $V_{X,B2} = 1.6$ V, $V_{X,B1} = 1.1$ V, $V_{X,B0} = 0.95$ V

B. $V_{X,B2} = 0.4$ V, $V_{X,B1} = 1.1$ V, $V_{X,B0} = 0.85$ V

C. $V_{X,B2} = 0.4$ V, $V_{X,B1} = 0.9$ V, $V_{X,B0} = 0.65$ V

D. $V_{X,B2} = 0.4$ V, $V_{X,B1} = 0.9$ V, $V_{X,B0} = 1.15$ V

Options :

89951415823. 1
89951415824. 2
89951415825. 3
89951415826. 4

Sub-Section Number : 4

Sub-Section Id : 89951462

Question Shuffling Allowed : Yes

Question Number : 19 Question Id : 8995143970 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

With increase in sampling frequency of a 3-bit SAR ADC, the percentage of total power consumed due to leakage in digital circuit:

A. decreases.
B. remains same.
C. increases.
D. depends on SAR control logic.

Options :

89951415827. 1
89951415828. 2
89951415829. 3
89951415830. 4

Sub-Section Number : 5
Sub-Section Id : 89951463
Question Shuffling Allowed : Yes

Question Id : 8995143971 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (20 to 22)

Question Label : Comprehension

Consider $V_{FS} = 2$ V, $C_0 = 5$ fF. V_X at time T is $V_X\{T\} = 0.4$ V.

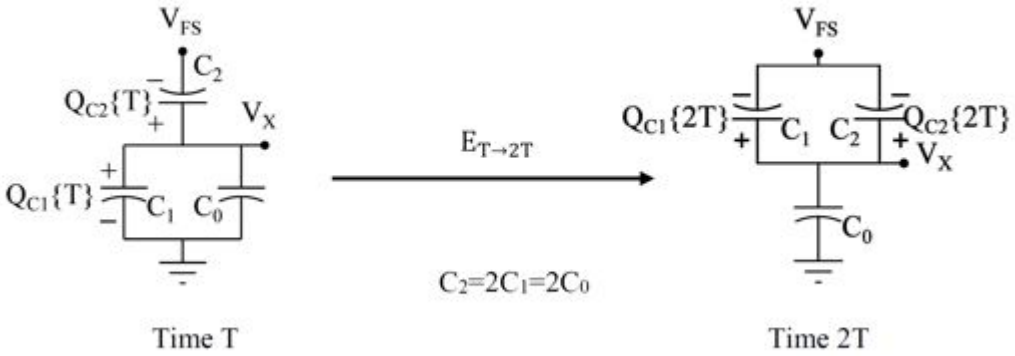

Figure 3. Single capacitor switching.

Sub questions

Question Number : 20 Question Id : 8995143972 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The charge stored capacitors C_1 and C_2 at time T are $Q_{C1}\{T\}$ and $Q_{C2}\{T\}$, respectively. Which one of the following is correct?

A. $Q_{C1}\{T\} = 2$ fC, $Q_{C2}\{T\} = -16$ fF

B. $Q_{C1}\{T\} = -2$ fC, $Q_{C2}\{T\} = -8$ fF

C. $Q_{C1}\{T\} = -2$ fC, $Q_{C2}\{T\} = -16$ fF

D. $Q_{C1}\{T\} = 2$ fC, $Q_{C2}\{T\} = 16$ fF

Options :

89951415831. 1

89951415832. 2

89951415833. 3

89951415834. 4

Question Number : 21 Question Id : 8995143973 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The charge stored on capacitors C_1 and C_2 at time 2T are $Q_{C1}\{2T\}$ and $Q_{C2}\{2T\}$, respectively. Which one of the following is correct?

A. $Q_{C1}\{2T\} = 5.5$ fC, $Q_{C2}\{2T\} = -11$ fF

B. $Q_{C1}\{2T\} = -5.5$ fC, $Q_{C2}\{2T\} = -11$ fF

C. $Q_{C1}\{2T\} = -5.5$ fC, $Q_{C2}\{2T\} = -5.5$ fF

D. $Q_{C1}\{2T\} = 5.5$ fC, $Q_{C2}\{2T\} = 11$ fF

Options :

89951415835. 1

89951415836. 2

89951415837. 3

89951415838. 4

Question Number : 22 Question Id : 8995143974 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Energy consumed in switching from time T to time 2T is.

A. 2.5 fJ

B. 1.25 fJ

C. 10 fJ

D. 5 Fj

Options :

89951415839. 1

89951415840. 2

89951415841. 3

89951415842. 4

Sub-Section Number :	6
Sub-Section Id :	89951464
Question Shuffling Allowed :	Yes

Question Number : 23 Question Id : 8995143975 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following method is not helpful in capacitive SAR ADC power saving?

A. Reducing full scale of the ADC.
B. Operating digital logic at low voltage.
C. Reducing sampling frequency of the ADC.
D. None of the above.

Options :

89951415843. 1
89951415844. 2
89951415845. 3
89951415846. 4

Sub-Section Number :	7
Sub-Section Id :	89951465
Question Shuffling Allowed :	Yes

Question Id : 8995143976 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (24 to 26)

Question Label : Comprehension

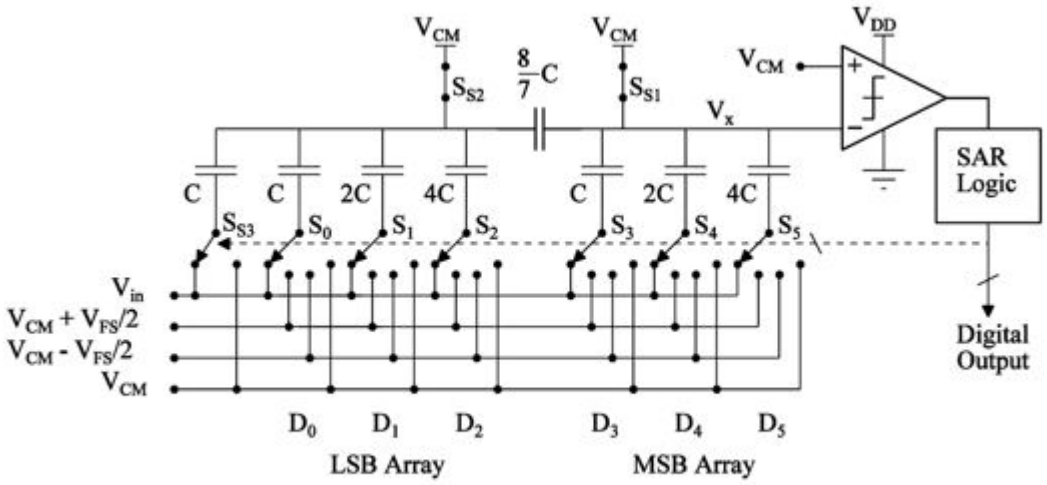

Figure 4. 6-bit split capacitor array SAR ADC.

Sub questions

Question Number : 24 Question Id : 8995143977 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

A 6-bit split capacitor array SAR ADC is shown in Figure 4. Assume we would like to replace the 6-bit SAR ADC with an 8-bit ADC so that 4-bits are obtained from LSB array and 4-bits from MSB array. In such 8-bit ADC, what is the size of attenuation capacitor which bridges the MSB DAC and the LSB DAC, in terms of unit capacitor C?

A. $\frac{32}{31}C$

B. $\frac{16}{15}C$

C. $\frac{15}{16}C$

D. $\frac{31}{32}C$

Options :
89951415847. 1

89951415848. 2
89951415849. 3
89951415850. 4

Question Number : 25 Question Id : 8995143978 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

A 6-bit split capacitor array SAR ADC is shown in Figure 4. In an N-bit ADC which uses split capacitor array technique, N/2-bits are obtained from LSB array and N/2-bits from MSB array. For such N-bit ADC, what is the size of capacitive DAC in terms of unit capacitor C?

A. $2^N + \frac{1}{2^{N/2-1}}$
B. $2^{N-1} + \frac{1}{2^{N/2-1}}$
C. $2^{N-1} - \frac{1}{2^{N/2-1}}$
D. $2^N - \frac{1}{2^{N/2-1}}$

Options :
89951415851. 1
89951415852. 2
89951415853. 3
89951415854. 4

Question Number : 26 Question Id : 8995143979 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

Split capacitor array technique (shown in Figure 4) is useful:

A. Only for power saving.
B. Only for area saving.
C. For area and power saving.
D. None of the above.

Options :

89951415855. 1
89951415856. 2
89951415857. 3
89951415858. 4

Sub-Section Number : 8
Sub-Section Id : 89951466
Question Shuffling Allowed : Yes

Question Number : 27 Question Id : 8995143980 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

Consider the random process

$$x[n] = Acos(n\omega_o + \phi).$$

This process is wide sense stationary (WSS) if

A. A is a random variable with mean 0 and variance σ_A^2; ω_o is constant; ϕ is constant
B. A is a constant; ω_o is constant; ϕ is uniformly distributed over $[-\pi, \pi]$
C. A is a constant, ω_o is uniformly distributed over $[-\omega_o - \triangle, \omega_o + \triangle]$; ϕ is constant
D. any of the above conditions are true

Options :
89951415859. 1
89951415860. 2
89951415861. 3
89951415862. 4

Question Number : 28 Question Id : 8995143981 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

The Wiener filter is the optimal filter for minimizing which of the following error functions between desired signal $d[n]$ and estimated signal $\hat{d}[n]$.

A. $\zeta = \sum_{i=0}^{n}(d[i] - \hat{d}[i])$

B. $\zeta = E\{|\, d[n] - \hat{d}[n]\,|\}$

C. $\zeta = \sum_{i=0}^{n} |(d[i] - \hat{d}[i])|^2$

D. $\zeta = E\{|d[n] - \hat{d}[n]|^2\}$

Options :

89951415863. 1
89951415864. 2
89951415865. 3
89951415866. 4

Question Number : 29 Question Id : 8995143982 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

The Wiener FIR filter is optimal when minimizing the mean-square error for the following combination of signal and system condition.

A. deterministic signal and LTI system

B. non-stationary random signal and LTI system

C. stationary random signal and LTI system

D. stationary random signal and non-linear time-invariant system

Options :

89951415867. 1
89951415868. 2
89951415869. 3
89951415870. 4

Question Number : 30 Question Id : 8995143983 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

Consider the steepest descent algorithm for updating weights

$$w_{n+1} = w_n + \mu E\{e[n]x^*[n]\}$$

in adaptive filters. Let R_x be the input correlation matrix with eigen-values λ_i and eigen-vectors v_i. The condition for convergence of the algorithm is

A. $\mu > 0$

B. $\mu > 2/\lambda_{max}$

C. $0 < \mu < 2/\lambda_{max}$

D. $0 \leq \mu \leq 2/\lambda_{max}$

Options :
89951415871. 1
89951415872. 2
89951415873. 3
89951415874. 4

Question Number : 31 Question Id : 8995143984 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

The least mean squares (LMS) algorithm has the following weight update step.

A. $w_{n+1} = w_n + \mu E\{e[n]x^*[n]\}$

B. $w_{n+1} = w_n + \mu \sum_{m=0}^{P} e[n-m]x^*[n-m]$

C. $w_{n+1} = w_n + \mu(r_{dx} - R_x w_n)$

D. $w_{n+1} = w_n + \mu e[n]x^*[n]$

Options :

89951415875. 1
89951415876. 2
89951415877. 3
89951415878. 4

Question Number : 32 Question Id : 8995143985 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

Which of the following choice of μ in LMS algorithm has faster convergence

A. $\mu = 0$

B. $\mu = \frac{2}{\lambda_{min}}$

C. $\mu = \frac{2}{\lambda_i}, where \lambda_{min} < \lambda_i < \lambda_{max}$

D. $\mu > \frac{2}{\lambda_{max}}$

Options :
89951415879. 1
89951415880. 2
89951415881. 3
89951415882. 4

Question Number : 33 Question Id : 8995143986 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

Let $x[n]$ be the input signal; $d[n]$ the desired signal with mean zero; and $v[n]$ white noise signal with mean zero and variance σ_v^2, related as

$$x[n] = d[n] + v[n].$$

Assume $d[n]$ and $v[n]$ are uncorrelated, and $d[n]$ is WSS. Then the autocorrelations are related as:

A. $r_{xx}[k] = r_{dd}[k]$

B. $r_{xx}[k] = r_{dd}[k] + r_{vv}[k]$

C. $r_{xx}[k] = r_{dd}[k] + \sigma_v^2$

D. $r_{xx}[k] = \sigma_v^2 r_{dd}[k]$

Options :

89951415883. 1

89951415884. 2

89951415885. 3

89951415886. 4

Question Number : 34 Question Id : 8995143987 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The LMS filter is

A. linear, time-invariant

B. linear, time-variant

C. non-linear, time-invariant

D. non-linear, time-variant

Options :

89951415887. 1

89951415888. 2

89951415889. 3

89951415890. 4

Question Number : 35 Question Id : 8995143988 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

By choosing $0 < \mu < 2/\lambda_{max}$, where λ_{max} is the maximum eigen-value of R_x, the LMS algorithm

A. converges only for WSS signals
B. converges both for WSS and non-WSS signals independent of the initial weight vector
C. converges both for WSS and non-WSS signals depending on the initial weight vector
D. will not converge

Options :
89951415891. 1
89951415892. 2
89951415893. 3
89951415894. 4

Question Number : 36 Question Id : 8995143989 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

For the WSS scenario, the minimum mean-square error ζ_{min} will be obtained by using the steepest descent algorithm. In this case the LMS converges and obtains the error ζ_{LMS}.

A. $\zeta_{LMS} = 0$
B. $\zeta_{LMS} = \zeta_{min}$
C. $\zeta_{LMS} = \zeta_{min} + \epsilon$, where ϵ is a small value.
D. *Can not be determined the question.*

Options :
89951415895. 1

89951415896. 2
89951415897. 3
89951415898. 4

Question Number : 37 Question Id : 8995143990 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

The RLS solves for the weight vector w_n using

$$R_x[n]w_n = r_{dx}[n]$$

Here,

A. $R_x[n]$ is the statistical autocorrelation matrix $E\{x[n]x^T[n]\}$
B. $R_x[n]$ is the deterministic autocorrelation matrix $x[n]x^T[n]$
C. $R_x[n]$ is the statistical autocorrelation matrix $E\{\sum_{i=0}^{n} x[i]x^T[i]\}$
D. $R_x[n]$ is the deterministic autocorrelation matrix $\sum_{i=0}^{n} x[i]x^T[i]$

Options :
89951415899. 1
89951415900. 2
89951415901. 3
89951415902. 4

Question Number : 38 Question Id : 8995143991 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

Considering LMS and exponentially weighted RLS adaptive filters, which one of the following statements is FALSE.

A. Both perform well for non-stationary signal conditions
B. Performance of LMS will be better than RLS
C. Performance of RLS will be better than LMS
D. Computational complexity of LMS is less than that of RLS

Options :

89951415903. 1
89951415904. 2
89951415905. 3
89951415906. 4

Question Number : 39 Question Id : 8995143992 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

The name of the pedagogical technique used throughout the lectures delivered by Prof. Vikram M. Gadre is:

A. Think, Inhale, Pair and Exhale
B. Think, Reflect, Share, Pair
C. Think, Inhale, Pair, Exhale and Share
D. None of the above

Options :

89951415907. 1
89951415908. 2
89951415909. 3
89951415910. 4

Question Number : 40 Question Id : 8995143993 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

In this technique, one is NOT encouraged to talk to anyone around in the

A. Think Phase
B. Inhale Phase
C. Pair Phase
D. Exhale Phase

Options :

89951415911. 1
89951415912. 2
89951415913. 3
89951415914. 4

Question Number : 41 Question Id : 8995143994 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In this technique, one IS expected to discuss locally with one or more partner(s) in the

A. Think Phase
B. Inhale Phase
C. Pair Phase
D. Exhale Phase

Options :

89951415915. 1
89951415916. 2
89951415917. 3
89951415918. 4

Question Number : 42 Question Id : 8995143995 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In this technique, the entire class participates together and focuses attention on the respondent(s), in responding during the

A. Inhale Phase
B. Pair Phase
C. Exhale Phase
D. Share Phase

Options :

89951415919. 1
89951415920. 2
89951415921. 3
89951415922. 4

Sub-Section Number :	9
Sub-Section Id :	89951467
Question Shuffling Allowed :	Yes

Question Id : 8995143996 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (43 to 44)

Question Label : Comprehension

When given an opportunity to explain the ideas of their group to the whole class, different groups identified some or all of the following transforms:

(i) Laplace Transform
(ii) Fourier Transform
(iii) Z-Transform
(iv) Hankel Transform
(v) Hausdorff transform
(vi) Wavelet Transform

Sub questions

Question Number : 43 Question Id : 8995143997 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Dr. Sanjeev Ahuja and Raja identified the following transforms:

A. (i), (ii), (iv), (v)
B. (i), (ii), (iii), (iv)
C. (ii), (iii), (iv), (v)
D. (i), (ii), (iii), (v)

Options :

89951415923. 1
89951415924. 2
89951415925. 3
89951415926. 4

Question Number : 44 Question Id : 8995143998 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Prof. Devi from KC College and Dr. Swati Lavand identified the following transforms:

A. (i), (ii), (iii), (v) only
B. (i), (ii), (iii), (iv), (v)
C. (i), (ii), (iii), (v), (vi)
D. (i), (ii), (iii), (iv) only

Options :

89951415927. 1
89951415928. 2
89951415929. 3
89951415930. 4

Sub-Section Number :	10
Sub-Section Id :	89951468
Question Shuffling Allowed :	Yes

Question Number : 45 Question Id : 8995143999 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is

Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

A Discrete Sequence is a mapping from

A. The set of integers to the set of complex numbers
B. The set of integers to the set of integers
C. The set of complex numbers to the set of integers
D. The set of real numbers to the set of complex numbers

Options :

89951415931. 1
89951415932. 2
89951415933. 3
89951415934. 4

Question Number : 46 Question Id : 8995144000 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

A Discrete System is a mapping from

A. The set of sequences to the set of complex numbers
B. The set of complex numbers to the set of sequences
C. The set of complex numbers to the set of irrationals
D. The set of sequences to the set of sequences

Options :

89951415935. 1
89951415936. 2
89951415937. 3
89951415938. 4

Question Number : 47 Question Id : 8995144001 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

A two-point moving average is best described by:

A. $y[n] = 0.5\ \{x[n] + x[n-1]\}$

B. $y[n] = 0.5\ \{x[n] - x[n-1]\}$

C. $y[n] =$ cube root of $\{x[n]\ x[n-1]\}$

D. $y[n] = 0.25\ \{x[n]\ x[n-1]\}$

Options :

89951415939. 1

89951415940. 2

89951415941. 3

89951415942. 4

Question Number : 48 Question Id : 8995144002 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The sequence $x[n] = n$ for all integer n is given as the input to a 2-point moving average. The output y[n] for this sequence x[n] would be the sequence $y[n] =$

A. $x[n] + 0.5$

B. $x[n] - 0.5$

C. $0.5\ x[n]$

D. $n\ x[n]$

Options :

89951415943. 1

89951415944. 2

89951415945. 3

89951415946. 4

Question Number : 49 Question Id : 8995144003 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The following CANNOT be a property of the two-point moving average:

A. Suppression of relatively slower variations in the sequence in comparison to faster ones
B. Suppression of relatively faster variations in the sequence in comparison to slower ones
C. Identification of trends across samples
D. Removing unwanted fluctuations

Options :

89951415947. 1
89951415948. 2
89951415949. 3
89951415950. 4

Question Number : 50 Question Id : 8995144004 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 1 Wrong Marks : 0

A 3-point moving average would give a zero output to the following input sequence:

A. $x[n] = \cos(\pi n/5)$
B. $x[n] = \cos(2\pi n/3)$
C. $x[n] = \cos(\pi n/2)$
D. $x[n] = \cos(\pi n/4)$

Options :

89951415951. 1
89951415952. 2
89951415953. 3
89951415954. 4