National Testing Agency

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Electronic Systems for Sensor Applications

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Break time:	0
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Is this Group for Examiner?:	No

Section A

Section Id :	28860748
Section Number :	1
Section type :	Online
Mandatory or Optional:	Mandatory
Number of Questions:	12
Number of Questions to be attempted:	12
Section Marks:	12

Sub-Section Number:	1
Sub-Section Id:	28860754
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 2886074099 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

For a sample of measurements obtained from a random process that exhibit non-uniform distribution, which technique may be used to estimate the mean and standard deviation of the underlying process:

A. Parseval's theorem
B. Pythagoras theorem
C. Central limit theorem
D. None of the above

Options :

28860716353. 1

28860716354. 2

28860716355. 3

28860716356. 4

Question Number : 2 Question Id : 2886074100 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Can a lock-in amplifier be used to estimate the peak frequency in the Bode plot of a resonator?

A. No
B. Yes, using amplitude modulated input
C. Yes, using frequency modulated input
D. Yes, using intensity modulated input

Options :

28860716357. 1

28860716358. 2

28860716359. 3

28860716360. 4

Question Number : 3 Question Id : 2886074101 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

What are the limitations of a chopper amplifier circuit?

A. Low bandwidth
B. Single ended operation
C. Both A and B
D. Neither A nor B

Options :

28860716361. 1

28860716362. 2

28860716363. 3

28860716364. 4

Question Number : 4 Question Id : 2886074102 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Implementing an op-amp as an auto-zero amplifier helps improve which of the following specifications:

A. Offset
B. Gain-bandwidth product
C. Cost
D. Power

Options :

28860716365. 1

28860716366. 2

28860716367. 3

28860716368. 4

Question Number : 5 Question Id : 2886074103 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following is true for a folded flexure spring?

A. Overall stiffness is reduced due to connections of several springs in series
B. Overall stiffness is reduced due to connections of several springs in parallel
C. No impact on overall stiffness
D. None of the above

Options :

28860716369. 1

28860716370. 2

28860716371. 3

28860716372. 4

Question Number : 6 Question Id : 2886074104 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The first MEMS device patent was issued for:

A. Resonant gate transistor
B. Explosion detector
C. Accelerometer
D. FBAR

Options :

28860716373. 1

28860716374. 2

28860716375. 3

28860716376. 4

Question Number : 7 Question Id : 2886074105 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

What application was primarily responsible for early commercial success of MEMS accelerometers:

A. Smartphones
B. Air-bags
C. Robotics
D. Playstation

Options :

28860716377. 1

28860716378. 2

28860716379. 3

28860716380. 4

Question Number : 8 Question Id : 2886074106 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Offset and noise measurements of a sensor may be impacted by:

A. Variation due to different operators handling the sensor
B. Variation due to measurements made on different measurement setups
C. Neither A nor B
D. Both A and B

Options :

28860716381. 1

28860716382. 2

28860716383. 3

28860716384. 4

Question Number : 9 Question Id : 2886074107 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The ratio of the equivalent noise bandwidth to the 3dB bandwidth for a first-order filter is:

A. π/2
B. π/4
C. 3π/4
D. π/3

Options :

28860716385. 1

28860716386. 2

28860716387. 3

28860716388. 4

Question Number : 10 Question Id : 2886074108 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following sensor specifications can be improved by filtering the sensor output?

A. Offset
B. Sensitivity
C. Noise
D. Bandwidth

Options :

28860716389. 1

28860716390. 2

28860716391. 3

28860716392. 4

Question Number : 11 Question Id : 2886074109 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In the case study presented on aliasing of noise in an accelerometer, the equivalent noise bandwidth of which of the following blocks was used to compute the Nyquist rate?

A. MEMS sensing element
B. Integrated amplifier
C. Internal clock
D. None of the above

Options :

28860716393. 1

28860716394. 2

28860716395. 3

28860716396. 4

Question Number : 12 Question Id : 2886074110 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which application of a lock-in amplifier was highlighted in this course?

A. Gas sensor
B. Tilt sensor
C. Corrosion sensor
D. None of the above

Options :

28860716397. 1

28860716398. 2

28860716399. 3

28860716400. 4

Section B

Section Id :	28860749
Section Number :	2
Section type :	Online
Mandatory or Optional:	Mandatory
Number of Questions:	7
Number of Questions to be attempted:	7
Section Marks:	12

Sub-Section Number:	1
Sub-Section Id:	28860755
Question Shuffling Allowed :	Yes

Question Id : 2886074111 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (13 to 14)

Question Label : Comprehension

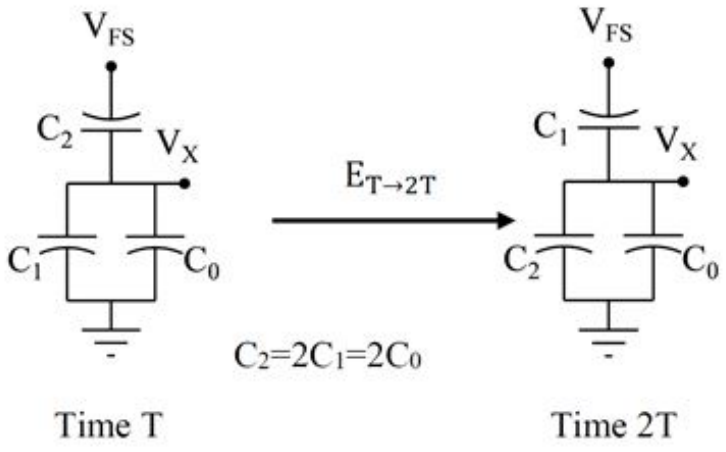

Figure 5. Single capacitor switching.

Sub questions

Question Number : 13 Question Id : 2886074112 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In Figure 5, the consumed energy in switching from time T to time 2T is independent of Vx. The expression for this consumed energy is

A. $\frac{1}{4}C_0V_{FS}^2$

B. $\frac{5}{4}C_0V_{FS}^2$

C. $\frac{7}{12}C_0V_{FS}^2$

D. $\frac{3}{4}C_0V_{FS}^2$

Options :

28860716401. 1

28860716402. 2

28860716403. 3

28860716404. 4

Question Number : 14 Question Id : 2886074113 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In Figure 5, two capacitors are switching in opposite polarity. To achieve same DAC output, which one of the following switching technique is most energy efficient?

A. Charge redistribution technique
B. Traditional one step switching
C. Two step switching technique
D. Split DAC technique

Options :

28860716405. 1

28860716406. 2

28860716407. 3

28860716408. 4

Sub-Section Number:	2
Sub-Section Id:	28860756
Question Shuffling Allowed :	Yes

Question Id : 2886074114 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (15 to 17)

Question Label : Comprehension

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

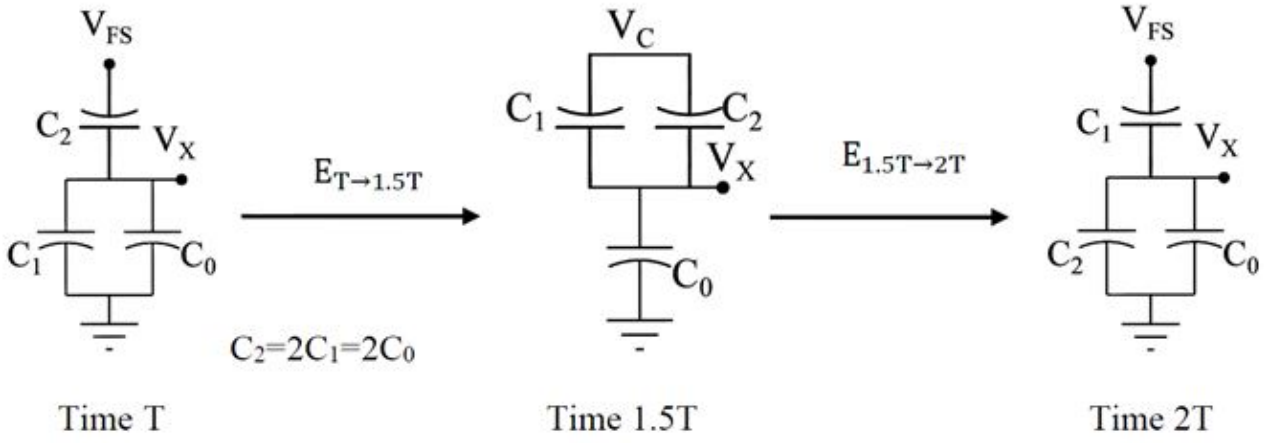

Figure 6. Charge Redistribution Technique for Two Capacitor Switching in opposite polarity

Sub questions

Question Number : 15 Question Id : 2886074115 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Energy consumed in switching from time T to time 1.5T in Figure 6 is

A. 0 J

B. 5.47 fJ

C. 10 fJ

D. 11.67 fJ

Options :

28860716409. 1

28860716410. 2

28860716411. 3

28860716412. 4

Question Number : 16 Question Id : 2886074116 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Energy consumed in switching from time 1.5T to time 2T in Figure 6 is

A. 2.5 J
B. 5.47 fJ
C. 10 fJ
D. 11.67 fJ

Options :

28860716413. 1

28860716414. 2

28860716415. 3

28860716416. 4

Question Number : 17 Question Id : 2886074117 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

What is value of V_X at time 1.5T and time 2T?

A. $V_X\{1.5T\} = 0.9, V_X\{2T\} = -0.1$
B. $V_X\{1.5T\} = 0.4, V_X\{2T\} = -0.1$
C. $V_X\{1.5T\} = 0.9, V_X\{2T\} = -0.4$
D. $V_X\{1.5T\} = 0.4, V_X\{2T\} = -0.6$

Options :

28860716417. 1

28860716418. 2

28860716419. 3

28860716420. 4

Sub-Section Number: 3
Sub-Section Id: 28860757
Question Shuffling Allowed : Yes

Question Number : 18 Question Id : 2886074118 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Differential configuration of SAR ADC

A. Helps in reducing DAC switching power
B. Helps in reducing DAC capacitive area
C. Helps in reducing DAC capacitive area as well as switching power
D. None of the above.

Options :

28860716421. 1

28860716422. 2

28860716423. 3

28860716424. 4

Sub-Section Number:	4
Sub-Section Id:	28860758
Question Shuffling Allowed :	Yes

Question Id : 2886074119 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (19 to 21)

Question Label : Comprehension

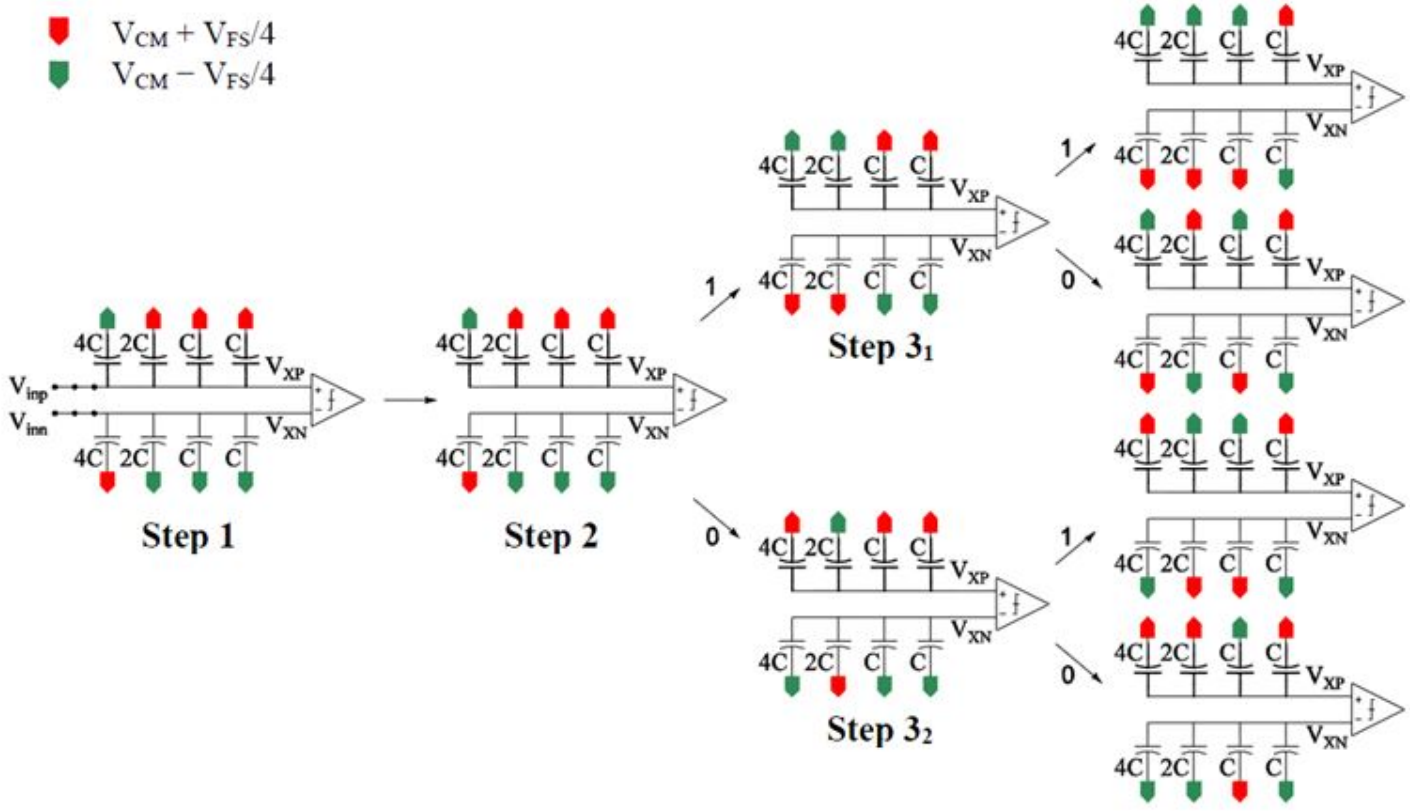

Figure 7. Traditional switching technique of a 3-bit SAR ADC

Sub questions

Question Number : 19 Question Id : 2886074120 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

In Figure 7, the energy consumed in switching from Step 2 to Step 3_2 is:

A. $C\left(\frac{V_{FS}}{2}\right)^2$

B. $5C\left(\frac{V_{FS}}{2}\right)^2$

C. $\frac{13}{4}C\left(\frac{V_{FS}}{2}\right)^2$

D. None of the above.

Options :

28860716425. 1

28860716426. 2

28860716427. 3

28860716428. 4

Question Number : 20 Question Id : 2886074121 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

In Figure 7, the energy consumed in switching from Step 2 to Step 3_1 is:

A. $C\left(\frac{V_{FS}}{2}\right)^2$

B. $5C\left(\frac{V_{FS}}{2}\right)^2$

C. $\frac{13}{4}C\left(\frac{V_{FS}}{2}\right)^2$

D. None of the above.

Options :

28860716429. 1

28860716430. 2

28860716431. 3

28860716432. 4

Question Number : 21 Question Id : 2886074122 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Consider V_{FS} = 2 V, V_{CM} = 0.5 V, C_0 = 5fF. Differential DC input of −0.6 V is applied. Find the value of V_{XP} (+ve input of the comparator) during each bit conversion ($B_2B_1B_0$) of the 3-bit SAR ADC shown in Figure 7.

A. $V_{XP,B2}$ = 0.2 V, $V_{XP,B1}$ = 0.45 V, $V_{XP,B0}$ = 0.575 V

B. $V_{XP,B2}$ = 0.2 V, $V_{XP,B1}$ = 0.45 V, $V_{XP,B0}$ = 0.325 V

C. $V_{XP,B2}$ = 0.8 V, $V_{XP,B1}$ = 0.55 V, $V_{XP,B0}$ = 0.425 V

D. $V_{XP,B2}$ = 0.8 V, $V_{XP,B1}$ = 0.55 V, $V_{XP,B0}$ = 0.675 V

Options :

28860716433. 1

28860716434. 2

28860716435. 3

28860716436. 4

Sub-Section Number:	5
Sub-Section Id:	28860759
Question Shuffling Allowed :	Yes

Question Number : 22 Question Id : 2886074123 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

For N-bit SAR ADC, which one of the following switching technique requires $2^{(N-1)}$C DAC size for capacitive SAR ADC? C is unit capacitor used in the capacitive DAC.

A. Monotonic switching technique

B. V_{CM} based monotonic switching technique

C. Merged capacitor switching technique

D. None of the above.

Options :

28860716437. 1

28860716438. 2

28860716439. 3

28860716440. 4

Question Number : 23 Question Id : 2886074124 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following techniques use only two reference levels for the differential DAC switching? (Choose the correct option.)

(i) Monotonic switching technique
(ii) V_{CM} based monotonic switching technique
(iii) Merged capacitor switching technique
(iv) Traditional Differential SAR technique

Answer:

A. (ii) and (iv)
B. (i) and (iii)
C. (i) and (iv)
D. (ii) and (iii)

Options :

28860716441. 1

28860716442. 2

28860716443. 3

28860716444. 4

Question Number : 24 Question Id : 2886074125 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following techniques require 2^N unit capacitors for the differential capacitive DAC for an N-bit SAR ADC? (Choose the correct option.)

(i) Monotonic switching technique
(ii) V_{CM} based monotonic switching technique
(iii) Merged capacitor switching technique
(iv) Traditional Differential SAR technique

Answer:

A. (ii) and (iv)
B. (i) and (iii)
C. (i) and (iv)
D. (ii) and (iii)

Options :

28860716445. 1

28860716446. 2

28860716447. 3

28860716448. 4

Section C

Section Id :	28860750
Section Number :	3
Section type :	Online
Mandatory or Optional:	Mandatory
Number of Questions:	13
Number of Questions to be attempted:	13
Section Marks:	13

Sub-Section Number:	1
Sub-Section Id:	28860760
Question Shuffling Allowed :	Yes

Question Number : 25 Question Id : 2886074126 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Consider $x[n]$ be a stationary random process with mean $m_x[n] = 0$ and autocorrelation $r_x[k]$. Let $y[n]$be obtained as follows

$$y[n] = x[n] + f[n],$$

where $f[n]$ is a deterministic signal. The mean $m_y[n]$and autocorrelation $r_y[k,l]$ of the process $y[n]$ are:

A. $m_y[n] = 0, r_y[k,l] = r_x[k,l]$

B. $m_y[n] = 0, r_y[k,l] = r_x[k,l] = r_f[k,l]$

C. $m_y[n] = f[n], r_y[k,l] = r_x[k,l] + f[k]f[l]$

D. $m_y[n] = f[n], r_y[k,l] = r_x[k,l] + r_f[k,l]$

Options :

28860716449. 1

28860716450. 2

28860716451. 3

28860716452. 4

Question Number : 26 Question Id : 2886074127 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following processes is NOT wide sense stationary (WSS)?

A. $x[n] = A$; where A is a random variable with probability distribution function (pdf) $p_A(\alpha)$.
B. $x[n] = Acos(n\omega_o)$,where A is Gaussian with mean m_A and variance σ_A^2.
C. $x[n] = Acos(n\omega_o) + Bsin(n\omega_o)$,where A and B are uncorrelated zero mean random variables with variance σ_2.
D. *All of the above*

Options :

28860716453. 1

28860716454. 2

28860716455. 3

28860716456. 4

Question Number : 27 Question Id : 2886074128 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Consider linear prediction in a noisy environment. Suppose that a signal is corrupted by noise,

$$x[n] = d[n] + \omega[n]$$

where $r_\omega[k] = 0.5\delta[k]$ and $r_{d\omega}[k] = 0$. The signal $d[n]$ is an auto-regressive (AR(1)) process that satisfies the difference equation

$$d[n] = 0.5d[n-1] + v[n]$$

where $v[n]$ is white noise with variance $\sigma_v^2 = 1$. Assume that $\omega[n]$ and $v[n]$are uncorrelated. Design a first-order Wiener FIR linear predictor

$$W[z] = w[0] + w[1]z^{-1}$$

for $d[n]$. Which of these are the coefficients of the filter if R_x and r_{dx}(for simplicity) are as given below?

$$R_x = [102; 210] \text{ and } r_{dx} = [2; 1]$$

A. $w[0] = 0.1875, w[1] = 0.0625$
B. $w[0] = 1, w[1] = 0.5$
C. $w[0] = 0.5, w[1] = 1$
D. $w[0] = 22, w[1] = 14$

Options :

28860716457. 1

28860716458. 2

28860716459. 3

28860716460. 4

Question Number : 28 Question Id : 2886074129 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The steepest descent algorithm for solving the Wiener FIR filtering problem converges to the optimal weight (with input signal $x[n]$ and desired signal $d[n]$) for

A. all signal conditions.
B. wide-sense stationary (WSS) $x[n]$, WSS $d[n]$, and jointly wide-stationary signals.
C. non-stationary $x[n]$, WSS $d[n]$, irrespective of the joint stationarity.
D. non-stationary $x[n]$, non-stationary $d[n]$, irrespective of the joint stationarity.

Options :

28860716461. 1

28860716462. 2

28860716463. 3

28860716464. 4

Question Number : 29 Question Id : 2886074130 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The eigenvalues and eigenvectors of the input correlation matrix Rx in the steepest descent algorithm for adaptive filters determine

A. only rate of convergence
B. only condition for convergence
C. both rate of convergence and condition for convergence
D. neither the rate of convergence nor the condition for convergence

Options :

28860716465. 1

28860716466. 2

28860716467. 3

28860716468. 4

Question Number : 30 Question Id : 2886074131 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The computational complexity of LMS algorithm for a filter of length N for a certain number of iterations, assuming multiplication and addition operation consume one cycle,

A. depends only on $N$and proportional to N
B. depends only on $N$and proportional to N^2
C. depends on N,$\mu$and proportional to N
D. depends on N,$\mu$and proportional to N^2

Options :

28860716469. 1

28860716470. 2

28860716471. 3

28860716472. 4

Question Number : 31 Question Id : 2886074132 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

For the scenario where $x[n]$ and $d[n]$ are jointly wide sense stationary (WSS) and Wiener optimal filter is

$$w_{opt} = {R_x}^{-1} r_{dx}$$

the LMS filter with $0 < \mu < 2/\lambda_{max}$

A. converges to w_{opt}
B. converges to $w_{opt} + \epsilon$, where ϵ is a very small number
C. converges to $w_{opt} = w_{init}$, where w_{init} is the initial weight.
D. does not converge

Options :

28860716473. 1

28860716474. 2

28860716475. 3

28860716476. 4

Question Number : 32 Question Id : 2886074133 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Consider the problem of denoising using optimal Wiener FIR filter where the input signal is $d[n] + v[n]$ and the output is $d'[n] + v'[n]$. Assume the input signal-to-noise ratio (SNR) is 0 dB. The output SNR will

A. remain 0 dB
B. decrease
C. increase
D. may increase or decrease

Options :

28860716477. 1

28860716478. 2

28860716479. 3

28860716480. 4

Question Number : 33 Question Id : 2886074134 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In steepest descent filter algorithm for FIR adaptive filters, the weight update direction is

A. the positive gradient (with respect to w) of the error function
B. the negative gradient (with respect to w) of the error function
C. the negative gradient (with respect to x) of the error function
D. independent of the error function

Options :

28860716481. 1

28860716482. 2

28860716483. 3

28860716484. 4

Question Number : 34 Question Id : 2886074135 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The condition on μ for convergence of LMS is $0 < \mu < 2/\lambda_{max}$.In practical application, which of the following is an INCORRECT statement about this bound.

A. Needs R_x (which is not available) to get λ_{max}, hence difficult to choose.
B. The upper limit of μ leads to very slow convergence.
C. An approximation for the upper bound can be obtained from the input signal.
D. Can assume λ_{max} to be any positive value.

Options :

28860716485. 1

28860716486. 2

28860716487. 3

28860716488. 4

Question Number : 35 Question Id : 2886074136 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The recursive least squares (RLS) adaptive filter minimizes which of the following error function ζ between desired signal $d[n]$ and estimated signal $\hat{d}[n]$.

A. $\zeta = \sum_{i=0}^{n}(d[i] - \hat{d}[i])$
B. $\zeta = E\{\vee d[n] - \hat{d}[n] \vee\}$
C. $\zeta = \sum_{i=0}^{n}(d[i] - \hat{d}[i])^2$
D. $\zeta = E\{\vee (d[n] - \hat{d}[n])^2\}$

Options :

28860716489. 1

28860716490. 2

28860716491. 3

28860716492. 4

Question Number : 36 Question Id : 2886074137 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The computational complexity of exponentially weighted RLS algorithm with exponential weight λ, for a filter of length N, assuming multiplication and addition operation consume one cycle,

A. depends only on N and proportional to N
B. depends only on N and proportional to N^2
C. depends on N, λ and proportional to N
D. depends on N, $\lambda$and proportional to N^2

Options :

28860716493. 1

28860716494. 2

28860716495. 3

28860716496. 4

Question Number : 37 Question Id : 2886074138 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Consider a practical situation (real-time implementation) where one is interested in removing power line interference (i.e., interference of 50 Hz signal from the power supply) from the corrupted signal. With no additional information, which one of the following filters cannot be used in this problem?

A. LTI FIR filter with a notch at 50 Hz
B. Optimal Wiener FIR filter
C. LMS filter
D. RLS filter.

Options :

28860716497. 1

28860716498. 2

28860716499. 3

28860716500. 4

Section D

Section Id :	28860751
Section Number :	4
Section type :	Online
Mandatory or Optional:	Mandatory
Number of Questions:	12
Number of Questions to be attempted:	12
Section Marks:	13

Sub-Section Number:	1
Sub-Section Id:	28860761
Question Shuffling Allowed :	Yes

Question Number : 38 Question Id : 2886074139 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

To accommodate complex sequences, the idea of 'dot product', generalized to many dimensions uses the following:

A. Complex conjugate the first argument
B. Complex conjugate the second argument
C. Take the square of the first argument
D. Take the square of both arguments

Options :

28860716501. 1

28860716502. 2

28860716503. 3

28860716504. 4

Question Number : 39 Question Id : 2886074140 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In the second lecture by Prof. Vikram M. Gadre, he explained why he still followed the practice of writing on the blackboard for explaining such subjects. The main reason was:

A. Power Point Presentations are energy inefficient.
B. There were no projection systems available to him at that time.
C. He believed that the participants in the class should work with him, to understand ideas better, the class was also meant to train the mind, for which this was necessary.
D. He wanted to go back to a conventional era, for nostalgic reasons.

Options :

28860716505. 1

28860716506. 2

28860716507. 3

28860716508. 4

Question Number : 40 Question Id : 2886074141 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

For which of these sequences would the Discrete Time Fourier Transform NOT exist (converge)?

(i) Exp(n) u[n]

(ii) Exp(– n) u[n]

(iii) u[n] – u[n-50]

(iv) Exp(n) u[n] + Exp(– n) u[n]

The answer is:

A. (i) only

B. (ii) only

C. (i) and (iv)

D. (ii), (iii) and (iv)

Options :

28860716509. 1

28860716510. 2

28860716511. 3

28860716512. 4

Question Number : 41 Question Id : 2886074142 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The systems that were largely dealt with during most of the second lecture by Prof. Vikram M. Gadre were:

A. Nonlinear

B. Only shift invariant

C. Linear and shift invariant

D. None of the above

Options :

28860716513. 1

28860716514. 2

28860716515. 3

28860716516. 4

Question Number : 42 Question Id : 2886074143 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

How would we best define a discrete system property, for example, linearity, according to the explanation provided during the second lecture by Prof. Vikram M. Gadre?

A. A prescribed experiment and the corresponding outcome
B. Prescribed outcome(s) of one or more prescribed experiment(s)
C. The outcome of a prescribed experiment
D. The relation between outcomes and experiments

Options :

28860716517. 1

28860716518. 2

28860716519. 3

28860716520. 4

Question Number : 43 Question Id : 2886074144 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

How would we best define a *transform*, for example, the Fourier Transform, according to the explanation provided during the second lecture by Prof. Vikram M. Gadre?

A. A change of basis functions
B. A change of variable
C. A change of paradigm in dealing with the underlying entities (sequences, signals and systems, for example)
D. A change of notation

Options :

28860716521. 1

28860716522. 2

28860716523. 3

28860716524. 4

Question Number : 44 Question Id : 2886074145 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

When we move from the 'time domain' to the 'Discrete Time Fourier Transform (DTFT)' domain in the context of discrete systems, list down which ALL of the following is/ are true.

(i) The DTFT of the sum of two sequences is the sum of the DTFTs of the individual sequences, if all these DTFTs exist.
(ii) If the input to a Discrete time linear, shift invariant system is the sequence x[n], the impulse response of the system is the sequence h[n], the output, the sequence y[n], if the DTFTs of all of x[.], h[.] and y[.] exist, then: DTFT of y[.] = DTFT of x[.] multiplied by DTFT of h[.]
(iii) The DTFT of the product of two sequences is the product of the DTFTs of the individual sequences, if all these DTFTs exist.
(iv) The DTFT of the difference of two sequences is the difference of the DTFTs of the individual sequences in the same order, if all these DTFTs exist.

Answer:

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

Options :

28860716525. 1

28860716526. 2

28860716527. 3

28860716528. 4

Question Number : 45 Question Id : 2886074146 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The main principle behind reconstructing the sequence from its DTFT is:

A. The relation between a vector and its (orthogonal) components
B. Stoke's Theorem in vector calculus
C. Green's Theorem in a plane
D. Cauchy Residue theorem

Options :

28860716529. 1

28860716530. 2

28860716531. 3

28860716532. 4

Question Number : 46 Question Id : 2886074147 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

To see the functions exp(jωn) as orthogonal for different values of the integer index n for any contiguous interval of 2π, we must

A. Integrate the sum of exp(jωn) and exp(– jωk) over that contiguous interval of 2π, for different integer values of n and k.
B. Integrate exp (jωn) over that contiguous interval of 2π, for different integer values of n.
C. Integrate exp (–jωn) over that contiguous interval of 2π, for different integer values of n.
D. Integrate the product of exp(jωn) and exp(– jωk) over that contiguous interval of 2π, for different integer values of n and k.

Options :

28860716533. 1

28860716534. 2

28860716535. 3

28860716536. 4

Sub-Section Number:	2
Sub-Section Id:	28860762
Question Shuffling Allowed :	Yes

Question Id : 2886074148 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No
Question Numbers : (47 to 48)

Question Label : Comprehension

A discrete time, linear, shift invariant system has input sequence x[n], impulse response sequence h[n], output sequence y[n].

Sub questions

Question Number : 47 Question Id : 2886074149 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

If x[.] has only N contiguous nonzero samples and h[.] has only L contiguous nonzero samples, then what is the maximum number of nonzero contiguous samples that y[.] can have:

A. $N + L$
B. $N + L - 1$
C. $N + L + 1$
D. $N - L$

Options :

28860716537. 1

28860716538. 2

28860716539. 3

28860716540. 4

Question Number : 48 Question Id : 2886074150 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

If x[n] = h[n] = u[n], then y[n] =

A. u[n]
B. u[n] – u[n – 10]
C. (n+1) u[n]
D. 2 (n + 5) u[n]

Options :

28860716541. 1

28860716542. 2

28860716543. 3

28860716544. 4

Sub-Section Number:	3
Sub-Section Id:	28860763
Question Shuffling Allowed :	Yes

Question Number : 49 Question Id : 2886074151 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

This question is intended to see if the candidate has viewed and reflected upon the immersive pedagogy workshop sessions made available. Which of the following activities are NOT seen in these four sessions? List all that apply.

(i) Garlanding of the chief guest during the commencement session
(ii) Presentations by student groups during the forenoon and afternoon sessions
(iii) A presentation by a winning team in the Smart India Hackathon in the last session
(iv) A prize distribution to the *best four* groups of the day in the conclusion session

Answer:

A. (i) and (iii)
B. (ii) and (iv)
C. (ii) and (iii)
D. (i) and (iv)

Options :

28860716545. 1

28860716546. 2

28860716547. 3

28860716548. 4

Question Number : 50 Question Id : 2886074152 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following activities ARE seen in these four sessions? List all that apply.

(i) A brief 'prelude' to their respective presentations by student groups in the forenoon session and the afternoon session
(ii) A sharing of 'take-aways' or learnings from this workshop by some external participants in the concluding session
(iii) A mention of the national Technical Education Quality Improvement Programme (TEQIP) during the first or commencement session.

Answer:

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

Options :

28860716549. 1

28860716550. 2

28860716551. 3

28860716552. 4