Started on	Saturday, 11 November 2023, 9:39 PM
State	Finished
Completed on	Sunday, 12 November 2023, 9:43 PM
Time taken	1 day
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

Flag question

OFDM is used in which of the wireless cellular standards

Select one:

- GSM
- 802.11b
- HSDPA
- LTE ✔

Your answer is correct.

The correct answer is: LTE

Question **2**

Correct

Mark 1.00 out of 1.00

Flag question

Consider a two tap frequency selective channel with channel taps $h(0), h(1)$. Let $x(l)$, $0 \le l \le 3$ denote the samples obtained via IFFT. These are transmitted over the channel after addition of a cyclic prefix of length 2 symbols. Let $v(l)$ denote the noise sample at time l. The received symbol $y(1)$ at time $l = 1$ is

Select one:

- $h(0)x(0) + v(0)$
- $h(0)x(1) + h(1)x(0) + v(1)$ ✔
- $h(0)x(0) + h(1)x(1) + v(0)$
- $h(0)x(0) + h(1)x(3) + v(0)$

Your answer is correct.

The correct answer is: $h(0)x(1) + h(1)x(0) + v(1)$

Question **3**

Correct

Mark 1.00 out of 1.00

Flag question

Consider a two tap frequency selective channel with channel taps $h(0), h(1)$. Let $x(l)$, $0 \le l \le 3$ denote the samples obtained via IFFT. Then, the channel coefficient $H(1)$ across subcarrier $k = 1$ is

Select one:

- $h(0)+h(1)$
- $h(0)-jh(1)$ ✔
- $h(0)-h(1)$
- $h(0)+jh(1)$

Your answer is correct.

The correct answer is: $h(0)-jh(1)$

Question **4**

Correct

Mark 1.00 out of 1.00

Flag question

Consider an $N=4$ subcarrier OFDM system with **conventional** channel estimation i.e. pilot symbols transmitted on all the subcarriers. The ISI channel has $L=2$ taps, denoted by $h(0), h(1)$. The transmit samples $x(k),\ k=0,1,2,3$ obtained after IFFT are respectively $\frac{1}{4}-\frac{1}{4}j, \frac{1}{2}, \frac{1}{2}, \frac{1}{4}+\frac{1}{4}j$. The symbol $X(2)$ loaded on subcarrier $k=2$ is

Select one:

- $-\frac{1}{2}j$ ✔
- $\frac{1}{2}-\frac{1}{2}j$
- $\frac{1}{2}+\frac{1}{2}j$
- $\frac{1}{2}j$

Your answer is correct.

The correct answer is: $-\frac{1}{2}j$

Question **5**

Correct

Mark 1.00 out of 1.00

Flag question

Consider an $N=4$ subcarrier OFDM system with **conventional** channel estimation i.e. pilot symbols transmitted on all the subcarriers. The ISI channel has $L=2$ taps, denoted by $h(0), h(1)$. The transmit samples $x(k),\ k=0,1,2,3$ obtained after IFFT are respectively $\frac{1}{4}-\frac{1}{4}j, \frac{1}{2}, \frac{1}{2}, \frac{1}{4}+\frac{1}{4}j$. The cyclic prefix is of length one symbol. The sample in the cyclic prefix is

Select one:

- 0
- $\frac{1}{4}-\frac{1}{4}j$
- $\frac{1}{2}$
- $\frac{1}{4}+\frac{1}{4}j$ ✔

Your answer is correct.

The correct answer is: $\frac{1}{4}+\frac{1}{4}j$

Question **6**

Correct

Mark 1.00 out of 1.00

Flag question

Consider an $N = 4$ subcarrier OFDM system with **conventional** channel estimation i.e. pilot symbols transmitted on all the subcarriers. The ISI channel has $L = 2$ taps, denoted by $h(0), h(1)$. The received samples $y(k)$ for $k = 0, 1, 2, 3$ are respectively $-1, -\frac{1}{2}j, \frac{1}{2}j, 1$. The symbol $Y(2)$ received on subcarrier $k = 2$ in the frequency domain is

Select one:

- $-2-j$
- $-2+j$ ✔
- $2+j$
- $2-j$

Your answer is correct.

The correct answer is: $-2+j$

Question **7**

Correct

Mark 1.00 out of 1.00

Flag question

Consider an $N = 4$ subcarrier OFDM system with **conventional** channel estimation i.e. pilot symbols transmitted on all the subcarriers. The ISI channel has $L = 2$ taps, denoted by $h(0), h(1)$. The transmit samples $x(k)$, $k = 0, 1, 2, 3$ obtained after IFFT are respectively $\frac{1}{4}-\frac{1}{4}j, \frac{1}{2}, \frac{1}{2}, \frac{1}{4}+\frac{1}{4}j$. The received samples $y(k)$ for $k = 0, 1, 2, 3$ are respectively $-1, -\frac{1}{2}j, \frac{1}{2}j, 1$. The noise samples are zero-mean i.i.d. Gaussian and the cyclic prefix is of length one symbol. The estimate $\widehat{H}(2)$ of the channel coefficient across subcarrier $k = 2$ is

Select one:

- $-2+4j$
- $4-2j$
- $-4-2j$
- $-2-4j$ ✔

Your answer is correct.

The correct answer is: $-2-4j$

Question **8**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the multiple transmit antenna channel estimation model given by $\bar{\mathbf{y}} = \mathbf{X}\bar{\mathbf{h}} + \bar{\mathbf{v}}$, with $\bar{\mathbf{v}}$ denoting the additive noise vector comprising of zero-mean i.i.d. Gaussian noise samples. The MMSE estimate at high SNR for this scenario reduces to the

Select one:

- ML estimate ✔
- Matched Filter
- LMMSE estimate
- Unbiased Estimate

Your answer is correct.

The correct answer is: ML estimate

Question **9**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the multiple transmit antenna channel estimation model given by $\bar{\mathbf{y}} = \mathbf{X}\bar{\mathbf{h}} + \bar{\mathbf{v}}$, with, $\mathbf{X}, \bar{\mathbf{y}}$ denoting the pilot matrix, output vector, respectively and $\bar{\mathbf{v}}$ denoting the additive noise vector comprising of zero-mean i.i.d. Gaussian noise samples of variance σ^2. The channel coefficients are zero-mean i.i.d. Gaussian with variance σ_h^2. The covariance matrix $\mathbf{R}_{yy}$ of the output vector y is

Select one:

- $\sigma_h^2\mathbf{X}^T\mathbf{X} + \sigma^2\mathbf{I}$
- $\sigma_h^2\mathbf{X}\mathbf{X}^T + \sigma^2\mathbf{I}$ ✔
- $\sigma_h^2\bar{\mathbf{h}}\bar{\mathbf{h}}^T + \mathbf{I}$
- $\sigma_h^2\mathbf{I} + \sigma^2\mathbf{X}\mathbf{X}^T$

Your answer is correct.

The correct answer is:

$\sigma_h^2\mathbf{X}\mathbf{X}^T + \sigma^2\mathbf{I}$

Question **10**

Correct

Mark 1.00 out of 1.00

Flag question

Consider the multiple transmit antenna channel estimation model given by $\bar{\mathbf{y}} = \mathbf{X}\bar{\mathbf{h}} + \bar{\mathbf{v}}$, with, $\mathbf{X}, \bar{\mathbf{y}}$ denoting the pilot matrix, output vector, respectively and $\bar{\mathbf{v}}$ denoting the additive noise vector comprising of zero-mean i.i.d. Gaussian noise samples of variance σ^2. The channel coefficients are zero-mean i.i.d. Gaussian with variance σ_h^2. The MMSE estimate of the channel vector $\bar{\mathbf{h}}$ is

Select one:

- $\left(\mathbf{X}^T\mathbf{X} + \frac{\sigma^2}{\sigma_h^2}\mathbf{I}\right)^{-1}\mathbf{X}^T\bar{\mathbf{y}}$ ✔

- $\left(\frac{\sigma_h^2}{\sigma^2}\mathbf{X}^T\mathbf{X}+\mathbf{I}\right)^{-1}\mathbf{X}^T\bar{\mathbf{y}}$
- $\left(\mathbf{X}\mathbf{X}^T+\frac{\sigma^2}{\sigma_h^2}\mathbf{I}\right)^{-1}\mathbf{X}^T\bar{\mathbf{y}}$
- $\frac{\sigma^2}{\sigma_h^2}(\mathbf{X}\mathbf{X}^T+\mathbf{I})^{-1}\mathbf{X}^T\bar{\mathbf{y}}$

Your answer is correct.

The correct answer is: $\left(\mathbf{X}^T\mathbf{X}+\frac{\sigma^2}{\sigma_h^2}\mathbf{I}\right)^{-1}\mathbf{X}^T\bar{\mathbf{y}}$

Finish review