

## Course outline

How does an NPTEL online course work?

Week-0

Week-1

Week-2

Week-3

Week-4

Week-5

Week-6

Week-7

Week-8

Week-9

Lec 42- Fast Fourier transform (FFT) and Inverse fast Fourier transform (IFFT)

Lec 43- IFFT/ FFT application in Orthogonal Frequency Division Multiplexing (OFDM) wireless technology

Lec 44- OFDM system: Circulant matrices and properties

Lec 45- OFDM system model: Transmitter and receiver processing

Lec 46- Single-carrier frequency division for multiple access (SC-FDMA) technology

Lec 47- Linear dynamical systems: definition and solution via matrix exponential

Lec 48- Linear dynamical systems: matrix exponential via SVD

 Quiz : Assignment-9

 Feedback for Week 9

 Solution-9

Week-10

Week-11

Week-12

DOWNLOAD VIDEOS

Live session

Text transcripts

# Assignment-9

The due date for submitting this assignment has passed.

**Due on 2021-03-24, 23:59 IST.**

As per our records you have not submitted this assignment.

 1) Consider a movie recommender system with the user biases  $u_i$ , movie biases  $m_j$ , and average bias  $r_a$ . The quantity  $r_{ij}$ , which denotes the rating given by user  $i$  to movie  $j$ , can be modeled as **1 point**

- $r_{ij} = u_i(m_j + r_a)$
- $r_{ij} = u_i + m_j + r_a$
- $r_{ij} = \frac{u_i}{m_j} r_a$
- $r_{ij} = u_i m_j - r_a$

No, the answer is incorrect.

Score: 0

 Accepted Answers:  $r_{ij} = u_i + m_j + r_a$ 

 2) Consider the user-rating matrix below, where rows show the users and columns show the movies **1 point**

	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>
U <sub>1</sub>	3	2	3
U <sub>2</sub>	4		2
U <sub>3</sub>	3	3	4

 The bias  $r_a$  is

- 1
- 2
- 3
- 4

No, the answer is incorrect.

Score: 0

Accepted Answers: 3

 3) Consider the user-rating matrix below, where rows show the users and columns show the movies **1 point**

	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>
U <sub>1</sub>	3	2	3
U <sub>2</sub>	4		2
U <sub>3</sub>	3	3	4

 The quantity  $\tilde{r}_{12} = u_1 + m_2$  equals

- 2
- 2
- 1
- 1

No, the answer is incorrect.

Score: 0

Accepted Answers: -1

 4) In OFDM, the operations performed are **1 point**

- IFFT at the transmitter and FFT at the receiver
- FFT at the transmitter and IFFT at the receiver
- IFFT at the transmitter and IFFT at the receiver
- FFT at the transmitter and FFT at the receiver

No, the answer is incorrect.

Score: 0

Accepted Answers: IFFT at the transmitter and FFT at the receiver

 5) The  $4 \times 4$  FFT matrix is given as **1 point**

- $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & j & -1 & -j \\ 1 & -1 & 1 & -1 \\ 1 & -j & -1 & j \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & 1 & -1 & -1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & j \end{bmatrix}$

No, the answer is incorrect.

Score: 0

 Accepted Answers:  $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix}$ 

 6) The  $4 \times 4$  IFFT matrix is given as **1 point**

- $\frac{1}{4} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & j & -1 & -j \\ 1 & -1 & 1 & -1 \\ 1 & -j & -1 & j \end{bmatrix}$
- $\frac{1}{4} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & 1 & -1 & -1 \end{bmatrix}$
- $\frac{1}{4} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & -j \end{bmatrix}$
- $\frac{1}{4} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & j & -1 & j \\ 1 & -1 & 1 & -1 \\ 1 & j & -1 & j \end{bmatrix}$

No, the answer is incorrect.

Score: 0

 Accepted Answers:  $\frac{1}{4} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & j & -1 & -j \\ 1 & -1 & 1 & -1 \\ 1 & -j & -1 & j \end{bmatrix}$ 

 7) Orthogonal Frequency Division Multiplexing (OFDM) technology enables high speed data transmission in 4G/ 5G systems **1 point**

- via Beamforming
- via Spatial Multiplexing
- by eliminating Inter Symbol Interference (ISI)
- via extraction of Principal Components

No, the answer is incorrect.

Score: 0

Accepted Answers: by eliminating Inter Symbol Interference (ISI)

 8) Consider the Inter Symbol Interference (ISI) channel with channel taps **1 point**

$$h(0) = 2, h(1) = -1, h(2) = 3, h(3) = 1$$

 The circulant matrix corresponding to this channel for  $N = 4$  subcarriers is given as

- $\begin{bmatrix} -2 & -1 & 3 & 1 \\ 1 & -2 & -1 & 3 \\ 3 & 1 & -2 & -1 \\ -1 & 3 & 1 & -2 \end{bmatrix}$
- $\begin{bmatrix} -2 & -1 & 3 & 1 \\ -2 & -1 & 3 & 1 \\ -2 & -1 & 3 & 1 \\ -2 & -1 & 3 & 1 \end{bmatrix}$
- $\begin{bmatrix} -2 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$
- $\begin{bmatrix} -2 & 1 & 3 & -1 \\ -1 & -2 & 1 & 3 \\ 3 & -1 & -2 & 1 \\ 1 & 3 & -1 & -2 \end{bmatrix}$

No, the answer is incorrect.

Score: 0

 Accepted Answers:  $\begin{bmatrix} -2 & 1 & 3 & -1 \\ -1 & -2 & 1 & 3 \\ 3 & -1 & -2 & 1 \\ 1 & 3 & -1 & -2 \end{bmatrix}$ 

 9) Consider the Inter Symbol Interference (ISI) channel with channel taps **1 point**

$$h(0) = 2, h(1) = -1, h(2) = 0, h(3) = 0$$

 Let  $\mathbf{H}_c$  denote the circulant matrix corresponding to this channel for  $N = 4$  subcarriers. One of the eigenvalues of  $\mathbf{H}_c$  is given as

- $\frac{1}{2}$
- 2
- 3
- $\frac{1}{4}$

No, the answer is incorrect.

Score: 0

Accepted Answers: 3

 10) SC-FDMA technology is used in **1 point**

- Uplink of 4G systems
- Downlink of 4G systems
- Wi-Fi systems
- Bluetooth

No, the answer is incorrect.

Score: 0

Accepted Answers: Uplink of 4G systems