

SAVITRIBAI PHULE PUNE UNIVERSITY
T.E. (Department of ENTC)

CELLULAR NETWORKS

UNIT-1 & UNIT -2
COMPLETE NOTES
WITH IMP QUESTION

DESIGNED BY



Unit-1
Introduction To Wireless Channel

Important point :

Introduction, Free Space Propagation Model, Ground-Reflection Scenario, Hata Model and Receiver-Noise Computation. Channel Estimation techniques and Diversity in wireless communications.



Important question :



Define wireless communication, what are the need of wireless communication, mention the merits and demerits.



List and explain different radio propagation mechanism with suitable example.



Define the following terms : 1) Friis free space equation 2) path Loss 3) Fraunhofer (far field) region



Numericals on free space equation, path loss and far field.



Draw and explain ground reflection (Two Ray) model. Write expression for received power.



Explain small scale and large scale fading in wireless communication. Explain coherence bandwidth.



Write the small notes on Doppler effect.



Write down equations of median path loss and correction factor in Hata model for Urban areas, Suburban areas and rural areas. (Numericals on Hata model)



Write note on receiver noise computation.

[illegible]

Unit-2
Orthogonal Frequency Division Multiplexing

Important point :

Introduction, Motivation and Multicarrier basics, OFDM example, bit error rate for OFDM. Multiple-Input Multiple-Output Wireless Communications, MIMO System Model and MIMO-OFDM.



Important question :



Explain signal and multicarrier carrier system.



Draw and explain the block diagram of MCM transmitter & receiver



Write the notes on MIMO wireless communication system



Draw and explain the block diagram of OFDM transmitter & receiver with cyclic prefix.



Explain the OFDM with Design Example.



Draw and explain the block diagram of MIMO-OFDM transmitter and receiver



Derive the expression for bit-rate error in OFDM.

Basic of Wireless Communication :

Important question :

Define wireless communication, what are the need of wireless communication, mention the merits and demerits.

Definition:

Wireless communication refers to the transmission of information or data between devices without the need for physical cables or wires. Instead, it relies on radio waves, infrared signals, or other wireless technologies to facilitate communication.

Needs of Wireless Communication:

- Long-Distance Challenge: Wired media faces difficulties in long-distance communication.
- Simplified User Expansion: Adding new users is easy with wireless communication, requiring no additional wiring.
- Mobility Advantage: Wireless communication remains possible even when user is moving.

Merits :

- No need for wires.
- Large bandwidth in wireless media.
- No maintenance required for wireless media.
- Suitable for broadcasting, radio, and mobile networks.
- Provides mobility for users.
- Lower cost compared to wired communication.

Demerits :

- Wireless communication is susceptible to unauthorized access and security breaches.
- Signal interference from other devices can degrade the quality of wireless connections.
- Wireless networks may face reliability issues, such as dropped signals or slower speeds, especially in crowded areas.

Wireless Communication and their Signal Propagation :

Important question :

List and explain different radio propagation mechanism with suitable example.

Mobile Radio Propagation:

- Wireless communication, like that in mobile phones, operates at frequencies higher than 30 MHz.
- Unlike wired communication, it relies on space wave propagation or line of sight (LOS) propagation.
- Ground wave and sky wave propagation are not suitable for mobile communication.
- LOS propagation requires a clear path between the mobile device and the cell tower.
- Mobile channels are unpredictable, changing rapidly due to factors like the speed of the mobile station.

Signal Propagation Effects:

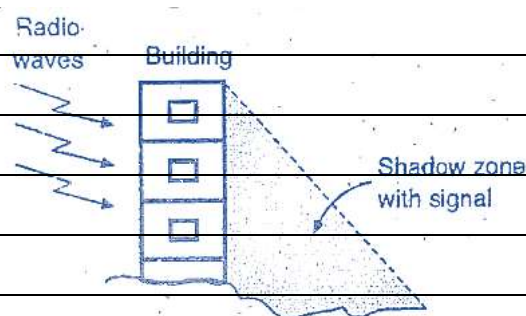
Real-life Scenarios:

Mobile phones are often used in various environments, not just in direct line of sight situations. Understanding additional effects is crucial for designing effective wireless communication systems.

Important Effects (Mechanisms):

Blocking and Shadowing:

- Obstacles such as buildings or hills can obstruct the path of wireless signals.
- Shadows created by these obstacles influence the strength of the signal.





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