

LIST OF SEMESTER TOPICS

How 5G networks work and what services they enable

Explore the architecture of 5G networks, the principle of radio access and core network operation.

Describe the types of services they provide (low-latency transmission, massive IoT).

Optical networks and their role in transmission systems

Explain the principle of light transmission, types of optical cables, and multiplexing. Compare optical and metallic transmission, highlighting their advantages.

Wireless transmissions in the millimeter wave band

Describe the use of millimeter waves in telecommunications. Explain their advantages (capacity, speed) and limitations (range, attenuation).

Satellite transmission systems and their practical use

Explain the principle of satellite communication, frequency bands used, and examples of usage (Internet, television, navigation).

MIMO technology in mobile networks

Describe the principle of MIMO technology. Show how it increases transmission capacity and where it is used in practice.

VoIP and its operation in telecommunication systems

Examine how voice transmission over IP networks works. Compare it with traditional telephony, including advantages and disadvantages.

Internet of Things (IoT) and its communication technologies

Explain the technologies used in IoT (NB-IoT, LoRa, ZigBee). Compare their parameters and application areas.

WebRTC and its use in real-time multimedia and data transmission

Explore how WebRTC works and enables direct communication between browsers or apps without additional plugins. Describe its protocols, advantages (low latency, secure transmission), disadvantages, and example applications.

Edge computing and its importance for data processing

Explain the difference between cloud and edge computing. Show why processing data closer to devices is beneficial.

Transmission networks for data centers

Explore transmission technologies used between servers and data centers. Compare their parameters and speeds.

Security in transmission systems

Describe the main threats (eavesdropping, DoS attacks). Explain the protocols and methods used to protect transmissions.

Zero Trust Security in telecommunication networks

Explain the principle of "trust no one" and compare it with traditional security models. Give examples of its application.

Intelligent antenna systems in modern networks

Explore beamforming and adaptive antenna principles. Explain why they are important for 5G networks.

Private 5G networks in industrial environments

Explain what private mobile networks are. Discuss their benefits for factories, logistics, and industrial applications.

Optical transmission in Passive Optical Networks (PON)

Describe how PON works, the principle of signal splitting, and its advantages for providing home Internet access.

Hybrid networks: combining optical and wireless transmissions

Explore why combining optical and wireless technologies is used. Provide examples of implementation.

QoS (Quality of Service) in transmission systems

Explain what QoS means. Describe parameters such as latency, jitter, and packet loss and their impact on service quality.

Green IT and energy efficiency of transmission systems

Examine how telecommunication networks save energy. Provide examples of green solutions.

The importance of submarine optical cables for the Internet

Describe how continents are connected via optical cables. Explain their capacity and importance for global data transfer.

The future of Wi-Fi and its role alongside mobile networks

Explore Wi-Fi 6/7 principles and parameters. Discuss whether Wi-Fi will compete with or complement mobile networks.

The future of 6G networks from a technical perspective

Explore the technologies planned for 6G networks, focusing on the terahertz band, new modulations, and transmission speeds.

AI in optimization of telecommunication networks

Explain how AI is used for network management, fault prediction, and efficient data transmission.

Quantum communication and transmission networks

Describe the principle of quantum data transmission and its use in encryption. Evaluate its limitations.

Satellite Internet and its limitations

Examine how satellite Internet (e.g., Starlink) works. Explain its limitations in latency and capacity.

IoT and its requirements for transmission networks

Explain how IoT devices communicate and what specific demands they place on transmission systems.

Open RAN and its impact on transmission systems

Explain the principle of Open RAN and its influence on mobile network flexibility.

5G network security from the transmission perspective

Explore the risks associated with the transmission part of 5G and the security measures used.

Blockchain in data transmission

Describe how blockchain is used for authentication and secure data transmission.

Wi-Fi 7 as a complement to transmission technologies

Explore Wi-Fi 7 features and compare them with mobile transmission technologies.

Li-Fi and its practical applications

Explain the principle of Li-Fi and where it can be advantageous compared to Wi-Fi.

Cyberattacks on transmission networks

Describe common attacks (DDoS, eavesdropping, spoofing). Provide prevention methods.

Industrial 5G and its transmission characteristics

Explore the key transmission parameters for industrial applications (latency, reliability).

The future of roaming in mobile networks

Explain how roaming works and what technologies enable it. Discuss ways to reduce its costs.

Energy efficiency of optical transmission systems

Examine how energy consumption is optimized in optical networks. Provide solution examples.

QoE (Quality of Experience) as an extension of QoS

Describe the difference between QoS and QoE. Explain how service quality is measured from the user's perspective.

Processor development and the impact of smaller nanometer processes on communication

Explore trends in processor development focused on smaller nanometer processes. Explain their impact on performance, power consumption, and reliability in telecommunication devices.

CIN (Cloud Infrastructure Network) and its role in telecommunication networks

Explore the principle of CIN as a connection between telecommunication and cloud infrastructures.

Explain how CIN supports 5G, IoT, and modern data services. Analyze its advantages (scalability, flexibility) and challenges (security, interoperability, cost).