Blockchain technology is a distributed ledger system designed to record transactions in a secure, transparent, and tamper-resistant manner. Unlike traditional centralized databases, a blockchain is maintained by a network of nodes, each holding a copy of the ledger. This decentralization increases resilience and trust.

Each block in a blockchain contains transaction data, a timestamp, and a cryptographic hash of the previous block. This structure ensures immutability, as altering one block would require changing all subsequent blocks. Cryptographic hash functions and consensus mechanisms secure the network.

Bitcoin was the first major blockchain application, enabling peer-to-peer digital currency. Ethereum expanded blockchain functionality by introducing smart contracts, which are self-executing programs stored on the blockchain. These contracts enable decentralized applications.

Blockchains can be public, private, or consortium-based. Public blockchains emphasize transparency, while private blockchains are used within organizations. Consortium blockchains are shared among multiple institutions.

Beyond cryptocurrencies, blockchain is applied in supply chain tracking, healthcare records, digital identity, and voting systems. Challenges include scalability, energy consumption, and regulatory uncertainty. Research continues to improve efficiency and governance.