

BCT - UNIT 6 (Blockchain Case Studies) – END-SEM PYQ Answers

➤ **MAY / JUN 2023**

Q7) a) Explain use of Blockchain in retail. [6]

Blockchain is used in the retail sector to improve transparency, security, and efficiency across product movement and customer transactions. It helps retailers track goods, prevent fraud, and automate many business processes.

1. Supply Chain Transparency

- Tracks product journey from manufacturer to store in a tamper-proof way.
- Helps detect fake or altered products.
- Builds trust between retailers and customers.

2. Product Authenticity Verification

- Customers can verify originality of goods using blockchain records.
- Useful for luxury, pharmaceutical, and food industries.
- Increases brand trust and product reliability.

3. Smart Contracts for Automation

- Automates vendor payments, returns, and warranty processing.
- Reduces human errors and delays.
- Ensures faster and trusted transactions.

4. Secure and Faster Payments

- Supports blockchain-based or crypto payments.
- Reduces transaction fees and settlement time.
- Adds security due to decentralization.

5. Better Inventory Management

- Provides real-time, accurate inventory tracking.
- Prevents overstock or shortage situations.
- Lowers operational and storage costs.

6. Enhanced Loyalty Programs

- Loyalty points can be stored as blockchain tokens.
- Easy to manage and redeem across platforms.
- Improves customer engagement and retention.

b) List and explain benefits of using Blockchain in Government sector. [6]

Blockchain offers many advantages to the government sector by improving transparency, reducing corruption, and increasing efficiency in public services. It also helps maintain secure, tamper-proof records that citizens can trust.

1. Enhanced Transparency

- All transactions are recorded on a shared ledger visible to authorized parties.
- Reduces corruption and manipulation of government data.
- Builds trust between government and citizens.

2. Improved Data Security

- Records cannot be altered once stored on the blockchain.
- Protects sensitive citizen data from hacking or unauthorized access.
- Ensures long-term integrity of public records.

3. Faster and Efficient Public Services

- Automates processes like issuing certificates, licenses, and approvals.
- Reduces delays caused by paperwork and manual verification.
- Improves service delivery and reduces workload on government offices.

4. Better Land and Property Record Management

- Stores land records on blockchain to avoid tampering, fraud, or duplication.
- Citizens can easily verify ownership history.
- Helps in transparent real-estate transactions.

5. Secure Digital Identity Management

- Blockchain provides a verified, tamper-proof digital identity for citizens.
- Prevents identity theft and fake ID creation.
- Useful for voting, subsidies, banking, and welfare schemes.

6. Transparent and Reliable Voting System

- Blockchain-based voting ensures votes cannot be altered or duplicated.
- Increases trust and reduces chances of election fraud.
- Allows secure remote or online voting.

c) List and explain any two Blockchain applications [5]

Blockchain technology is used in many real-world sectors because of its transparency, security, and decentralized nature. Two important applications are:

1. Cryptocurrency (Bitcoin, Ethereum)

- Most common application of blockchain used for secure digital currency transactions.
- All transactions are recorded on a decentralized ledger, making them tamper-proof and transparent.
- Removes the need for intermediaries like banks, enabling faster and cheaper transfers.
- Every transaction is verifiable by the public, increasing trust.
- Widely used for online payments, trading, and cross-border transactions.

2. Supply Chain Management

- Blockchain helps track products throughout their entire journey from manufacturing to delivery.
- Each movement is recorded on an immutable ledger, preventing fraud or fake products.
- Provides real-time visibility of product location and status.
- Improves trust between suppliers, manufacturers, and retailers.
- Used in food, pharma, electronics, and luxury goods industries.

Q8) a) Discuss use of Blockchain in Healthcare [6]

Blockchain is widely used in healthcare to improve security, accuracy, and transparency of medical data. It helps hospitals, patients, and insurance companies share information safely without risk of tampering.

1. Secure Patient Data Management

- Stores patient records on a tamper-proof, encrypted ledger.
- Prevents unauthorized access and hacking of medical data.
- Ensures long-term integrity of sensitive health information.

2. Interoperability Between Hospitals

- Allows different hospitals and clinics to share patient records securely.
- Reduces duplication of tests and improves treatment accuracy.
- Helps doctors access updated patient history anytime.

3. Improved Drug Supply Chain

- Tracks medicines from manufacturer to pharmacy using blockchain.
- Prevents counterfeit drugs from entering the market.
- Ensures only authentic and safe medicines reach patients.

4. Faster and Fraud-Free Insurance Claims

- Smart contracts automate claim approvals based on predefined rules.

- Reduces fake claims and unnecessary delays.
- Improves trust between patients and insurance companies.

5. Clinical Trials and Research Integrity

- Research data is recorded on blockchain to prevent manipulation.
- Ensures transparency in clinical trial results.
- Builds trust in scientific studies and medical advancements.

6. Patient-Centric Control of Data

- Patients can control who can access their medical records.
- Increases privacy and empowers individuals.
- Enables secure sharing of data for second opinions or specialist consultations.

b) List and explain any two applications of Blockchain in retail. [6]

Blockchain technology is increasingly used in the retail industry to improve transparency, customer experience, and security. Two important applications are:

1. Product Traceability System

- Blockchain helps retailers track a product's entire journey from manufacturer to store shelf.
- Every step (production, packaging, shipping, warehousing) is stored on an immutable ledger.
- This prevents counterfeit or expired products from entering the market.
- Customers can verify the authenticity and origin of goods.
- Widely used in food, pharmaceuticals, and luxury products.
- Improves supply chain visibility and increases consumer trust.

2. Blockchain-Based Loyalty Programs

- Retailers convert loyalty points into secure, tamper-proof digital tokens on blockchain.
- Customers can easily earn, store, and redeem points without fraud or duplication.
- Ensures transparency and prevents manipulation of reward records.
- Enhances customer engagement and encourages repeat purchases.
- Points can be redeemable across different stores or platforms.
- Helps brands build stronger, data-driven loyalty strategies.

c) Explain how Blockchain can be used in Financial Services. [5]

Blockchain plays a major role in modern financial services by improving security, speed, and transparency. It helps banks, payment companies, and customers handle transactions more efficiently.

1. Faster and Low-Cost Payments

- Blockchain removes intermediaries like banks in money transfers.
- This reduces transaction fees and enables instant cross-border payments.
- Useful for international remittances and online transactions.

2. Fraud Prevention and High Security

- Every transaction is recorded on a tamper-proof ledger.
- Makes it difficult for hackers or fraudsters to alter data.
- Ensures secure handling of financial records and customer information.

3. Smart Contracts for Financial Automation

- Automates tasks like loan approvals, insurance claims, and settlements.
- Reduces paperwork and manual errors.
- Speeds up financial processes and increases trust.

4. Transparent and Auditable Transactions

- All financial activities on blockchain can be verified in real time.
- Helps banks and regulators monitor transactions easily.
- Reduces risk of money laundering and illegal transfers.

5. Digital Assets and Tokenization

- Blockchain allows creation of digital assets like cryptocurrency or tokenized shares.
- Investors can trade assets more easily and securely.
- Increases liquidity and opens new opportunities in fintech.

➤ MAY / JUN 2024**Q7) a) Describe the role of Blockchain in the financial sector. [7]**

Blockchain plays a major role in transforming the financial sector by increasing transparency, reducing fraud, and improving the speed of financial transactions. It helps banks, fintech companies, and customers manage financial operations securely and efficiently.

1. Secure and Tamper-Proof Transactions

- All financial transactions are stored on an immutable ledger.
- Prevents alteration, hacking, or manipulation of records.
- Enhances trust between banks and customers.

2. Faster Cross-Border Payments

- Eliminates intermediaries like correspondent banks.

- Enables near-instant international money transfers.
- Reduces transaction fees and delays.

3. Fraud Reduction and Enhanced Security

- Uses cryptographic methods to protect sensitive financial data.
- Detects suspicious or unauthorized transactions easily.
- Minimizes risks of identity theft, double spending, and fraud.

4. Smart Contracts for Automation

- Automates tasks like loan processing, settlements, and insurance claims.
- Removes manual paperwork and errors.
- Increases efficiency in banking operations.

5. Transparent and Real-Time Auditing

- All financial activities are timestamped and traceable.
- Helps regulators and auditors monitor transactions instantly.
- Reduces chances of money laundering and illegal financial activities.

6. Digital Identity Management

- Provides secure, verified digital identities for customers.
- Speeds up KYC (Know Your Customer) and onboarding processes.
- Reduces duplication of customer verification efforts.

7. Tokenization of Assets

- Converts physical assets like shares, gold, or property into digital tokens.
- Makes trading easier, faster, and more accessible.
- Increases liquidity in the financial market.

b) Describe the role of Blockchain in the Government sector. [9]

Blockchain plays an important role in the government sector by improving transparency, reducing corruption, and making public services faster and more secure. It allows government departments to maintain trustworthy, tamper-proof records and deliver citizen services with higher efficiency and reliability.

1. Enhanced Transparency in Government Operations

- All government transactions are recorded on a shared, immutable ledger.
- Prevents manipulation, data tampering, and hidden activities.
- Builds trust among citizens by making processes more open and verifiable.

2. Strong Data Security and Privacy Protection

- Blockchain stores data using advanced cryptography.
- Unauthorized access or hacking becomes extremely difficult.
- Ensures long-term security of sensitive public records.

3. Efficient Public Service Delivery

- Reduces paperwork and manual verification processes.
- Helps automate services like certificate issuance, licensing, and approvals.
- Speeds up delivery of government schemes and reduces delays.

4. Better Land and Property Record Management

- Land records stored on blockchain cannot be faked or illegally modified.
- Prevents disputes, duplicate ownership claims, and fraud in real estate.
- Citizens get transparent access to property history and ownership details.

5. Secure Digital Identity for Citizens

- Blockchain creates tamper-proof digital identities.
- Helps in accurate KYC, voter identity verification, and welfare distribution.
- Reduces identity theft and fake document generation.

6. Transparent and Fraud-Free Voting System

- Voting records on blockchain cannot be altered or deleted.
- Eliminates fake votes, duplication, and vote manipulation.
- Enables secure online or remote voting, increasing participation.

7. Streamlined Welfare and Subsidy Distribution

- Subsidies and benefits can be transferred directly to verified beneficiaries.
- Removes intermediaries, reducing corruption and leakage.
- Ensures only eligible citizens receive government support.

8. Improved Regulatory Compliance and Auditing

- Blockchain keeps real-time, timestamped records of all transactions.
- Regulators can instantly audit government finances and workflows.
- Helps identify illegal activities, money misuse, or mismanagement.

9. Inter-department Data Sharing

- Different government departments (health, police, transport, revenue) can share data securely.
- Eliminates duplication of documents and repetitive verification.
- Improves coordination and accuracy of citizen-related information.

Q8) a) Explain the role of Blockchain in Healthcare. [9]**1. Secure Patient Data Management**

- Blockchain stores patient records on an encrypted, tamper-proof ledger.
- Prevents unauthorized access, hacking, and alteration of medical data.
- Ensures long-term security and accuracy of sensitive health information.

2. Interoperability Between Hospitals and Clinics

- Enables safe sharing of patient records across hospitals, labs, and doctors.
- Reduces duplication of tests and improves treatment decisions.
- Ensures that medical history is always up to date and easily accessible.

3. Improved Drug Supply Chain Management

- Tracks medicines from production to pharmacy using blockchain entries.
- Helps identify counterfeit drugs and prevents fake medicines from reaching patients.
- Protects patient safety and increases trust in healthcare products.

4. Fraud-Free and Faster Insurance Claims

- Smart contracts automatically verify treatment details and approve claims.
- Reduces fake claims, delays, and paperwork.
- Improves transparency between hospitals, insurers, and patients.

5. Transparency in Clinical Trials & Research

- Research data stored on blockchain cannot be modified or deleted.
- Ensures fairness and accuracy in clinical trial results.
- Builds trust in scientific studies and medical research findings.

6. Efficient Electronic Health Record (EHR) Management

- Combines all patient records (lab tests, prescriptions, scans) in a single secure system.
- Reduces errors caused by manual record keeping.
- Ensures smooth coordination among different healthcare departments.

7. Patient Ownership and Control of Data

- Patients decide who can access their health information.
- Allows safe sharing of data for second opinions or specialist consultations.
- Increases privacy and patient empowerment.

8. Medical Billing and Payment Security

- Billing records stored on blockchain prevent overcharging or manipulation.

- Reduces medical billing fraud and false transactions.
- Ensures transparent and accurate financial processes in hospitals.

9. Telemedicine and Remote Healthcare Support

- Blockchain verifies identity and medical history during online consultations.
- Ensures secure digital prescriptions and remote treatment.
- Supports safe telehealth services during emergencies.

b) Discuss potential challenges and benefits of implementing Blockchain in Voting System. [9]

Blockchain-based voting systems aim to make elections more secure, transparent, and trustworthy. While they offer many benefits, they also face several technical and operational challenges.

Benefits :

1. High Transparency and Trust

- Every vote is recorded on a blockchain ledger that cannot be altered.
- Reduces chances of vote tampering, manipulation, or hidden changes.
- Increases public confidence in the election process.

2. Improved Security

- Votes are encrypted and stored in a decentralized system.
- Eliminates single point of failure found in traditional electronic voting machines.
- Protects against hacking and unauthorized access.

3. Prevents Duplicate or Fake Voting

- Each voter's identity and vote is securely verified using blockchain.
- Eliminates duplicate votes, fake identities, and impersonation.
- Ensures only legitimate voters participate.

4. Supports Remote / Online Voting

- Citizens can cast votes from anywhere using verified digital identities.
- Beneficial for elderly, differently-abled, overseas citizens, and remote areas.
- Increases voter turnout and participation.

Challenges :

1. Technical Complexity

- Blockchain voting requires advanced digital infrastructure.
- Many regions may lack the required hardware, software, or network capability.
- High setup and maintenance costs.

2. Privacy Concerns

- While votes must be transparent, voter identity must remain secret.
- Balancing transparency with privacy is a technical challenge.
- Mistakes could expose voter choices.

3. Risk of Digital Divide

- Not all citizens are comfortable with mobile apps or blockchain systems.
- Low digital literacy may lead to confusion or misuse.
- Could exclude rural or older populations.

4. Scalability Issues

- National elections involve millions of votes in a short time.
- Handling such large data securely on blockchain requires high processing power.
- Scalability limitations may slow the system during peak voting.

➤ MAY / JUN 2025

Q7) a) List the prominent block chain application. Explain in detail any one with the architecture. [9]

Blockchain is used in many sectors due to its transparency, security, and decentralized nature. Some prominent applications include:

Prominent Blockchain Applications

1. **Cryptocurrency (Bitcoin, Ethereum)**
2. **Supply Chain Management**
3. **Healthcare Data Management**
4. **Voting Systems**
5. **Financial Services & Payments**
6. **Real Estate and Land Registries**
7. **Digital Identity Management**
8. **Insurance and Smart Contracts**
9. **Retail & Product Authenticity Tracking**

Explain Any One Application with Architecture:

Cryptocurrency (Example: Bitcoin) – with Architecture

Cryptocurrency is the most popular application of blockchain, used for secure digital payments without banks. It uses blockchain to record all transactions in a transparent and tamper-proof way.

1. User Layer (Wallets & Keys)

- Users store their digital currency in crypto wallets.
- Each user has a **public key** (address) and **private key** (for signing transactions).
- Transactions are initiated using the private key, ensuring security.

2. Transaction Layer

- When a user sends cryptocurrency, a digital transaction is created.
- This includes sender address, receiver address, and amount.
- The transaction is broadcast to the peer-to-peer network.

3. Network (P2P) Layer

- Many distributed nodes receive the transaction.
- Nodes verify the authenticity using cryptographic signatures.
- Ensures no central authority controls the system.

4. Consensus Layer

- Nodes follow a consensus mechanism (e.g., **Proof of Work** in Bitcoin).
- Miners solve mathematical puzzles to validate transactions.
- Prevents double spending and ensures only legitimate transactions are added.

5. Block Creation Layer

- Verified transactions are grouped to form a **block**.
- The block contains:
 - Block header
 - Previous block hash
 - Merkle root
 - Timestamp
 - Validated transactions
- Once formed, miners compete to add the block to the chain.

6. Blockchain Layer

- The new block is linked to the previous block using a hash.
- This forms a continuous tamper-proof **chain of blocks**.
- Once added, the transaction becomes permanent and cannot be altered.

7. Application Layer

- Users can perform activities like:

- Sending/receiving cryptocurrency
- Checking balance
- Viewing transaction history
- Applications include crypto exchanges, payment services, and digital wallets.

ARCHITECTURE DIY

b) Discuss in brief how cyber hacks can be reduced for Digital Identity using Blockchain. [9]

Blockchain can greatly reduce cyber hacks in digital identity systems by providing security, decentralization, and tamper-proof data management. It protects user identities from theft, unauthorized access, and manipulation.

1. Decentralized Storage of Identity Data

- Identity information is not stored in one central server.
- Hackers cannot attack a single point to steal data.
- Distributed nodes increase security and resilience.

2. Tamper-Proof Digital Identity Records

- Once identity data is added to blockchain, it cannot be modified or deleted.
- Prevents identity alteration, forgery, or fake identity creation.
- Ensures trust in stored identity information.

3. Strong Cryptographic Protection

- Blockchain uses hashing, digital signatures, and encryption.
- Even if hackers access data, it is unreadable without private keys.
- Ensures secure authentication of users.

4. Self-Sovereign Identity (SSI)

- Users control their own identity data instead of third-party servers.
- Reduces exposure of personal data to companies or platforms that can be hacked.
- Only required information is shared (zero-knowledge proofs).

5. Reduced Identity Theft and Impersonation

- Every identity transaction is verified through cryptographic keys.
- Prevents attackers from creating duplicate or fake identities.
- Ensures that only legitimate users access their accounts.

6. Secure Authentication & Access Control

- Blockchain-based identity uses multi-layer authentication.

- Private keys replace passwords, reducing password-based hacks.
- Prevents phishing, brute-force attacks, and credential leaks.

7. Transparent Audit Trail

- All identity-related activities are recorded on blockchain.
- Suspicious access attempts can be tracked immediately.
- Helps detect and block cyber attacks quickly.

8. Protection Against Data Breaches

- No central database for hackers to breach.
- Even if one node is compromised, overall identity data stays safe.
- Ensures high security for sensitive personal information.

9. Verification Without Sharing Actual Data

- Blockchain supports “attribute-based verification.”
- Example: System can verify you are 18+ without revealing your full DOB.
- Minimizes data exposure and reduces chances of cyber hacks.

Q8) a) Elaborate the use of block chain technology in the government sector. Which are the different block chain based applications available/proposed for it? [9]

Blockchain is increasingly used in the government sector to improve transparency, reduce corruption, and deliver efficient public services. Its decentralized and tamper-proof nature helps governments manage data securely and increase trust among citizens.

A) Uses of Blockchain in Government Sector

1. Transparent Government Processes

- Blockchain records data in an immutable ledger.
- Prevents manipulation of government records.
- Increases trust between citizens and authorities.

2. Secure Citizen Data Management

- Protects personal information (ID, certificates, licenses) from hacking.
- Ensures data privacy using cryptographic techniques.
- Prevents unauthorized modification of records.

3. Efficient Public Service Delivery

- Automates processes like issuing certificates, permits, subsidies.

- Reduces paperwork and human errors.
- Improves speed and accuracy of government operations.

4. Fraud-Free Voting System

- Blockchain enables tamper-proof vote recording and counting.
- Reduces fake votes, duplication, and manipulation.
- Supports safe remote/online voting.

5. Transparent Land and Property Records

- Stores land registry data in a tamper-proof form.
- Prevents illegal changes, disputes, and fake ownership claims.
- Helps citizens easily verify property history.

6. Streamlined Welfare & Subsidy Distribution

- Ensures benefits reach the right beneficiaries.
- Reduces corruption by removing intermediaries.
- Tracks fund flow transparently.

B) Blockchain-Based Applications Available/Proposed for Government

1. Digital Identity Systems (e.g., Aadhaar-linked blockchain)

- Secures citizen identity data using decentralized storage.
- Prevents identity theft and unauthorized modifications.

2. Land Registry Platforms (e.g., Sweden, Georgia, Andhra Pradesh)

- Blockchain-based property registration and ownership verification.
- Accurate, tamper-proof land records.

3. Blockchain Voting Systems (e.g., Estonia, West Virginia Pilot)

- Secure online voting with verifiable audit trails.
- Eliminates fake voting and enhances election trust.

4. Public Financial Management Platforms

- Tracks government spending and budgets transparently.
- Reduces corruption and misuse of public funds.

5. Healthcare Data Management Systems

- Stores medical records securely for government hospitals.
- Enables safe sharing between hospitals and insurance schemes.

6. Tax Collection and Compliance Systems

- Automates tax tracking using smart contracts.
- Reduces tax fraud and improves compliance.

7. Supply Chain Monitoring for Public Distribution (PDS)

- Tracks movement of ration, food grains, and medicines.
- Ensures no leakage, diversion, or corruption in public supply chains.

b) Discuss the impact made by block chain with IOT and Block chain in banking.[9]

Blockchain has a powerful impact on both IoT (Internet of Things) and the banking sector by improving transparency, security, and automation. It strengthens system reliability and reduces cyber risks in both industries.

Impact of Blockchain with IoT

1. Enhanced Security for IoT Devices

- IoT devices are vulnerable to hacking due to weak security.
- Blockchain stores device data in a secure, tamper-proof ledger.
- Prevents unauthorized access and device manipulation.

2. Decentralized Network for IoT

- Traditional IoT works on centralized cloud systems.
- Blockchain removes the central point of failure.
- Improves reliability and prevents large-scale cyberattacks.

3. Trusted Device-to-Device Communication

- IoT devices can interact autonomously through smart contracts.
- Ensures trusted, automated communication without human intervention.
- Reduces errors and improves efficiency.

4. Real-Time Data Integrity

- Data generated by sensors is stored immutably on blockchain.
- Prevents data tampering, alteration, or loss.
- Useful for industrial IoT, smart homes, and smart cities.

Impact of Blockchain in Banking

1. Faster and Low-Cost Transactions

- Blockchain reduces dependence on intermediaries.

- Enables near-instant international money transfers.
- Reduces high transaction fees and delays.

2. High Security and Fraud Reduction

- Banking transactions stored on blockchain cannot be altered.
- Prevents fraud, identity theft, and double spending.
- Cryptography ensures strong protection of financial data.

3. Smart Contracts for Automation

- Automates loan approvals, settlements, insurance claims.
- Reduces paperwork and human errors.
- Speeds up banking operations significantly.

4. Transparent and Auditable Financial Records

- All transactions are time-stamped and traceable.
- Helps regulators monitor suspicious activities easily.
- Reduces money laundering and illegal financial transactions.

➤ NOV / DEC 2023

Q7) a) Discuss any use case of Blockchain integration with any other domain like cloud.

Blockchain can be integrated with cloud computing to improve security, transparency, and data integrity. This combination is mainly used for secure data storage, trusted data sharing, and decentralized cloud services.

1. Secure Cloud Data Storage

- Blockchain stores the hash of data uploaded to the cloud.
- Even if cloud servers are hacked, the original data integrity can be verified through blockchain.
- Prevents data tampering and unauthorized modifications.

2. Decentralized Cloud Storage (Blockchain + Cloud)

- Instead of storing data on one centralized server, blockchain distributes storage across multiple nodes.
- Reduces risk of single-point failures and data loss.
- Increases reliability and privacy.

3. Cloud Access Control Using Smart Contracts

- Smart contracts regulate who can access the cloud data.
- Automatically grants or denies access based on predefined rules.

- Eliminates manual errors and strengthens data protection.

4. Trusted Data Sharing Between Organizations

- Blockchain maintains an immutable record of who accessed or modified cloud data.
- Useful for businesses, hospitals, and government departments.
- Ensures transparent and trusted data exchange.

5. Enhanced Cybersecurity in Cloud

- Blockchain prevents unauthorized changes by verifying every action.
- Adds an extra layer of protection over traditional cloud security methods.
- Useful against data breaches, insider attacks, and ransomware.

6. Example Use Case: IBM Cloud + Hyperledger Fabric

- IBM integrates blockchain with its cloud platform to offer secure business solutions.
- Enterprises use it for supply chain, finance, and identity management.
- Ensures high security, transparency, and trusted cloud operations.

b) Explain use of Blockchain in Energy and utilities [6]

Blockchain is increasingly used in the energy and utilities sector to improve transparency, decentralization, and efficiency in energy production, distribution, and billing.

1. Peer-to-Peer (P2P) Energy Trading

- Consumers with solar panels can directly sell extra electricity to neighbors.
- Blockchain records every energy sale securely and transparently.
- Removes need for a central electricity authority for small transactions.

2. Transparent and Accurate Billing

- Smart meters send energy usage data to blockchain.
- Prevents bill manipulation, estimation errors, or fraudulent readings.
- Ensures customers are billed accurately for real consumption.

3. Renewable Energy Certificate (REC) Tracking

- Blockchain records generation of green energy in a tamper-proof manner.
- Ensures renewable energy certificates are genuine and not duplicated.
- Helps companies prove they used clean energy.

4. Grid Management and Load Balancing

- Blockchain helps track real-time electricity demand and supply.
- Improves stability in power grids using decentralized data sharing.
- Prevents power outages and reduces energy waste.

5. Energy Asset Management

- Tracks maintenance and performance of utility equipment (turbines, transformers).
- Immutable records help companies schedule repairs accurately.
- Increases lifespan and efficiency of energy infrastructure.

6. Automated Smart Contracts for Utilities

- Smart contracts manage electricity distribution, billing, and supplier payments.
- Eliminates manual processes and reduces delays.
- Ensures faster and more reliable utility operations.

c) Explain use of Blockchain in Health Sector. [5]

Blockchain is widely used in the health sector to secure medical data, improve transparency, and ensure safe sharing of patient information among hospitals and healthcare providers.

1. Secure Patient Data Storage

- Stores medical records on a tamper-proof ledger.
- Prevents hacking, unauthorized access, and data manipulation.

2. Easy and Safe Sharing of Medical Records

- Patients' data can be shared securely between hospitals, labs, and doctors.
- Reduces repeated testing and improves treatment accuracy.

3. Drug Supply Chain Monitoring

- Tracks medicine movement from manufacturer to pharmacy.
- Helps identify fake or expired drugs and protects patient safety.

4. Fraud-Free Insurance Claims

- Smart contracts automate insurance approval and claim verification.
- Reduces fraudulent claims and speeds up processing.

5. Patient-Controlled Healthcare Data

- Patients decide who can access their health information.
- Ensures privacy and builds trust in digital healthcare services.

Q8) a) Discuss any use case of Blockchain integration with any other domain like Internet of Things (IoT). [6]

Blockchain can be integrated with IoT to improve security, reliability, and trusted communication between connected devices. This integration is widely used for smart homes, smart cities, industrial automation, and supply chain systems.

1. Secure IoT Device Communication

- IoT devices connect and exchange data automatically.
- Blockchain ensures these communications are encrypted and tamper-proof.
- Prevents unauthorized control of IoT devices.

2. Decentralized Structure for IoT Networks

- Traditional IoT relies on centralized cloud servers.
- Blockchain removes central dependency and avoids single-point failure.
- Makes IoT systems more reliable and secure.

3. Trusted Machine-to-Machine (M2M) Transactions

- Smart contracts allow IoT devices to interact automatically.
- For example, a smart car paying for charging or tolls on its own.
- Ensures transparent and rule-based operations.

4. Enhanced Data Integrity

- Sensor data stored on blockchain cannot be modified later.
- Ensures accurate readings for industrial IoT, agriculture IoT, or healthcare IoT.
- Improves decision-making and monitoring.

5. Supply Chain Tracking with IoT + Blockchain

- IoT sensors monitor real-time location, temperature, humidity of products.
- Blockchain stores this information securely and transparently.
- Helps track food, medicines, electronics, and prevent fraud.

6. Reduced Cybersecurity Risks

- IoT devices are often vulnerable to hacking.
- Blockchain provides distributed security and prevents large-scale attacks.
- Protects smart homes, smart grids, and industrial IoT systems.

b) What is the significance of adoption of Blockchain in Banking and Financial Services? [6]

Blockchain plays a major role in transforming banking and financial services by improving transparency, reducing fraud, and speeding up transactions. Its decentralized and secure nature makes financial operations more trustworthy and efficient.

1. Faster and Low-Cost Transactions

- Eliminates intermediaries in money transfers.
- Enables near-instant cross-border payments.

- Reduces transaction fees and settlement delays.

2. Enhanced Security and Fraud Prevention

- Financial records stored on blockchain cannot be altered.
- Protects against identity theft, double spending, and hacking.
- Uses strong cryptography to secure sensitive data.

3. Transparency and Real-Time Auditing

- All transactions are timestamped and traceable.
- Regulators can monitor financial activities easily.
- Reduces corruption, money laundering, and hidden transactions.

4. Automation Using Smart Contracts

- Smart contracts handle loan approvals, insurance claims, and settlements automatically.
- Reduces paperwork and human errors.
- Improves efficiency and trust in banking processes.

5. Improved Customer Identity Management (KYC)

- Blockchain stores verified customer identities securely.
- Banks can share KYC data safely, reducing repeated verification.
- Speeds up onboarding and reduces compliance costs.

6. Asset Tokenization and Digital Payments

- Converts assets like shares, bonds, and property into digital tokens.
- Enables secure and fast trading.
- Supports modern digital payment systems and cryptocurrencies.

c) Explain any one application of Blockchain in Government sector [5]

Application: Blockchain-Based Land and Property Record Management

1. Secure and Tamper-Proof Land Records

- Land ownership details are stored on a blockchain ledger.
- Prevents illegal modifications, duplication, or forgery of documents.

2. Transparent Property Transactions

- Buyers and sellers can verify ownership history instantly.
- Reduces disputes and increases trust in property dealings.

3. Faster Property Registration Process

- Smart contracts help automate registration and approval steps.
- Eliminates paperwork, delays, and middlemen.

4. Reduction in Fraud and Corruption

- Immutable ledger prevents manipulation by corrupt officials.
- Ensures only verified and legitimate land transfers.

5. Examples of Implementation

- Countries like **Georgia, Sweden, Andhra Pradesh (India)** use blockchain for land records.
- Helps governments maintain accurate, secure, and updated property databases

➤ NOV / DEC 2024

Q7) a) With the help of neat diagram explain how blockchain can be used for any supply chain application.

Phase	Traditional Process	What Blockchain Adds
Origin / Raw-Material Production	Supplier issues paper invoices, PDFs, or proprietary ERP records.	The farmer/manufacturer creates a digital asset (e.g., a <i>batch token</i>) on the blockchain that contains immutable metadata – origin, certification, timestamp, GPS coordinates, and quality metrics.
Transportation to Manufacturer	Carrier logs data in separate TMS systems; data can be altered or lost.	The carrier signs a transaction each time the batch changes hands (pickup, customs, hand-off). Because each transaction is cryptographically signed, the ledger proves who performed the action and when.
Manufacturing / Assembly	Plant records production steps in internal databases.	The plant writes a smart-contract event that records transformation (e.g., raw material → finished component), linking the new token to its parent tokens. This creates a verifiable lineage (a “digital twin”).
Distribution / Warehousing	Warehouse receipts are stored in spreadsheets or PDFs.	Each storage event (inbound, outbound, temperature checks) is logged on-chain, optionally with IoT sensor hashes (temperature, humidity). Stakeholders can query the ledger to confirm conditions were met.
Retail / End-Customer	Point-of-sale systems generate receipts; warranty claims rely on manual paperwork.	The retailer scans the token’s QR code, instantly retrieving the full provenance. Warranty, recall, or resale verification becomes a single-click operation because the entire history lives on an immutable ledger.

Core Benefits

1. **Transparency & Traceability** – Every participant sees the same, tamper-proof record.
2. **Reduced Fraud** – Counterfeit goods can be flagged because they lack a valid on-chain provenance.
3. **Automation via Smart Contracts** – Payments, escrow releases, or compliance checks trigger automatically when predefined conditions are met (e.g., “release payment when temperature stays $\leq 8^{\circ}\text{C}$ for 48 h”).
4. **Interoperability** – Different companies can keep their own internal systems while sharing a common, permissioned ledger for the shared data points.

DIAGRAM DIY

b) Explain the use of blockchain technology in the government sector. ‘Which are the different blockchain based applications proposed for it? [9]

→ Done

Q8) a) Explain how Blockchain and IoT can work together. [9]

Blockchain and IoT (Internet of Things) can work together to create secure, transparent, and automated systems. IoT devices generate large amounts of data, and blockchain ensures this data is stored securely, verified transparently, and shared reliably among devices and organizations.

1. Enhanced Security for IoT Devices

- IoT devices are often targeted by hackers due to weak security.
- Blockchain provides decentralized, tamper-proof protection.
- Prevents unauthorized control of smart home, industrial, and medical IoT devices.

2. Decentralized Network for IoT

- Traditional IoT systems use centralized cloud servers.
- Blockchain distributes control across many nodes, removing single-point failure.
- Ensures higher reliability, especially in industrial and smart city IoT.

3. Trusted Device-to-Device (M2M) Communication

- Smart contracts let IoT devices interact and make decisions automatically.
- Example: A smart meter paying for electricity on its own.
- Ensures accurate and rule-based operations.

4. Improved Data Integrity

- Sensor data is stored on blockchain, making it immutable.
- No one can alter or fake IoT-generated data later.
- Useful in agriculture IoT, healthcare IoT, logistics, and manufacturing.

5. Automation Using Smart Contracts

- IoT events can trigger automatic blockchain transactions.
- Example: A temperature sensor triggering a supply chain alert.
- Reduces manual supervision and speeds up decision-making.

6. Real-Time Monitoring and Tracking

- IoT sensors track goods, vehicles, energy usage, or environment conditions.
- Blockchain records this data transparently for all stakeholders.
- Useful for logistics, cold-chain, energy grids, and asset management.

7. Energy and Utility Management

- IoT devices measure consumption of water, gas, or electricity.
- Blockchain ensures accurate billing and peer-to-peer energy trading.
- Prevents fraud and meter tampering.

8. Supply Chain and Logistics

- IoT provides live data (location, humidity, temperature).
- Blockchain stores this data permanently.
- Prevents counterfeit products and improves traceability.

9. Reduced IoT Cyber Risks

- Blockchain removes centralized servers that hackers typically attack.
- Prevents large-scale DDoS attacks targeting IoT devices.
- Ensures secure operation of smart homes, smart cities, and industrial IoT systems.

b) List out the applications of Blockchain Technology in different areas. Explain any 2 in detail. [9]

Blockchain technology is used in many sectors because it provides transparency, decentralization, and tamper-proof data management.

Applications of Blockchain Technology (List):

1. Cryptocurrency (Bitcoin, Ethereum)
2. Supply Chain Management
3. Healthcare and Medical Records
4. Banking and Financial Services
5. Voting Systems
6. Real Estate and Land Registry
7. Digital Identity Management
8. Energy and Utilities
9. Insurance and Smart Contracts
10. Education Certificate Verification

Explain Any TWO in Detail:

1. Cryptocurrency (Bitcoin, Ethereum)

- Cryptocurrency is the most common application of blockchain used for digital payments and online transactions.
- Blockchain records every transaction on a decentralized ledger, which ensures transparency and prevents tampering.
- No central authority (like a bank) controls the system, so transactions are faster and cheaper.
- Users hold digital wallets with public and private keys for secure transfers.
- Provides global, borderless payments with strong cryptographic security.
- Widely used for online payments, trading, and investment.

2. Supply Chain Management

- Blockchain tracks goods from the point of manufacturing to the final delivery.
- Every stage (production, packaging, shipment, warehouse) is recorded on an immutable ledger.
- Helps detect counterfeit items and prevents fraud.
- Ensures that product origin, quality, and movement are fully transparent.
- Used in sectors like food, pharmaceuticals, electronics, and luxury goods.
- Improves trust between suppliers, manufacturers, distributors, and customers.

Note: Please check and verify all answers once before referring.