FREE EDITION · NOTES + 3 SAMPLE MCQS

CUET · COMPUTER SCIENCE · CLASS XI · CODE 308

Emerging Trends

CUET unit: Emerging Trends

By **UniDrill** · NCERT-grounded study material

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📌 Snapshot

- Six state-of-the-art technology domains — AI, Big Data, IoT, Cloud Computing, Grid Computing, and Blockchains — are reshaping digital economies and societies.
- CUET tests this area heavily through broad conceptual definitions, classification systems (e.g., the 5 Vs of Big Data, three cloud service models), and real-world applications that lend themselves to MCQ distractors.
- Paired concepts recur that NTA exploits for confusion: VR vs. AR, Cloud vs. Grid, IoT vs. WoT, IaaS vs. PaaS vs. SaaS.
- The vocabulary (humanoid, blockchain, smart sensor, data analytics) recurs in later topics and in crossover questions from the Computer Science stream.
- Understanding the distinction between traditional and emerging approaches (centralised vs. decentralised database, traditional DBMS vs. Big Data tools) is a frequent exam angle.

📖 Detailed Notes

2.1 Core concepts

- **Introduction to Emerging Trends (§2.1, p. 15–16):** New technologies emerge continuously; those that gain popularity and persist are called "emerging trends." They are state-of-the-art technologies that gain attention from users and will make a huge impact on digital economies and interactions in digital societies. (NCERT §2.1, p. 15)
- **Artificial Intelligence — overview (§2.2, p. 16):** AI endeavours to simulate the natural intelligence of human beings into machines, making them behave intelligently. An intelligent machine imitates cognitive functions like learning, decision-making, and problem solving. AI systems are programmed to create a knowledge base and make decisions based on it; they can also learn from past experiences. Examples of AI applications include route-optimising maps, automatic face-tagging on social networks, and voice assistants (Siri, Google Now, Cortana, Alexa). (NCERT §2.2, p. 16)
- **Knowledge base** is a store of information consisting of facts, assumptions, and rules that an AI system uses for decision making. (NCERT §2.2, p. 16 sidebar)

- **Machine Learning (§2.2.1, p. 16):** Machine Learning is a subsystem of AI wherein computers learn from data using statistical techniques without being explicitly programmed. It comprises algorithms (called models) that are first trained and tested using training data and testing data; once accuracy is acceptable, models make predictions on new and unknown data. (NCERT §2.2.1, p. 16)
- **Natural Language Processing — NLP (§2.2.2, p. 16–17):** NLP deals with interaction between humans and computers using human spoken languages (Hindi, English, etc.). Applications include predictive typing, spell checking, text-to-speech, speech-to-text, machine translation, and automated customer service. NLP makes it possible to search the web or control devices using voice. (NCERT §2.2.2, p. 16–17)
- **Immersive Experiences — Virtual Reality (§2.2.3A, p. 17–18):** VR is a three-dimensional, computer-generated situation that simulates the real world. The user interacts with and explores that environment while immersed in it, achieved using VR Headsets. VR promotes other sensory information — sound, smell, motion, temperature — to make the experience realistic. Applications: gaming, military training, medical procedures, entertainment, flight simulators. (NCERT §2.2.3A, p. 17–18)
- **Augmented Reality (§2.2.3B, p. 18):** AR is the superimposition of computer-generated perceptual information over existing physical surroundings, making the environment interactive and digitally manipulable. Unlike VR, AR does not create something new — it alters or augments perception of the physical world. Location-based AR apps let travellers access real-time information about historical places by pointing a camera. (NCERT §2.2.3B, p. 18)
- **Robotics (§2.2.4, p. 18–19):** A robot is a programmable machine capable of carrying out tasks automatically with accuracy and precision. Robots can be of many types: wheeled robots, legged robots, manipulators, and humanoids. Sensors are one of the prime components of a robot. Robotics is an interdisciplinary branch requiring mechanical engineering, electronics, and computer science; it is primarily concerned with design, fabrication, operation, and application of robots. Examples: NASA's Mars Exploration Rover (MER), Sophia (a humanoid using AI and facial recognition), and drones. (NCERT §2.2.4, p. 18–19)
- **Big Data — overview (§2.3, p. 19–20):** Around 2.5 quintillion bytes of data are created each day. Data sets of enormous volume and complexity that cannot be processed using traditional data processing tools are called Big Data. Big data is not only voluminous but also unstructured (posts, tweets, photos, audio/video chats, etc.). Big data holds rich information of high business value. (NCERT §2.3, p. 19–20)
- **Five characteristics of Big Data — the 5 Vs (§2.3.1, p. 20–21):** Volume (enormous size, difficult to process with traditional DBMS), Velocity (exponentially higher rate of generation than traditional data sets), Variety (structured, semi-structured, and unstructured data — text, images, videos, web pages), Veracity (trustworthiness of data — data can be inconsistent, biased, or noisy), and Value

(hidden patterns and useful knowledge of high business value). (NCERT §2.3.1, p. 20–21)

- **Data Analytics (§2.3.2, p. 21):** Data analytics is the process of examining data sets to draw conclusions about the information they contain, with the aid of specialised systems and software. Used in commercial industries for informed business decisions and in science to verify or disprove models, theories, and hypotheses. Pandas (a Python library) is one tool to simplify data analysis. (NCERT §2.3.2, p. 21)
- **Internet of Things — IoT (§2.4, p. 21–22):** IoT is a network of devices that have embedded hardware and software to communicate (connect and exchange data) with other devices on the same network. IoT brings devices that were previously operating in isolation into collaboration, creating an intelligent network of things. Example: microwave oven, air conditioner, CCTV camera connected to the Internet and remotely controlled via smartphone. (NCERT §2.4, p. 21–22)
- **Web of Things — WoT (§2.4.1, p. 22):** WoT allows the use of web services to connect anything in the physical world, besides human identities on the web. It provides one interface to connect all IoT devices (instead of 'n' different apps for 'n' devices), paving the way for smart homes, smart offices, and smart cities. (NCERT §2.4.1, p. 22)
- **Sensors (§2.4.2, p. 22):** A smart sensor takes input from the physical environment, uses built-in computing resources to perform predefined functions upon detection of specific input, and then processes data before passing it on. The accelerometer sensor in mobile phones detects orientation; the gyroscope tracks rotation or twist. Smart electronic sensors are driving the evolution of IoT. (NCERT §2.4.2, p. 22)
- **Smart Cities (§2.4.3, p. 23):** Smart cities use computer and communication technology along with IoT and WoT to manage and distribute resources efficiently. Smart buildings use sensors to detect earthquake tremors and warn nearby buildings; smart bridges use wireless sensors to detect loose bolts or cracks; smart tunnels detect leakage or congestion. All city spheres — transport, power, water, waste, law enforcement, health — work in unison using IoT infrastructure. (NCERT §2.4.3, p. 23)
- **Cloud Computing — overview (§2.5, p. 23–24):** Cloud computing is an emerging trend where computer-based services (software, hardware/servers, databases, storage) are delivered over the Internet, accessible from anywhere using any smart device. Resources are provided by cloud service providers on a pay-per-use basis. A user can run large applications or process large data without having the required hardware locally. India's government cloud initiative is 'GI Cloud' named 'MeghRaj'. (NCERT §2.5, p. 23–24)
- **Cloud Services — IaaS, PaaS, SaaS (§2.5.1, p. 24–25):** Three standard service models: (i) Infrastructure as a Service (IaaS) — provides computing infrastructure (servers, virtual machines, storage, networks) on demand; user deploys and executes

any software on it. (ii) Platform as a Service (PaaS) — provides a platform/ environment to develop, test, and deliver software applications; user controls the deployed application and its configuration. (iii) Software as a Service (SaaS) — provides on-demand access to application software (e.g., Google Docs, Microsoft Office 365, Dropbox); user need not worry about installation or configuration. (NCERT §2.5.1, p. 24–25)

- **Grid Computing (§2.6, p. 25–26):** A grid is a computer network of geographically dispersed and heterogeneous computational resources that creates a virtual supercomputer with enormous processing power and storage. Constituent resources are called nodes; they temporarily come together to solve a single large task. Grid can be of two types: (i) Data grid — manages large distributed data with multi-user access; (ii) CPU/Processor grid — processing is moved from one PC to another or a large task is divided into subtasks for parallel processing. Grid differs from IaaS cloud: in IaaS, a service provider rents infrastructure; in grid, multiple nodes join together to solve a common computational problem. The Globus toolkit is an open-source software used for building grids. (NCERT §2.6, p. 25–26)
- **Blockchains (§2.7, p. 26–28):** Blockchain technology works on the concept of a decentralised and shared database where each computer has a copy of the database. A block is a secured chunk of data (valid transaction); each block has a header visible to every node, while only the owner accesses private data. Blocks form a chain — the blockchain — that maintains an 'append only' open ledger updated only after all nodes authenticate the transaction. Security is ensured because all members keep a copy, making it impossible for a single member to alter data. Most popular application: digital currency. Also used in healthcare, land registration, voting systems, banking, media, telecom, and governance. (NCERT §2.7, p. 26–28)

2.2 Definitions to memorise

Term	Definition	Page
Emerging Trends	State-of-the-art technologies that gain popularity among users and persist over time, making a huge impact on digital economies	15
Artificial Intelligence (AI)	Endeavours to simulate the natural intelligence of human beings into machines, making them behave intelligently	16
Knowledge Base	A store of information consisting of facts, assumptions, and rules which an AI system can use for decision making	16
Machine Learning	A subsystem of AI wherein computers learn from data using statistical techniques without being explicitly programmed	16
Natural Language Processing (NLP)	Deals with interaction between humans and computers using human spoken languages	16
Virtual Reality (VR)		17

Term	Definition	Page
	A three-dimensional, computer-generated situation that simulates the real world, allowing user to interact with and explore that environment	
Augmented Reality (AR)	Superimposition of computer-generated perceptual information over existing physical surroundings, making the environment interactive and digitally manipulable	18
Robotics	An interdisciplinary branch of technology primarily concerned with the design, fabrication, operation, and application of robots	18
Humanoid	A robot that resembles a human	18
Big Data	Data sets of enormous volume and complexity that cannot be processed using traditional data processing tools	19
Veracity (Big Data)	Trustworthiness of data — refers to data being consistent, unbiased, and reliable	20
Data Analytics	Process of examining data sets to draw conclusions about the information they contain, with the aid of specialised systems and software	21
Internet of Things (IoT)	A network of devices with embedded hardware and software to communicate and exchange data with other devices on the same network	21
Web of Things (WoT)	Allows use of web services to connect anything in the physical world; provides a single interface for all IoT devices	22
Smart Sensor	A device that takes input from the physical environment, uses built-in computing resources to perform predefined functions, and processes data before passing it on	22
Cloud Computing	An emerging IT trend where computer-based services are delivered over the Internet, accessible from anywhere on a pay-per-use basis	23
IaaS	Infrastructure as a Service — cloud model providing computing infrastructure (servers, VMs, storage) on demand	24
PaaS	Platform as a Service — cloud model providing a platform/ environment to develop, test, and deliver software applications	25
SaaS	Software as a Service — cloud model providing on-demand access to application software via licensing or subscription	25
Grid Computing	A network of geographically dispersed heterogeneous computational resources that function as a virtual supercomputer to solve large computational tasks	25
Node (Grid)	A constituent resource in a grid network that temporarily joins to solve a single large task	26

Term	Definition	Page
Blockchain	A decentralised, shared database system where each computer holds a copy and an 'append only' open ledger is updated only after all nodes authenticate the transaction	26
Block	A secured chunk of data or valid transaction in a blockchain, containing a header visible to all nodes	27
MeghRaj	India's Government Cloud initiative ('GI Cloud')	24
Globus toolkit	Open-source software used to build computational grids	26
Sophia	Humanoid robot from Hanson Robotics using AI and facial recognition	19
Drone	An unmanned aircraft remotely or autonomously controlled using onboard sensors and GPS	19
Pandas	Python library used for data analytics	21
Accelerometer	Smart sensor that detects orientation in mobile phones	22
Gyroscope	Smart sensor that tracks rotation or twist in mobile phones	22
Smart City	Urban area using IoT/WoT to manage transport, power, water, waste, and law-enforcement infrastructure efficiently	23
Decentralised database	Database stored across many nodes rather than a single server — the model behind blockchain	26
Append-only ledger	Ledger where new records can only be added (never edited or deleted), authenticated by all nodes	27
Pay-per-use	Cloud billing model where users pay only for the resources consumed	24

2.3 Diagrams / processes to remember

- **Figure 2.1 (p. 17):** Use of Natural Language Processing — shows NLP enabling voice-to-text and text-to-speech interactions between humans and computers.
- **Figure 2.8 (p. 19):** Sources of Big Data — pie/clock infographic showing data generated every 60 seconds (e.g., 204 million emails, 2.78 million video views, 2.4 million Google searches). Reinforces the Volume and Velocity characteristics.
- **Figure 2.9 (p. 20):** Five characteristics (5 Vs) of Big Data — Venn-style diagram with Volume, Velocity, Variety, Veracity, and Value surrounding the "BIG DATA" label. Memorise all five V-names and their meanings.
- **Figure 2.10 (p. 21):** Internet of Things — shows diverse devices (appliances, vehicles, wearables, phones) connected through a central IoT cloud hub.
- **Figure 2.12 (p. 24):** Cloud Computing Services — three-layer diagram showing IaaS at the bottom, PaaS in the middle, and SaaS at the top, accessed by laptops, phones, desktops, and tablets.

- **Figure 2.13 (p. 26):** Grid Computing — shows users sharing their resources managed by a Grid Resource Management System.
- **Figure 2.14 (p. 27):** Blockchain technology flow — (1) Someone requests a transaction → (2) Request broadcast to all nodes → (3) If verified, block added to chain → (4) Transaction complete.

2.4 Common confusions / NTA trap points

- **VR vs. AR:** VR creates an entirely new computer-generated environment (user is immersed in it); AR superimposes digital information on the real physical world (it alters/augments the real world, does not replace it). NTA often swaps definitions in options.
- **Cloud vs. Grid:** Cloud computing is service-oriented (a provider rents infrastructure/platform/software to users); Grid computing is application-specific and resource-sharing (multiple heterogeneous nodes join temporarily to solve one large computational task). The IaaS model is the cloud model most similar to grid — NTA uses this to create confusing distractors.
- **IoT vs. WoT:** IoT is the network of devices with embedded hardware/software communicating with each other; WoT specifically uses web services as the integration layer, providing a single interface to manage all IoT devices. WoT is a subset/evolution of IoT, not a replacement.
- **5 Vs of Big Data — Veracity vs. Value:** Students confuse Veracity (trustworthiness/reliability of data) with Value (business usefulness of patterns in data). NTA frequently asks which V refers to accuracy or reliability — the answer is Veracity, not Value.
- **IaaS vs. PaaS vs. SaaS scope (NCERT §2.5.1, p. 24-25).** IaaS gives the most control (raw infrastructure); PaaS gives control over the deployed application and configuration but abstracts infrastructure; SaaS gives the least control. NTA may ask "who manages hardware" — for SaaS/PaaS the provider does; for IaaS the user configures but still relies on the provider's physical infrastructure.
- **2.5 quintillion bytes/day, not gigabytes (NCERT §2.3, p. 19).** NTA distractor: claims a much smaller number.
- **Blockchain is decentralised, NOT centralised (NCERT §2.7, p. 26).** Each node holds a copy; no single member can alter it. NTA distractor: claims blockchain has a master server.
- **MeghRaj is Government of India cloud, not a private vendor (NCERT §2.5, p. 24).**
- **Big Data tools differ from traditional DBMS (NCERT §2.3, p. 19).** Traditional DBMS cannot handle Volume + Variety + Velocity at the same time. NTA may suggest Excel can process Big Data — false.

- **Pandas is for analytics, not ML training per se (NCERT §2.3.2, p. 21).** Although the line blurs, NCERT lists Pandas specifically as a data-analytics simplification library.
- **WoT solves the "n apps for n devices" problem (NCERT §2.4.1, p. 22).** It provides a single interface for all IoT devices.

🎯 Practice MCQs

📊 PYQ Alignment

Emerging Trends is one of the highest-yield areas for CUET Computer Science/ Informatics Practices, with questions appearing every year on the definitions and characteristics of AI subfields, the 5 Vs of Big Data, cloud service models (IaaS/PaaS/ SaaS distinctions), and the difference between IoT and WoT; NTA particularly favours match-the-following and statement-based questions that exploit the paired concepts (VR vs. AR, Cloud vs. Grid, Veracity vs. Value). See PYQ archive for Computer Science.