

COURSE ON COMPUTER CONCEPTS
**OVERVIEW OF FUTURE SKILLS AND
ARTIFICIAL INTELLIGENCE**

Topics Covered:

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10.0	Introduction to Future Skills	10.5	Goals of Artificial Intelligence
10.1	Introduction to Emerging Technologies	10.6	Ethics of Artificial Intelligence
10.1.1	Internet of Things (IoT)	10.7	Advantages of Artificial Intelligence
10.1.2	Big Data Analytics	10.8	Disadvantages of Artificial Intelligence
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SECTION 1: INTRODUCTION TO FUTURE SKILLS

10.0 Introduction to Future Skills

Future skills are the knowledge, abilities and attitudes that people need to learn, work and live successfully in a world that is rapidly changing because of technology such as the Internet, automation, data and Artificial Intelligence (AI).

Technology changes jobs very fast. Some routine jobs are being done by machines and software, while new jobs such as data analyst, AI engineer, cloud engineer, cyber-security expert, drone operator and digital marketer are growing. This new stage of industry, based on smart machines, connected devices and data, is called **Industry 4.0** (the Fourth Industrial Revolution). To stay employable, everyone needs **lifelong learning** — keep learning new skills throughout life.

Industrial Revolution	Period	Main Technology
First	Late 1700s	Steam engine, mechanization
Second	Late 1800s	Electricity, assembly line, mass production
Third	1970s onwards	Computers, electronics, automation, Internet
Fourth (Industry 4.0)	Today	AI, IoT, Big Data, cloud, robotics, blockchain, 3D printing

Important Future Skills

Skill Group	Skills	Why Needed
Digital skills	Computer and mobile use, Internet, e-mail, digital payments, cyber safety	Basic requirement for study, work and services
Data and AI literacy	Understanding data, charts, spreadsheets, how AI works and how to use AI tools wisely (writing good prompts)	Most jobs now use data and AI tools
Technical skills	Programming basics, cloud, IoT, cyber security, robotics, automation	Needed for technology jobs
Thinking skills	Critical thinking, problem solving, analytical thinking, creativity	Machines are weak at judgement and original ideas
Social skills	Communication, teamwork, leadership, empathy (emotional intelligence)	People work with people
Personal skills	Adaptability, resilience, time management, curiosity, ethics, lifelong learning	To handle change and keep growing

- According to the World Economic Forum's *Future of Jobs* reports, analytical thinking, creative thinking, resilience/flexibility and AI & big data skills are among the most important and fast-growing skills.
- In India, programmes such as **Skill India**, **FutureSkills PRIME** (MeitY–NASSCOM), **PMKVY** and the **IndiaAI Mission** help people to learn digital and future skills.

Memory Trick: Future skills = Digital skills + Data/AI skills + Thinking skills + Social skills + Lifelong learning.

SECTION 2: INTRODUCTION TO EMERGING TECHNOLOGIES

10.1 Introduction to Emerging Technologies

Emerging technologies are new and fast-growing technologies that are changing the way we live and work. The main ones are IoT, Big Data, Cloud, Virtual Reality, Artificial Intelligence, Social & Mobile, Blockchain, 3D Printing and Robotic Process Automation. They often work together — for example, IoT devices produce Big Data, which is stored on the Cloud and analysed by AI.

10.1.1 Internet of Things (IoT)

*The Internet of Things (IoT) is a network of physical objects ("things") — such as home appliances, vehicles, machines and wearable devices — that have **sensors, software and Internet connectivity**, so that they can collect and exchange data and be monitored or controlled remotely. The term was coined by **Kevin Ashton** in 1999.*

Component	Function
Sensors / Devices	Collect data from the surroundings — temperature, motion, light, soil moisture, heart rate, location
Connectivity	Send the data using Wi-Fi, Bluetooth, mobile network (4G/5G), RFID, LoRa
Data processing	Data is processed on the cloud or an edge device; AI can analyse it
User interface	Mobile app or dashboard to see the data and control the device

Area	IoT Examples
Smart home	Smart bulbs, smart plugs, CCTV, voice assistants (Alexa, Google Nest), smart AC and door locks
Wearables / Health	Smart watches, fitness bands, remote patient monitoring
Agriculture	Soil moisture sensors, automatic irrigation, drones for crop monitoring
Smart city / Transport	Smart street lights, traffic control, connected vehicles, FASTag, smart parking
Industry	Machine sensors for predictive maintenance, tracking of goods (supply chain)
Energy	Smart electricity meters

- **Advantages:** automation and convenience, saves energy and cost, real-time monitoring, better decisions with data.
- **Challenges:** security and privacy (devices can be hacked), need of Internet, cost, and compatibility of devices.

10.1.2 Big Data Analytics

*Big Data means extremely large and complex collections of data that cannot be stored or processed by ordinary software. **Big Data Analytics** is the process of examining such data to find patterns, trends and useful information for better decisions. Data is produced by social media, sensors, online shopping, banking, GPS, videos and more.*

V of Big Data	Meaning
Volume	Very large amount of data — terabytes, petabytes, exabytes, zettabytes
Velocity	Speed at which data is created and processed (e.g., live social media posts)
Variety	Different types — structured (tables), semi-structured (XML/JSON), unstructured (text, images, audio, video)
Veracity	Accuracy and trustworthiness of data
Value	Useful benefit that can be taken from the data

Type of Analytics	Question Answered	Example
Descriptive	What happened?	Monthly sales report
Diagnostic	Why did it happen?	Why did sales fall in July?
Predictive	What is likely to happen?	Forecasting next month's demand

Type of Analytics	Question Answered	Example
Prescriptive	What should we do?	Suggest the best price or route

- **Tools / technologies:** Hadoop, Apache Spark, NoSQL databases (MongoDB), Tableau, Power BI, Python and R.
- **Uses:** product recommendations (Amazon, Netflix), fraud detection in banks, traffic prediction, weather forecasting, health research, targeted advertising, election and market research.

10.1.3 Cloud Computing

*Cloud computing is the delivery of computing services — servers, storage, databases, software, networking and analytics — over the **Internet ("the cloud")** on demand and with **pay-as-you-use** pricing, instead of owning and maintaining one's own computers and data centre.*

Service Model	Meaning	Example
IaaS — Infrastructure as a Service	Virtual servers, storage and networks are rented	Amazon EC2, Microsoft Azure VMs, Google Compute Engine
PaaS — Platform as a Service	Platform for developers to build and run applications	Google App Engine, Azure App Service
SaaS — Software as a Service	Ready-made software used through a browser/app	Gmail, Google Docs, Microsoft 365, Zoom

Deployment Model	Meaning
Public cloud	Services shared by many users over the Internet (AWS, Microsoft Azure, Google Cloud)
Private cloud	Used by a single organization; more control and security
Hybrid cloud	Combination of public and private cloud
Community cloud	Shared by organizations having a common purpose (e.g., government departments)

- **Advantages:** low initial cost, anytime-anywhere access, easy scaling up/down, automatic backup and updates, easy sharing and teamwork.
- **Disadvantages:** needs Internet, data security and privacy concerns, dependence on the provider.
- **Examples in daily life:** Google Drive, OneDrive, iCloud, DigiLocker, online video streaming, UPI apps. The Government of India has its own cloud initiative called **MeghRaj**.

10.1.4 Virtual Reality

Virtual Reality (VR) is a computer-generated 3D environment in which the user feels present and can interact with objects, usually by wearing a VR headset and using hand controllers. It completely replaces the real world with a simulated world.

Technology	Meaning	Example
VR — Virtual Reality	Fully virtual world; real world is blocked out	VR games, virtual classroom, flight simulator (Meta Quest, HTC Vive)
AR — Augmented Reality	Digital objects/information added on top of the real world seen through the camera	Pokémon GO, Google Lens, furniture preview apps, face filters
MR — Mixed Reality	Virtual objects interact with the real world	Microsoft HoloLens, Apple Vision Pro (spatial computing)

- **Devices:** head-mounted display (headset), motion sensors, hand controllers, headphones, powerful computer/phone.
- **Uses:** gaming and entertainment, education and virtual labs, medical training and surgery practice, pilot and army training, virtual tours of tourist places and real estate, designing and architecture.
- **Issues:** costly equipment, motion sickness/eye strain, health and privacy concerns.

10.1.5 Artificial Intelligence

Artificial Intelligence (AI) is the ability of a computer or machine to perform tasks that normally need human intelligence — such as learning, reasoning, understanding language, recognizing images and making decisions. It is explained in detail from section 10.2 onwards.

- AI is the "brain" behind many other emerging technologies: IoT devices become smart, Big Data is analysed, robots become intelligent and cloud platforms offer AI services.
- Examples in daily life: voice assistants, face unlock, Google Maps traffic prediction, YouTube/Netflix recommendations, spam filters, chatbots and translation apps.

10.1.6 Social & Mobile

Social technologies (social media, networking sites, blogs, messaging apps) let people create and share content and connect online. **Mobile technologies** (smartphones, tablets, apps, 4G/5G, mobile payments) provide computing and Internet access anywhere. Together with **Analytics** (Big Data) and **Cloud** they form **SMAC** — a group of technologies that are changing business and society.

Letter	Technology	Role
S	Social	Connect with customers and people, share opinions and feedback (Facebook, Instagram, LinkedIn, X, WhatsApp, YouTube)
M	Mobile	Anywhere access through smartphones and apps; m-commerce, mobile banking, UPI, e-governance apps
A	Analytics	Turning the data produced on social and mobile platforms into useful information
C	Cloud	Stores the data and runs the applications for all these services

- **Mobile trends:** 5G networks, mobile-first services, wearable devices, mobile wallets and digital payments, on-device AI features (voice assistants, camera enhancement, translation).
- **Social media uses:** communication, marketing and branding, customer service, education, awareness campaigns, jobs (LinkedIn). **Risks:** fake news, cyberbullying, privacy and addiction.

10.1.7 Blockchain Technology

A **blockchain** is a digital ledger (record book) of transactions that is shared among many computers in a network. Records are stored in **blocks**; each block is linked to the previous block with a cryptographic code called a **hash**, forming a chain. Once a record is added it is practically impossible to change or delete it, and no single person or bank controls the data.

Part of a Block	Meaning
Data	Transactions or records (e.g., who paid whom and how much)
Hash	Unique digital fingerprint of the block calculated from its data
Previous hash	Hash of the previous block — this links the blocks together
Timestamp	Date and time when the block was created
Nonce	A number used in mining (in proof-of-work blockchains)

Feature	Meaning
Decentralized	Data is stored on many computers (nodes), not on one central server
Transparent	Participants can verify the transactions
Immutable	Recorded data cannot be altered easily — changing one block breaks the chain
Secure	Uses cryptography and consensus (agreement) of the network
Smart contracts	Self-executing programs on the blockchain that run when conditions are met (e.g., Ethereum)

- **History:** the idea of blockchain was introduced with **Bitcoin** (2009) by the pseudonymous **Satoshi Nakamoto**. Other examples: Ethereum, Polygon.
- **Uses:** cryptocurrencies, digital certificates and degree verification, land and property records, supply-chain tracking, healthcare records, secure voting, banking and cross-border payments. The RBI's digital rupee (₹) pilot also uses distributed ledger technology.
- **Limits:** high energy use in some systems (proof-of-work), slow speed and scalability, legal/regulatory uncertainty, and cryptocurrency price risk — investment in crypto assets is risky and taxed in India.

10.1.8 3D Printing / Additive Manufacturing

3D printing (additive manufacturing) is a process of making a three-dimensional solid object from a digital 3D model by adding material **layer by layer**. Traditional (subtractive) manufacturing, in contrast, cuts or drills material away from a block.

How 3D printing works

Step	Action
1. Design	Create a 3D model with CAD software (Tinkercad, Fusion 360, Blender) or scan an object
2. Slicing	Convert the model (STL file) into thin horizontal layers using slicer software; it creates the G-code for the printer
3. Printing	The printer deposits/hardens the material layer by layer (nozzle, laser or light)
4. Finishing	Remove support structures, sand, polish or paint

Technology	Working	Materials
FDM (Fused Deposition Modeling)	Melts plastic filament and extrudes it layer by layer	PLA, ABS, PETG
SLA (Stereolithography)	Laser/light hardens liquid resin	Photopolymer resin
SLS / Metal printing	Laser fuses powder	Nylon powder, metals (titanium, steel)
Construction 3D printing	Large printer deposits concrete	Concrete mix

- **Uses:** prototypes, spare parts, medical implants, dental aligners and prosthetics, jewellery, education, aerospace, 3D-printed houses and buildings (India's first 3D-printed post office was built in Bengaluru in 2023).

- **Advantages:** rapid prototyping, customized products, less material waste, complex shapes, lower cost for small batches.
- **Disadvantages:** slow for mass production, limited material strength/size, cost of machines, misuse risk (for example printing of unsafe items).

10.1.9 Robotic Process Automation (RPA)

*Robotic Process Automation (RPA) is a technology that uses software "bots" to copy the actions a human performs on a computer — clicking, typing, copying and pasting data, filling forms, reading e-mails — to automate **repetitive, rule-based** office tasks. These bots are software, not physical robots.*

Basis	RPA	AI
Purpose	Follows fixed rules to do repetitive tasks	Learns from data and makes decisions
Data	Structured data and fixed steps	Structured and unstructured data
Thinking	No thinking — does exactly what it is programmed to do	Can learn, predict and adapt
Example	Copy invoice data from e-mail to accounts software	Chatbot that understands a customer's query

- **Popular tools:** UiPath, Automation Anywhere, Blue Prism, Microsoft Power Automate.
- **Uses:** data entry, invoice and bill processing, bank KYC checking, payroll and HR onboarding, report generation, insurance claim processing, customer-service ticket handling.
- **Benefits:** fast and accurate, works 24 × 7, reduces cost and human errors, frees people for creative work.
Limits: works only on rule-based tasks, bots break when the screen/process changes, may reduce routine jobs. RPA combined with AI is called **Intelligent Automation**.

Summary of Emerging Technologies

Technology	One-line Meaning	Example
IoT	Connected objects with sensors	Smart watch, smart bulb
Big Data	Huge data analysed for insights	Netflix recommendations
Cloud	Computing services over the Internet	Google Drive, AWS
VR / AR	Virtual / augmented 3D experience	Meta Quest, Pokémon GO
AI	Machines that act intelligently	ChatGPT, Google Assistant
Social & Mobile	Connected people and anywhere access	WhatsApp, UPI apps
Blockchain	Tamper-proof shared ledger	Bitcoin, Ethereum
3D Printing	Objects made layer by layer	Prosthetics, prototypes
RPA	Software bots automating routine tasks	Invoice processing

SECTION 3: ARTIFICIAL INTELLIGENCE

10.2 What is Artificial Intelligence (AI)?

*Artificial Intelligence (AI) is the branch of computer science that makes computers and machines **think, learn and act like human beings**. An AI system can perceive its environment, process data, learn from experience, solve problems and make decisions. The term was coined by **John McCarthy**, who is called the "Father of AI", in 1956.*

- **Artificial** = made by humans; **Intelligence** = ability to learn, understand, reason and solve problems.
- AI systems are built using **algorithms** (step-by-step instructions), **data** and powerful **computing power** (CPU/GPU). A trained AI system is called a **model**.
- AI does not "think" like a human or have feelings; it finds patterns in data and gives results based on that.

Basis	Traditional Program	AI System
Working	Programmer writes exact rules	System learns rules/patterns from data
Output	Same output for same input	Can improve with more data and may give different answers
Example	Calculator, payroll program	Face recognition, chatbot, self-driving car

How does AI work? (simple steps)

Step	Description
1. Data collection	Large amounts of data (text, images, sound, numbers) are collected
2. Training	An algorithm learns patterns from the data (e.g., photos labelled "cat")
3. Model	The trained system (model) is created
4. Testing	The model is tested on new data and improved
5. Use (inference)	The model gives the answer or prediction for new input

10.3 History of Artificial Intelligence

Year	Event
1943	Warren McCulloch and Walter Pitts proposed the first mathematical model of an artificial neuron
1950	Alan Turing published "Computing Machinery and Intelligence" and proposed the Turing Test — can a machine converse so that a human cannot tell it is a machine?
1956	Dartmouth Conference — John McCarthy coined the term "Artificial Intelligence"; birth of AI as a field
1958	John McCarthy created the LISP language for AI
1966	ELIZA — first chatbot, by Joseph Weizenbaum
1970s	First AI winter — less funding because expectations were not met
1980s	Expert systems became popular in industry; later a second AI winter
1997	IBM Deep Blue defeated world chess champion Garry Kasparov
2011	IBM Watson won the quiz show Jeopardy!; Apple introduced Siri
2012	Deep learning breakthrough (AlexNet) in image recognition
2016	DeepMind's AlphaGo defeated Go champion Lee Sedol
2017	"Transformer" architecture introduced — base of modern language models
2022	ChatGPT released (30 November 2022) — generative AI became popular with the public
2023–25	Many AI assistants and multimodal models (text, image, voice, video), AI agents and AI in smartphones and search; India approved the IndiaAI Mission (2024)
2026	India hosted the AI Impact Summit in New Delhi (February 2026)

10.4 Why Artificial Intelligence?

- **To handle huge data** — humans cannot analyse the enormous data produced today; AI finds patterns quickly.
- **To automate repetitive work** — saves time and effort of people for creative work.
- **To work with high accuracy and speed** — 24 × 7 without tiredness (e.g., scanning medical images).
- **To do dangerous or difficult jobs** — mines, deep sea, space exploration, bomb disposal, firefighting.
- **To make better decisions** — predictions about weather, crops, traffic, diseases and markets.
- **To provide personal services** — recommendations, virtual assistants, personalized learning.
- **To solve complex problems** — drug discovery, climate modelling, protein structure prediction.
- **To make services available to all** — language translation, voice interfaces for people who cannot read or write, tools for disabled persons.

10.5 Goals of Artificial Intelligence

Goal	Description
Reasoning and Problem solving	Make machines solve problems and make logical decisions
Knowledge representation	Store knowledge about the world in a form the computer can use
Planning	Decide the best sequence of actions to reach a goal (e.g., route planning)
Learning	Machines learn from data and experience and improve (Machine Learning)
Natural Language Processing	Understand, speak and write human languages
Perception	Understand images, video, sound and sensor data (vision, speech recognition)
Motion and manipulation (Robotics)	Move, grasp and work in the physical world
Creativity	Generate new text, images, music, code and designs (Generative AI)
General intelligence	Long-term goal — a machine with human-like ability in all tasks (AGI)

- **Main aim:** to create systems that can work intelligently and independently, to help humans and to improve human life.

10.6 Ethics of Artificial Intelligence

AI ethics is the set of moral principles and guidelines for designing and using AI in a way that is fair, safe, transparent and beneficial to people and society.

Ethical Issue	Meaning	Example
Bias and fairness	AI trained on biased data gives unfair results for some groups	Hiring AI that prefers one gender
Privacy	AI collects and uses personal data; data must be protected and used with consent	Face recognition and tracking without permission
Transparency / Explainability	People should know how and why AI took a decision	Why a loan application was rejected
Accountability	Humans/companies remain responsible for the actions of AI	Who is responsible if a self-driving car causes an accident
Safety and security	AI must be reliable and safe from misuse and hacking	Cyber-attacks using AI, weapons
Misinformation and deepfakes	AI can create fake news, images, voice and videos	Fake video of a leader
Jobs and inequality	Automation may replace some jobs; need reskilling	Routine clerical work
Intellectual property	Questions on copyright of data used for training and content created by AI	AI-generated art and text
Human control	Important decisions should have human oversight	AI in courts, hospitals, defence
Environment	Training large AI models uses much electricity and water	Data centres

Principles of Responsible AI

- NITI Aayog's "Responsible AI for All" (India) lists principles such as safety and reliability, equality, inclusivity and non-discrimination, privacy and security, transparency, accountability and protection of positive human values.
- India's **AI Governance Guidelines** (2025, under the IndiaAI Mission) promote safe, inclusive and responsible AI; the **Digital Personal Data Protection Act, 2023** protects personal data. Globally, UNESCO has a Recommendation on the Ethics of AI (2021) and the European Union has the **EU AI Act**, which regulates AI according to risk.
- **Good practices for users:** check AI answers for mistakes, do not share personal or confidential data with AI tools, do not use AI to cheat or create fake content, give credit to sources, and follow the rules of your school/organization.

10.7 Advantages of Artificial Intelligence

- **Reduces human error** — consistent and accurate when trained well.
- **Works 24 × 7** without rest, boredom or fatigue (chatbots, monitoring systems).
- **Fast processing** of huge data and quick decisions.
- **Automation of repetitive tasks** — saves time and cost; people can do creative work.
- **Takes risks instead of humans** — bomb disposal, mining, space and deep-sea exploration.
- **New inventions and discoveries** — drug discovery, climate and science research.
- **Personalization** — suggestions in shopping, learning, music and video.
- **Better services** — healthcare diagnosis, farming advice, banking fraud detection, translation and accessibility for disabled people.
- **Creates new jobs** — AI engineer, data scientist, prompt engineer, AI ethicist.

10.8 Disadvantages of Artificial Intelligence

- **Job loss** in routine and repetitive work; reskilling is needed.
- **High cost** of development, powerful computers and data centres.
- **No emotions or common sense** — AI cannot truly understand feelings or context and can make absurd mistakes ("hallucinations" in generative AI).
- **Bias and unfair results** if the training data is biased.
- **Privacy risk** — misuse of personal data, surveillance.
- **Misuse** — deepfakes, scams, cyber-attacks, fake news, autonomous weapons.
- **Dependence** on machines may reduce human thinking, skills and creativity.
- **Needs lots of data and electricity**; lack of transparency in how decisions are taken ("black box").
- **Legal and ethical issues** — responsibility and copyright are not always clear.

Advantages	Disadvantages
Accuracy, speed, 24 × 7 work	Job displacement
Automation of dull tasks	High cost; needs data and power
Helps in risky jobs	No emotions/common sense; can be wrong
Better healthcare, farming, education	Bias, privacy and security risks
New jobs and innovation	Misuse such as deepfakes and cybercrime

10.9 Application of AI

Sector	Applications of AI
Healthcare	Disease detection from X-ray/MRI/CT scans, drug discovery, robot-assisted surgery, health chatbots, personalized treatment, wearable monitoring
Education	Personalized learning, AI tutors, automatic grading, translation, accessible learning for disabled students
Agriculture	Crop disease detection, weather and yield prediction, drones, smart irrigation, mandi price advice
Banking & Finance	Fraud detection, credit scoring, chatbots, algorithmic trading, KYC, insurance claim checks
E-commerce & Retail	Product recommendation, price optimization, chatbots, visual search, demand forecasting
Transport	Self-driving and driver-assistance cars, traffic management, route planning (Google Maps), airline pricing, drones
Manufacturing	Smart robots, quality inspection with cameras, predictive maintenance
Entertainment & Media	Recommendations on YouTube/Netflix/Spotify, game characters, AI-generated music, images and video, subtitles
Government & Security	Face recognition, traffic challans, e-governance chatbots, crime analysis, speech/language services (Bhashini), disaster prediction
Daily life	Voice assistants (Siri, Alexa, Google Assistant), face/fingerprint unlock, spam filters, smart home, translation apps, photo enhancement
Space & Defence	Satellite image analysis, rover navigation, surveillance, drones

10.10 Types of Artificial Intelligence

A. Based on Capability

Type	Meaning	Status / Example
Narrow AI (ANI) — Weak AI	Designed for one specific task only; cannot do other tasks	All AI today — face recognition, voice assistants, chess programs, recommendation systems, chatbots
General AI (AGI) — Strong AI	Machine with human-level intelligence able to learn and perform any intellectual task	Hypothetical; still a research goal
Super AI (ASI)	AI that becomes more intelligent than humans in every field	Hypothetical; only in science fiction/discussion

B. Based on Functionality

Type	Meaning	Example
Reactive Machines	No memory; reacts only to the present input	IBM Deep Blue, spam filter
Limited Memory	Uses past data for a short time to decide	Self-driving cars, chatbots, recommendation systems
Theory of Mind	Would understand human emotions, beliefs and intentions	Future research; not yet achieved
Self-aware AI	Would have consciousness and self-awareness	Hypothetical

Exam Tip: Today's AI = Narrow AI with Reactive / Limited Memory. AGI, Super AI, Theory of Mind and Self-aware AI do not exist yet.

10.11 Subsets of Artificial Intelligence

*AI is a broad field. Machine Learning (ML) is a subset of AI, Deep Learning (DL) is a subset of ML, and Generative AI is built mostly with deep learning — like circles inside circles: **AI $\supset$ ML $\supset$ DL $\supset$ Generative AI**.*

Subset	Meaning	Examples
Machine Learning (ML)	Computers learn from data and improve without being explicitly programmed	Spam filter, loan scoring, movie recommendations
Deep Learning (DL)	ML using artificial neural networks with many layers; needs large data and GPUs	Face recognition, speech recognition, self-driving
Natural Language Processing (NLP)	Understanding and generating human language	Chatbots, translation, voice assistants, sentiment analysis
Computer Vision	Understanding images and videos	Face unlock, medical imaging, number-plate reading
Speech Recognition	Converting speech to text and text to speech	Siri, Google Assistant, voice typing
Robotics	Intelligent machines that sense and act in the physical world	Warehouse robots, robot vacuum cleaners, surgical robots
Expert Systems	Programs that copy the decision-making of a human expert using rules	Medical diagnosis systems, troubleshooting
Generative AI	Creates new content — text, images, audio, video, code	ChatGPT, Gemini, Claude, Copilot, image generators

Types of Machine Learning

Type	How it learns	Example
Supervised learning	From labelled data (input with the correct answer)	Predicting house price, email spam/not spam
Unsupervised learning	Finds hidden groups/patterns in unlabelled data	Grouping customers by buying behaviour

Type	How it learns	Example
Reinforcement learning	Learns by trial and error with rewards and penalties	Game-playing AI (AlphaGo), robots, self-driving training

Neural Network (Deep Learning) in brief

- An **artificial neural network** is inspired by neurons of the human brain. It has an **input layer**, one or more **hidden layers** and an **output layer**. Connections between neurons have **weights** which are adjusted during training.
- **Large Language Models (LLMs)** are deep-learning models trained on huge amounts of text to understand and generate language; they power AI chatbots.

10.12 Future of Artificial Intelligence

- **More powerful and multimodal AI** — systems that understand and create text, images, audio, video and code together.
- **AI agents** — AI that can plan and carry out multi-step tasks (booking, research, coding, customer support) with human supervision.
- **AI everywhere** — in phones, laptops, cars, appliances and robots (on-device / edge AI) and personal AI assistants for everyone, in local languages.
- **Healthcare and science** — faster drug discovery, early disease detection, personalized medicine, climate and materials research.
- **Smart cities, farming and education** — traffic, energy and waste management, precision farming, personalised education for each learner.
- **Robotics and autonomous vehicles** — humanoid and service robots, self-driving taxis and drones.
- **Regulation and responsible AI** — more laws and standards on safety, privacy, transparency and copyright.
- **Job changes** — many tasks will be automated and new jobs will be created; people who learn to work with AI will have an advantage.
- **Research goals** — more efficient and less energy-hungry models, explainable AI, and the long-term question of AGI (it is uncertain when or if it will be achieved).

10.13 Artificial Intelligence (AI) at Present

Today AI is a part of everyday life and business. Most present AI is **Narrow AI**, and the biggest change in recent years is **Generative AI** — systems that create text, images, audio, video and code from a simple instruction (prompt).

Area	Present Status
Generative AI & chatbots	AI assistants such as ChatGPT, Google Gemini, Microsoft Copilot, Claude and Meta AI are used by crores of people for writing, studying, coding, translation and research
Smartphones & daily life	AI in camera, voice assistants, keyboards, search, photo editing, live translation and recommendations
Business	Customer-care chatbots, document processing, marketing, software development, analytics and automation (RPA + AI)
Healthcare	AI-assisted scan reading, drug discovery, hospital management
Transport	Driver-assistance in cars; robotaxi services running in some cities of the world
Hardware	High-performance chips (GPUs, AI accelerators) and large data centres are used to train and run AI models
Government in India	IndiaAI Mission (approved in 2024 with a budget of ₹10,371 crore over five years) for computing power, datasets, Indian-language models, startups and skilling; Bhashini for language translation; India AI Governance Guidelines (2025); India AI Impact Summit held in New Delhi in February 2026
Regulation	The EU AI Act, India's AI Governance Guidelines, data protection laws and global AI summits are shaping the rules

Present challenges

- **Hallucinations** — AI sometimes gives confident but wrong answers, so facts must be verified.
- **Deepfakes, scams and misinformation**, bias, privacy and copyright issues.
- High **energy and water use** of data centres, and the need for skilled people.

Note: Details of AI tools and policies change very fast. Use the latest news and official sources for the newest information.

10.14 Myths about Advanced Artificial Intelligence

Myth	Reality
AI will take over the world and control humans.	Present AI is narrow and has no goals or desires of its own. Risks come mainly from misuse and poor design, so safety rules and human control are needed.

Myth	Reality
AI is conscious and has feelings.	AI only processes data and patterns; it has no consciousness or emotions, even if it sounds human.
AI will replace all jobs.	AI will automate many tasks and change jobs, but also create new jobs; skills like creativity, judgement and empathy remain valuable.
AI is always correct and unbiased.	AI makes mistakes and can be biased because of its training data. Outputs must be checked by humans.
AI is the same as robots.	Robots are machines; AI is the intelligence (software). Most AI (like a chatbot) has no body at all.
AI learns by itself without humans.	AI needs data, algorithms, computing power and human design, training and supervision.
Only big companies or scientists can use AI.	Many AI tools are available free or at low cost for students and small businesses.
AI is a brand-new invention.	AI research began in the 1950s; recent progress is because of big data, powerful chips and better algorithms.
General AI (AGI) or super-intelligence is just around the corner.	AGI does not exist today and experts disagree on when (or whether) it will come.

10.15 Future Impact of AI in Different Sectors

Sector	Future Impact
Healthcare	Early detection of diseases, personalized medicine, AI doctors' assistants, telemedicine in villages, faster discovery of medicines and vaccines
Education	Personal AI tutor for every student in own language, adaptive learning, automatic evaluation, teachers get more time for mentoring
Agriculture	Precision farming, better yield and price forecasting, early pest/disease warning, smart irrigation, drones
Banking & Finance	Stronger fraud and risk detection, personalized financial advice, faster loans, AI customer service
Transport & Smart cities	Self-driving vehicles, intelligent traffic and public transport, drone delivery, energy-efficient smart cities
Manufacturing & Industry	Smart factories with robots and predictive maintenance, customized products, safer workplaces
Government & Public services	Faster, multilingual e-governance, better disaster management, targeted welfare, smart policing and planning
Jobs & Economy	Productivity growth; new roles such as AI engineer, data scientist, AI ethicist; need for reskilling and lifelong learning
Environment & Energy	Climate prediction, smart grids, wildlife protection, waste and water management
Entertainment & Media	AI-created music, films, games and personalized content; issues of copyright and deepfakes
Defence & Security	Smarter surveillance and cyber-defence, autonomous systems; need of strict ethical rules

- AI can be a powerful tool for the national vision of **Viksit Bharat** if it is developed responsibly, inclusively and with proper skilling of people.
- Everyone should learn **AI literacy**: how AI works, how to use it safely and how to question its results.

SECTION 4: SUMMARY

10.16 Summary

Future Skills and Emerging Technologies

- Future skills = digital, data/AI, technical, thinking, social and personal skills, plus lifelong learning (Industry 4.0).
- IoT = connected objects with sensors (Kevin Ashton, 1999). Big Data = 5 Vs: Volume, Velocity, Variety, Veracity, Value; analytics: descriptive, diagnostic, predictive, prescriptive.
- Cloud = computing services over the Internet; IaaS, PaaS, SaaS; public, private, hybrid. VR = fully virtual world; AR = digital over the real world.
- SMAC = Social, Mobile, Analytics, Cloud. Blockchain = tamper-proof distributed ledger of hash-linked blocks (Bitcoin, 2009).
- 3D printing = additive manufacturing (layer by layer from a CAD/STL model). RPA = software bots for repetitive rule-based tasks (UiPath).

Artificial Intelligence

- AI = making machines think, learn and act like humans; term coined by John McCarthy (1956). Turing Test (1950), Deep Blue (1997), AlphaGo (2016), ChatGPT (2022).
- Goals: reasoning, learning, planning, NLP, perception, robotics, creativity, general intelligence.
- Ethics: bias, privacy, transparency, accountability, safety, misinformation, jobs, copyright, environment.
- Advantages: accuracy, speed, 24 × 7, automation, safety in risky jobs. Disadvantages: job loss, cost, no emotions, bias, privacy and misuse.
- Types: Narrow (exists), General, Super; Reactive, Limited Memory, Theory of Mind, Self-aware. Subsets: ML, Deep Learning, NLP, Computer Vision, Robotics, Expert Systems, Generative AI.
- AI today = Narrow AI and generative AI; IndiaAI Mission supports AI in India. AI will transform healthcare, education, agriculture, finance, transport and governance; many myths (AI is conscious, takes all jobs, is always right) are false.

SECTION 5: MODEL QUESTIONS AND ANSWERS

10.17 Model Questions and Answers

These questions are commonly asked in exams. Correct answers are marked with ✓ and an explanation is provided.

Part A: Multiple Choice Questions (MCQs)

Q1. Future skills are:

- (a) Skills needed to work and succeed in a technology-driven future ✓
- (b) Only typing skills
- (c) Skills of old machines
- (d) Only physical strength

Explanation: Future skills include digital, data and AI literacy together with thinking, creative and social skills.

Q2. Which of the following is a human (soft) future skill?

- (a) Critical thinking and creativity ✓
- (b) Operating a typewriter
- (c) Memorizing tables only
- (d) Using a slide rule

Explanation: Critical thinking, creativity, communication and adaptability are key skills that machines cannot easily copy.

Q3. IoT stands for:

- (a) Internet of Things ✓
- (b) Input of Technology
- (c) Internet of Tools
- (d) Integration of Things

Explanation: IoT connects everyday objects having sensors and software to the Internet.

Q4. The term 'Internet of Things' was coined by:

- (a) Kevin Ashton ✓
- (b) Tim Berners-Lee
- (c) Alan Turing
- (d) Larry Page

Explanation: Kevin Ashton used the term IoT in 1999.

Q5. Which of these is an example of IoT?

- (a) Smart watch / smart bulb connected to the Internet ✓
- (b) A calculator
- (c) A ceiling fan with a regulator
- (d) A printed book

Explanation: A smart watch or smart bulb has sensors and connectivity, so it is an IoT device.

Q6. The 5 Vs of Big Data are Volume, Velocity, Variety, Veracity and:

- (a) Value ✓
- (b) Vision
- (c) Virus
- (d) Version

Explanation: The 5 Vs: Volume, Velocity, Variety, Veracity, Value.

Q7. Which tool/framework is associated with Big Data processing?

- (a) Hadoop ✓
- (b) Notepad
- (c) Paint
- (d) WordPad

Explanation: Hadoop and Spark are popular Big Data frameworks.

Q8. Predicting what is likely to happen in future from data is called:

- (a) Predictive analytics ✓
- (b) Descriptive analytics
- (c) Diagnostic analytics
- (d) Manual analytics

Explanation: Predictive analytics uses past data to forecast future trends.

Q9. Cloud computing means:

- (a) Using servers and services over the Internet ✓
- (b) Computing in the sky only
- (c) A new type of weather software
- (d) Using only a pen drive

Explanation: Cloud computing provides storage, software and computing power over the Internet on demand.

Q10. Google Docs is an example of which cloud service model?

- (a) SaaS ✓
- (b) IaaS
- (c) PaaS
- (d) None

Explanation: SaaS (Software as a Service) delivers software through a browser.

Q11. In which cloud model does a user get virtual servers and storage?

- (a) IaaS ✓
- (b) SaaS
- (c) PaaS
- (d) DaaS only

Explanation: IaaS = Infrastructure as a Service (e.g., virtual machines).

Q12. A cloud shared by many customers over the Internet is called a:

- (a) Public cloud ✓
- (b) Private cloud
- (c) Closed cloud
- (d) Local cloud

Explanation: Public cloud services (AWS, Azure, Google Cloud) are open to many users.

Q13. Virtual Reality (VR) creates:

- (a) A completely computer-generated environment ✓
- (b) Only a printed picture
- (c) Only an audio file
- (d) Only a text file

Explanation: VR places the user inside a simulated 3D world using a headset.

Q14. Which technology adds digital objects over the real world?

- (a) Augmented Reality (AR) ✓
- (b) Virtual Reality (VR)
- (c) Blockchain
- (d) 3D printing

Explanation: AR (e.g., Pokémon GO) overlays digital content on the real world seen through a camera.

Q15. SMAC stands for Social, Mobile, Analytics and:

- (a) Cloud ✓
- (b) Computer
- (c) Cable
- (d) Chip

Explanation: SMAC = Social, Mobile, Analytics, Cloud.

Q16. Blockchain is:

- (a) A distributed ledger of linked blocks ✓
- (b) A type of printer
- (c) A search engine
- (d) An antivirus

Explanation: A blockchain is a chain of blocks of records, shared across many computers and protected by cryptography.

Q17. Bitcoin was created in 2009 by:

- (a) Satoshi Nakamoto ✓
- (b) Mark Zuckerberg
- (c) Elon Musk
- (d) Bill Gates

Explanation: Bitcoin, the first cryptocurrency, was proposed by the pseudonymous Satoshi Nakamoto.

Q18. Which feature makes blockchain records difficult to change?

- (a) Hash linking of blocks and consensus ✓
- (b) Large font size
- (c) Colour of screen
- (d) Wi-Fi speed

Explanation: Each block stores the hash of the previous block; changing one block breaks the chain.

Q19. 3D printing is also known as:

- (a) Additive manufacturing ✓
- (b) Subtractive manufacturing
- (c) Photo printing
- (d) Screen printing

Explanation: In additive manufacturing objects are built layer by layer.

Q20. A 3D printer builds an object from a:

- (a) Digital 3D model (CAD file) ✓
- (b) Paper drawing only
- (c) Voice command only
- (d) Photograph only

Explanation: A CAD model is converted to an STL file and sliced into layers for printing.

Q21. RPA stands for:

- (a) Robotic Process Automation ✓
- (b) Random Program Access
- (c) Remote Printing Application
- (d) Real Process Analysis

Explanation: RPA uses software 'bots' to automate repetitive, rule-based computer tasks.

Q22. Which is an RPA tool?

- (a) UiPath ✓
- (b) Photoshop
- (c) Tally
- (d) VLC

Explanation: UiPath, Automation Anywhere, Blue Prism and Power Automate are RPA tools.

Q23. The term 'Artificial Intelligence' was coined by:

- (a) John McCarthy ✓
- (b) Alan Turing
- (c) Charles Babbage
- (d) Steve Jobs

Explanation: John McCarthy coined the term at the 1956 Dartmouth workshop.

Q24. The Turing Test was proposed by Alan Turing in:

- (a) 1950 ✓
- (b) 1850
- (c) 1990
- (d) 2010

Explanation: Alan Turing's paper 'Computing Machinery and Intelligence' (1950) proposed the test.

Q25. Which computer defeated world chess champion Garry Kasparov in 1997?

- (a) Deep Blue ✓
- (b) Watson
- (c) AlphaGo
- (d) Siri

Explanation: IBM's Deep Blue defeated Kasparov in 1997.

Q26. AlphaGo, which defeated a world champion of Go in 2016, was developed by:

- (a) DeepMind (Google) ✓
- (b) Apple
- (c) Intel
- (d) Tesla

Explanation: AlphaGo was developed by DeepMind.

Q27. ChatGPT was released to the public in:

- (a) November 2022 ✓
- (b) November 2002
- (c) March 1999
- (d) June 2030

Explanation: ChatGPT was released by OpenAI in November 2022, which made generative AI popular.

Q28. The AI that is designed for one specific task is called:

- (a) Narrow AI (ANI) ✓
- (b) General AI (AGI)
- (c) Super AI (ASI)
- (d) Self-aware AI

Explanation: Narrow AI performs a single task — e.g., face recognition, chess; all AI used today is narrow AI.

Q29. AI that would match human intelligence in every field is called:

- (a) Artificial General Intelligence (AGI) ✓**
- (b) Narrow AI
- (c) Reactive machine
- (d) Expert system

Explanation: AGI is a hypothetical AI with human-level ability across tasks.

Q30. Which of the following is a reactive machine?

- (a) IBM Deep Blue ✓**
- (b) Self-driving car
- (c) Siri
- (d) ChatGPT

Explanation: Reactive machines have no memory; they react to the present situation, like Deep Blue.

Q31. Machine Learning is a subset of:

- (a) Artificial Intelligence ✓**
- (b) Blockchain
- (c) 3D printing
- (d) Cloud only

Explanation: ML is a subset of AI in which computers learn from data without being explicitly programmed.

Q32. Deep Learning uses:

- (a) Multi-layer artificial neural networks ✓**
- (b) Only spreadsheets
- (c) Only databases
- (d) Only printers

Explanation: Deep learning is a subset of ML that uses neural networks with many layers.

Q33. Learning from labelled data is called:

- (a) Supervised learning ✓**
- (b) Unsupervised learning
- (c) Reinforcement learning
- (d) Manual learning

Explanation: In supervised learning the model learns from examples with correct answers (labels).

Q34. Which subset of AI deals with understanding human language?

- (a) Natural Language Processing (NLP) ✓**
- (b) Computer Vision
- (c) Robotics
- (d) Blockchain

Explanation: NLP helps computers understand and generate human language (translation, chatbots).

Q35. Which technology helps AI 'see' images and videos?

- (a) Computer Vision ✓**
- (b) NLP
- (c) RPA
- (d) IoT

Explanation: Computer vision is used in face recognition, medical image analysis and self-driving cars.

Q36. Unfair results in AI caused by biased training data are called:

- (a) Bias ✓**
- (b) Cloud
- (c) Speed
- (d) Bandwidth

Explanation: If the data is biased, the AI model can give unfair or discriminatory results.

Q37. A fake video/audio created with AI to look real is called a:

- (a) Deepfake ✓**
- (b) Hotfix
- (c) Firewall
- (d) Hashtag

Explanation: Deepfakes are AI-generated fake media and can be used for misinformation.

Q38. Which of the following is an advantage of AI?

- (a) Works 24 × 7 without tiredness ✓**
- (b) Always correct without data
- (c) Needs no electricity
- (d) Has human emotions

Explanation: AI systems can work continuously and quickly, but depend on data and power.

Q39. A major disadvantage/risk of AI is:

- (a) Job loss in routine work and privacy concerns ✓
- (b) Saves time
- (c) Better accuracy
- (d) 24 × 7 service

Explanation: AI may replace routine jobs and can misuse personal data.

Q40. The AI Mission of the Government of India for building the AI ecosystem is:

- (a) IndiaAI Mission ✓
- (b) Digital Locker Mission
- (c) Swachh Mission
- (d) Jal Mission

Explanation: IndiaAI Mission (MeitY, approved in 2024) supports computing power, datasets, startups, skilling and safe AI.

Part B: True or False

#	Statement	Answer
1	IoT devices have sensors and Internet connectivity.	True
2	Cloud computing means using only the hard disk of your own computer.	False — it means using services over the Internet.
3	Virtual Reality fully replaces the real world with a computer-generated world.	True
4	Blockchain data is stored only on one central server.	False — it is shared across many computers (distributed).
5	3D printing builds an object layer by layer.	True
6	RPA bots are physical robots.	False — they are software programs.
7	The term Artificial Intelligence was coined by John McCarthy.	True
8	Present-day AI is General AI (AGI).	False — all present AI is Narrow AI.
9	Machine Learning is a subset of Deep Learning.	False — Deep Learning is a subset of Machine Learning.
10	AI can be biased if its training data is biased.	True

Part C: Short Answer Questions

Q1. What are future skills? Give examples.

Ans: Future skills are the abilities needed to succeed in a technology-driven world, such as digital and data literacy, AI literacy, critical thinking, creativity, communication, adaptability and lifelong learning.

Q2. What is IoT? Give two examples.

Ans: IoT (Internet of Things) is a network of physical objects with sensors, software and Internet connection that collect and share data. Examples: smart watch, smart bulb, smart meter.

Q3. What is Big Data? Explain the 5 Vs.

Ans: Big Data means huge, complex data that ordinary software cannot handle. 5 Vs: Volume, Velocity, Variety, Veracity and Value.

Q4. What is cloud computing? Name its service models.

Ans: Cloud computing is delivery of computing services over the Internet on pay-as-you-use basis. Service models: IaaS, PaaS and SaaS.

Q5. Differentiate between VR and AR.

Ans: VR creates a completely virtual world using a headset; AR adds digital objects on the real world through a phone camera or glasses.

Q6. What is SMAC?

Ans: SMAC stands for Social, Mobile, Analytics and Cloud — four technologies that together are transforming business and services.

Q7. What is blockchain? Write its features.

Ans: Blockchain is a distributed digital ledger of blocks linked by hashes. Features: decentralization, transparency, immutability and security.

Q8. What is 3D printing? Write its uses.

Ans: 3D printing (additive manufacturing) builds objects layer by layer from a digital model. Uses: prototypes, medical implants, spare parts, buildings, education.

Q9. What is RPA? How is it different from AI?

Ans: RPA uses software bots to do repetitive rule-based tasks; it follows fixed rules. AI learns from data and can make decisions.

Q10. What is Artificial Intelligence?

Ans: AI is the branch of computer science that makes machines learn, reason, understand language, recognize images and make decisions like humans.

Q11. Write a brief history of AI.

Ans: 1950 Turing Test; 1956 term AI by John McCarthy; 1966 ELIZA; AI winters in 1970s–80s; 1997 Deep Blue; 2011 Watson and Siri; 2016 AlphaGo; 2022 ChatGPT.

Q12. Why do we need AI? Write any four reasons.

Ans: To handle huge data, to automate repetitive work, to work fast and accurately 24 × 7, and to do dangerous jobs.

Q13. Write the goals of AI.

Ans: Reasoning and problem solving, knowledge representation, planning, learning, natural language processing, perception, robotics and creativity.

Q14. What is AI ethics? Name four ethical issues.

Ans: AI ethics are the moral rules for fair and safe use of AI. Issues: bias, privacy, transparency, accountability, misinformation and job loss.

Q15. Write any four advantages and four disadvantages of AI.

Ans: Advantages: fewer errors, 24 × 7 work, speed, automation. Disadvantages: job loss, high cost, no emotions/common sense, misuse and privacy risks.

Q16. Write any five applications of AI.

Ans: Healthcare diagnosis, personalized education, crop monitoring in farming, fraud detection in banking, self-driving cars, voice assistants.

Q17. Explain the types of AI.

Ans: By capability: Narrow AI, General AI and Super AI. By functionality: Reactive machines, Limited memory, Theory of mind and Self-aware AI.

Q18. What are the subsets of AI? Differentiate ML and DL.

Ans: Subsets: ML, DL, NLP, computer vision, robotics, expert systems, generative AI. ML learns from data; DL is a type of ML using multi-layer neural networks.

Q19. What is generative AI? Give examples.

Ans: Generative AI creates new content — text, images, audio, video and code — from prompts. Examples: ChatGPT, Gemini, Copilot, Claude, image generators.

Q20. Write any four myths about AI with the reality.

Ans: Myth: AI has feelings — it only processes data. Myth: AI will take all jobs — it changes jobs and creates new ones. Myth: AI is always right — it can be wrong and biased. Myth: AGI already exists — present AI is narrow.

Q21. What is the IndiaAI Mission?

Ans: IndiaAI Mission is the Government of India's programme (MeitY, approved in 2024) to build the AI ecosystem through computing power, datasets, Indian-language models, startups, skilling and safe and responsible AI.

Part D: Long Answer Questions (Practice)

- What are future skills? Explain the important future skills and Industry 4.0.
- Explain IoT and Big Data Analytics with components, examples and uses.
- Explain cloud computing — service models, deployment models, advantages and disadvantages.
- Explain Virtual Reality, Augmented Reality and Mixed Reality with examples.
- Explain blockchain technology with its features, working and uses.
- Explain 3D printing and RPA with their working, uses, advantages and disadvantages.
- What is Artificial Intelligence? Explain its history, goals and why it is needed.
- Explain the ethics of AI. Write the advantages and disadvantages of AI.
- Explain the types and subsets of AI with examples.
- Explain the present and future of AI, myths about AI and its impact on different sectors.

Best of Luck for Your Exam!

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