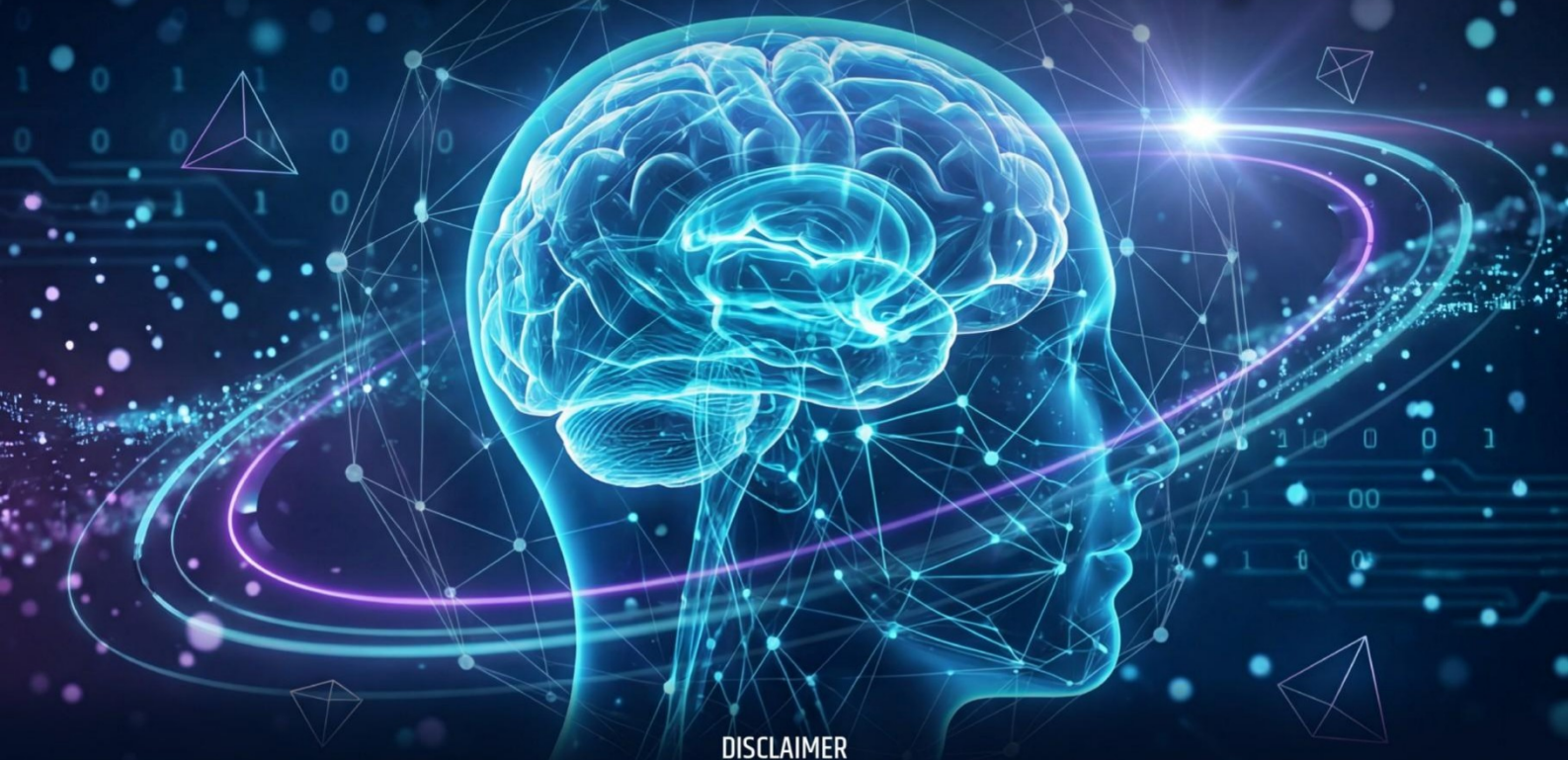
Success in competitive exams is built day by day through discipline, patience, and focused effort. Those who remain consistent, even when progress feels slow, are the ones who ultimately achieve their goals.

AI Comprehensive Handout

The Complete Guide to Artificial Intelligence



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ARTIFICIAL INTELLIGENCE

What It Is • Types • Relevance in Today's World

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1. What is Artificial Intelligence?

1.1 Definition & Core Concept

Artificial Intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (acquiring information and rules), reasoning (using those rules to reach conclusions), and self-correction.

The term was coined by John McCarthy in 1956 at the Dartmouth Conference, the event widely regarded as the birth of AI as a formal discipline.

KEY DEFINITION (Exam Tip)

"AI is any technique that enables machines to mimic human behaviour." — John McCarthy, 1956

"AI is the science and engineering of making intelligent machines." — Nils J. Nilsson

1.2 Brief History & Milestones

- **1950 —** Alan Turing proposes the Turing Test ("Can machines think?")
- **1956 —** Dartmouth Conference; John McCarthy coins 'Artificial Intelligence'
- **1966 —** ELIZA (first chatbot) developed at MIT by Joseph Weizenbaum
- **1997 —** IBM's Deep Blue defeats chess champion Garry Kasparov
- **2011 —** IBM Watson wins Jeopardy!; Apple launches Siri
- **2016 —** Google DeepMind's AlphaGo defeats world Go champion Lee Sedol
- **2022 —** OpenAI launches ChatGPT — crossing 100M users in 2 months (fastest ever)
- **2024-25 —** Rise of Multimodal AI (GPT-4o, Gemini 1.5, Claude 3); AI agents & autonomous systems

1.3 Key Characteristics of AI

- **Automation:** Performs repetitive tasks without human intervention
- **Adaptability:** Learns from data and improves over time
- **Reasoning:** Makes decisions based on logic and pattern recognition
- **Perception:** Can see (computer vision), hear (speech recognition), and read (NLP)
- **Prediction:** Uses statistical models to forecast outcomes

2. Types of Artificial Intelligence

2.1 Classification Based on Capability

A) Narrow AI (Weak AI)

Narrow AI is designed and trained for a specific task. It cannot generalise beyond its domain. This is the only type of AI that currently exists in practical deployment.

- **Examples:** Siri, Alexa, Google Translate, Netflix Recommendation, Face ID, AlphaGo
- **Exam Tip:** All existing AI applications (2025) are Narrow AI.

B) Artificial General Intelligence (AGI)

AGI refers to a hypothetical AI with human-level cognitive ability across all domains — it can learn, reason, and apply knowledge flexibly, just like a human being.

- **Status:** Does NOT exist yet. Estimated timeframes range from 2040–2100+ (highly debated).
- **Exam Tip:** AGI is sometimes called 'Strong AI'. It is a theoretical/future concept.

C) Artificial Super Intelligence (ASI)

ASI is a speculative AI that surpasses human intelligence in ALL fields — science, creativity, social interaction, problem-solving. Popularised by Nick Bostrom in his book Superintelligence (2014).

- **Status:** Purely theoretical. Associated with discussions on existential risk.
- **Key Thinkers:** Nick Bostrom, Eliezer Yudkowsky, Stuart Russell

2.2 Classification Based on Functionality (Arend Hintze, 2016)

Type 1: Reactive Machines

No memory. Cannot use past experience. Only reacts to current input.

- **Example:** IBM Deep Blue (chess), basic spam filters

Type 2: Limited Memory

Can use past data (short-term memory) to inform decisions. Most modern AI falls here.

- **Example:** Self-driving cars, ChatGPT, recommendation engines

Type 3: Theory of Mind

Can understand emotions, beliefs, and intentions of other agents. Still largely in research stage.

- **Example:** Sophia (Hanson Robotics) — partial attempt

Type 4: Self-Aware AI

AI with consciousness and self-awareness. Purely theoretical/fictional at present.

- **Example:** Skynet (Terminator), HAL 9000 (2001: A Space Odyssey) — fictional

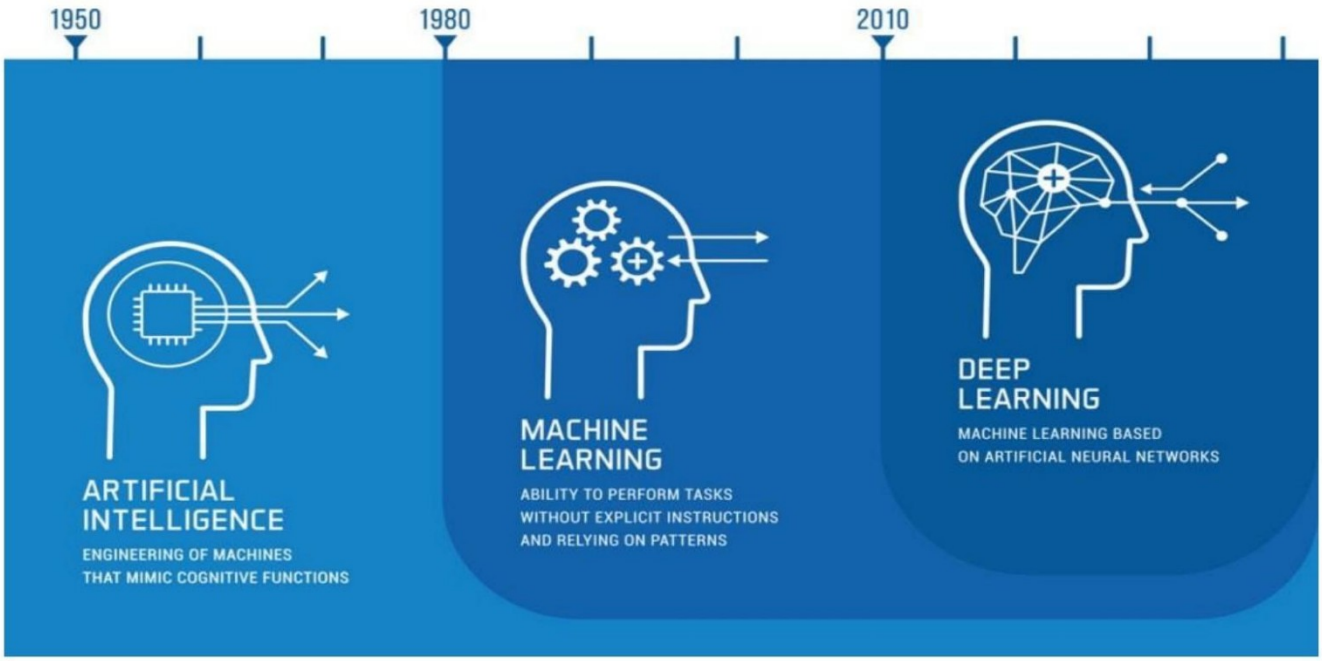
2.3 Classification Based on Learning Approach

- **Supervised Learning:** Trained on labelled data (e.g., email spam detection)

- **Unsupervised Learning:** Finds patterns in unlabelled data (e.g., customer segmentation)
- **Reinforcement Learning:** Learns via rewards and penalties (e.g., AlphaGo, game AI)
- **Semi-Supervised Learning:** Mix of labelled and unlabelled data
- **Self-Supervised Learning:** Generates its own labels from data (used in GPT, BERT)

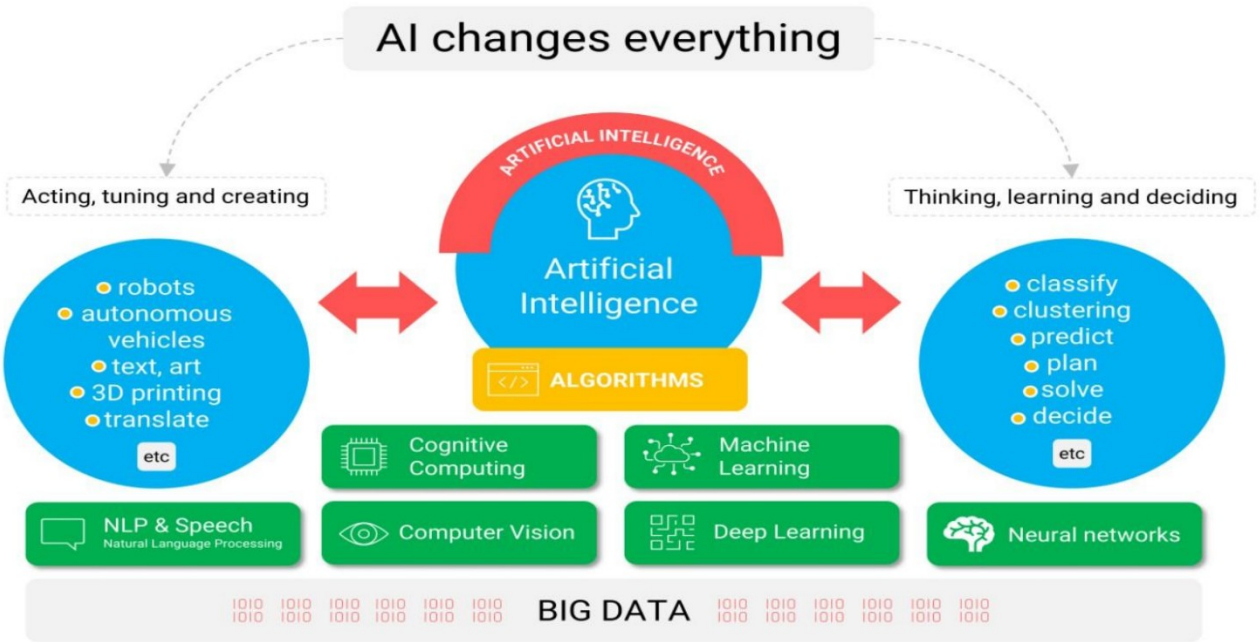
2.4 Comparison Table

AI Type	Capability	Examples	Current Status
Narrow AI	Single domain only	Siri, AlphaGo, ChatGPT	EXISTS (deployed)
General AI (AGI)	Human-level across all tasks	None yet	THEORETICAL
Super AI (ASI)	Surpasses human in all fields	None (fictional)	THEORETICAL
Reactive Machine	No memory, reacts only	Deep Blue	Mostly obsolete
Limited Memory	Short-term learning	Self-driving cars	EXISTS (most common)
Theory of Mind	Understands emotions/beliefs	Sophia (partial)	Research stage
Self-Aware AI	Consciousness + selfhood	None (sci-fi)	THEORETICAL



3. Core Technologies Powering AI

Machine Learning (ML)	Subset of AI; systems learn from data without explicit programming. Algorithms: Decision Trees, SVM, Random Forest, Neural Networks.
Deep Learning (DL)	Subset of ML using multi-layered Neural Networks (inspired by the brain). Powers image/speech recognition, LLMs. Needs large data.
Natural Language Processing (NLP)	Enables AI to understand, interpret, and generate human language. Used in chatbots, translation, sentiment analysis.
Computer Vision	Enables machines to interpret visual data (images, video). Used in facial recognition, medical imaging, autonomous vehicles.
Robotics	Physical AI systems that sense and interact with the environment. Used in manufacturing, surgery, exploration.
Expert Systems	Rule-based AI that mimics decision-making of human experts. Used in medical diagnosis (MYCIN), legal advice.
Generative AI	AI that creates new content — text, images, code, audio. Examples: ChatGPT (OpenAI), Gemini (Google), Claude (Anthropic), DALL-E, Stable Diffusion.
Large Language Models (LLMs)	Transformer-based models trained on massive text corpora. Foundation of modern NLP. GPT-4, Claude 3, LLaMA 2 are leading examples.



4. AI's Relevance in Today's World

4.1 Sector-wise Applications

- **Healthcare:** AI-aided diagnosis (IBM Watson Health), drug discovery, robotic surgery (da Vinci), predictive analytics for disease outbreaks
- **Agriculture:** Precision farming, crop disease detection (Plantix), yield prediction, drone surveillance
- **Finance & Banking:** Fraud detection, algorithmic trading, credit scoring, AI chatbots (virtual assistants)
- **Education:** Personalised learning, automated grading, virtual tutors
- **Defence & Security:** Autonomous drones, cyber threat detection, surveillance AI, DRDO's AI projects
- **Governance:** Smart city management, AI in judiciary (SUVAS — Supreme Court's translation tool), e-governance
- **Transport:** Self-driving cars (Tesla Autopilot, Waymo), traffic management, predictive maintenance
- **Retail & E-commerce:** Recommendation engines (Amazon, Flipkart), supply chain optimisation, customer service bots
- **Climate & Environment:** Climate modelling, deforestation tracking, energy efficiency optimisation

4.2 India-specific AI Initiatives

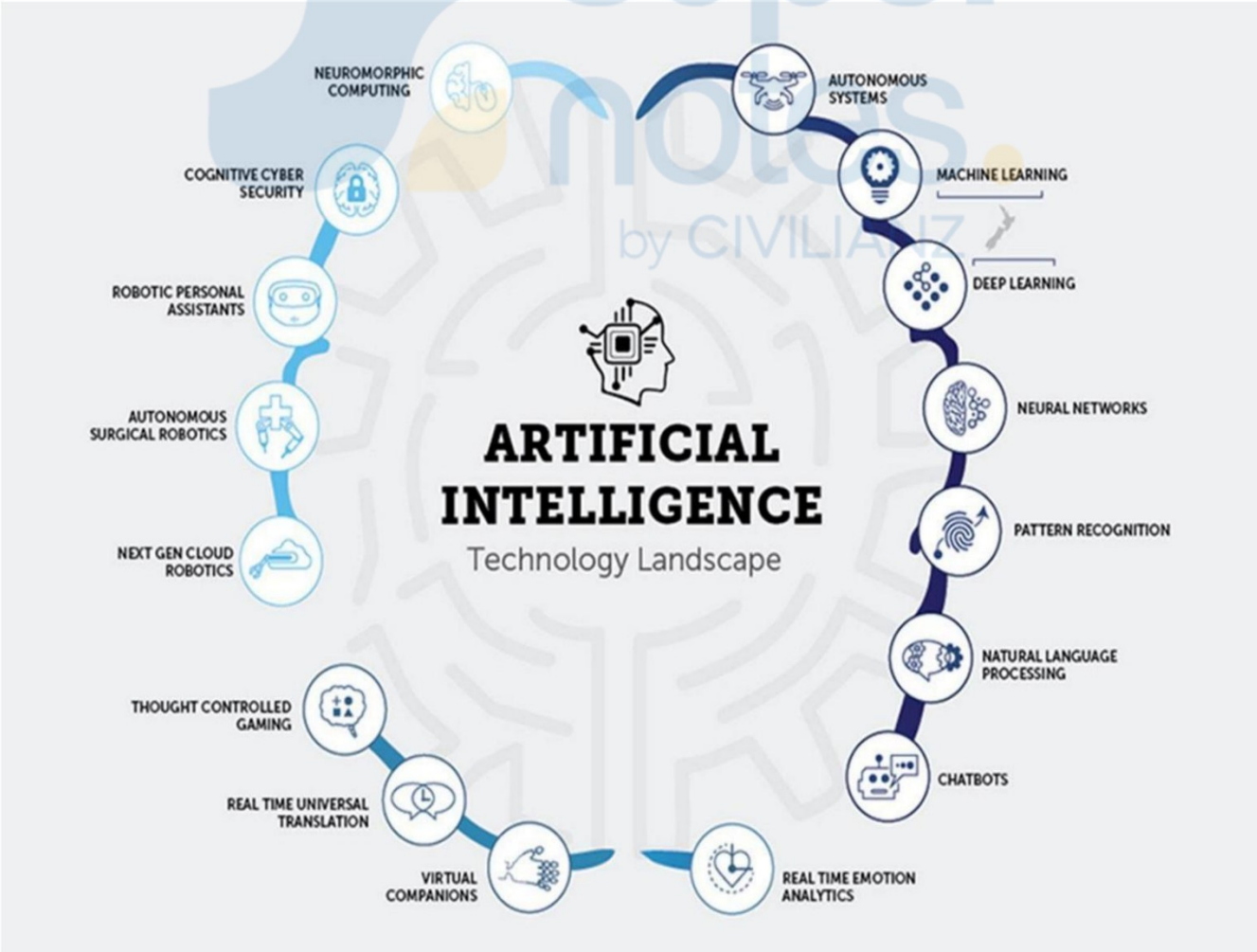
- **National AI Strategy (NITI Aayog, 2018):** #AIForAll — focus on 5 sectors: healthcare, agriculture, education, smart cities, smart mobility
- **IndiaAI Mission (2024):** Rs 10,372 crore outlay; establishing AI compute infrastructure, datasets, innovation ecosystem
- **AI Research Institutes:** IIIT Hyderabad, IITs, IISc — leading AI research hubs
- **SUVAS & SUPACE:** Supreme Court's AI tools for translation and case research assistance
- **Bhashini:** AI-powered Indian language translation platform for digital inclusion
- **DigiYatra:** AI-based facial recognition for seamless airport check-ins across India

4.3 Global AI Rankings & Key Reports

- **Global AI Index (Tortoise Media):** USA ranks #1; China #2; India ranks in Top 15 (2024)
- **Stanford HAI AI Index 2024:** AI investment globally crossed $91 billion in 2023; USA leads in private investment
- **OECD AI Principles:** First intergovernmental standard on AI (2019) — trustworthy AI
- **UN AI Advisory Body:** Established 2023; report 'Governing AI for Humanity' (2024)
- **G20 AI Principles:** India championed 'AI for All' during G20 presidency (2023)

4.4 Ethical Concerns & AI Governance

- **Bias & Discrimination:** AI trained on biased data perpetuates societal inequalities
- **Job Displacement:** IMF (2024) estimates ~40% of global jobs exposed to AI disruption
- **Deepfakes & Misinformation:** AI-generated fake media threatens elections and public trust
- **Privacy & Surveillance:** Mass surveillance using facial recognition raises civil liberty concerns
- **Autonomous Weapons:** Lethal Autonomous Weapons Systems (LAWS) — no human oversight
- **Regulation:** EU AI Act (2024) — world's first comprehensive AI law; India's DPDP Act (2023)



5. Key Terminologies — Exam Flash Cards

Turing Test	A test to determine if a machine can exhibit intelligent behaviour indistinguishable from a human (Alan Turing, 1950).
Algorithm	A set of rules/instructions a computer follows to solve a problem or make a decision.
Neural Network	A computing system loosely modelled on the human brain, consisting of interconnected nodes (neurons) in layers.
Training Data	The dataset used to teach an AI model to recognise patterns and make predictions.
Overfitting	When an AI model learns training data too well and fails to generalise to new data.
Chatbot	AI program that simulates conversation. E.g., ELIZA (1966), ChatGPT (2022).
Generative AI	AI that creates new content (text, image, code) rather than just analysing existing data.
Hallucination	When AI generates confident but factually incorrect or fabricated responses.
Prompt Engineering	Crafting effective inputs/instructions to get desired outputs from AI models.
Edge AI	Running AI computations locally on a device (not the cloud). Reduces latency and protects privacy.
Explainable AI (XAI)	AI systems whose outputs can be understood and interpreted by humans. Critical for trust in sensitive domains.
Singularity	Hypothetical point when AI surpasses human intelligence, leading to uncontrollable technological growth. Popularised by Ray Kurzweil.

6. 20 Exam-Ready MCQs with Answer Explanations

Each question is framed for UPSC, SSC, Banking, State PSC, and Tech Interviews.

Q1. Who is known as the 'Father of Artificial Intelligence'?

A) Charles Babbage
B) John McCarthy
C) Alan Turing
D) Marvin Minsky

✓ Answer: B) John McCarthy

Explanation: John McCarthy coined the term 'Artificial Intelligence' at the 1956 Dartmouth Conference and is universally recognised as the Father of AI. Alan Turing is the Father of Computer Science / Theoretical AI (Turing Test, 1950).

Q2. The Turing Test, proposed in 1950, is used to determine:

A) Processing speed of a computer
B) Whether a machine can exhibit human-like intelligent behaviour
C) The memory capacity of AI systems
D) The energy efficiency of neural networks

✓ Answer: B) Whether a machine can exhibit human-like intelligent behaviour

Explanation: Alan Turing proposed the 'Imitation Game' (Turing Test) in his paper 'Computing Machinery and Intelligence' (1950) to assess machine intelligence based on indistinguishability from human responses.

Q3. Which of the following is the ONLY type of AI that exists today (2025)?

A) Artificial General Intelligence
B) Artificial Super Intelligence
C) Narrow AI
D) Self-Aware AI

✓ Answer: C) Narrow AI

Explanation: All existing AI — including ChatGPT, Alexa, and self-driving cars — is Narrow (Weak) AI. It performs specific tasks well but cannot generalise. AGI and ASI remain theoretical.

Q4. Which AI system defeated world Go champion Lee Sedol in 2016?

A) IBM Deep Blue
B) AlphaZero
C) AlphaGo
D) DeepMind Gemini

✓ **Answer: C) AlphaGo**

Explanation: Google DeepMind's AlphaGo defeated Lee Sedol 4-1 in March 2016. This was a landmark event as Go has more board positions than atoms in the universe, making it far more complex than chess.

Q5. NITI Aayog's National AI Strategy for India is branded as:

A) AI India
B) #AIForAll
C) Digital AI India
D) Smart AI 2030

✓ **Answer: B) #AIForAll**

Explanation: NITI Aayog published India's National AI Strategy in 2018 titled '#AIForAll'. It focuses on 5 sectors: healthcare, agriculture, education, smart cities, and smart mobility/transportation.

Q6. Which type of AI has NO memory and only reacts to the current input?

A) Limited Memory AI
B) Theory of Mind AI
C) Reactive Machine AI
D) Self-Aware AI

✓ **Answer: C) Reactive Machine AI**

Explanation: Reactive Machines (Type 1 in Arend Hintze's classification) have no memory and cannot learn from past experiences. IBM Deep Blue is the classic example — it evaluated positions but stored no history.

Q7. The EU AI Act (2024) is significant because it is the:

A) First AI research programme globally

B) World's first comprehensive legal framework for AI regulation

C) First AI chip export ban

D) World's first AI ethics committee

✓ Answer: B) World's first comprehensive legal framework for AI regulation

Explanation: The EU AI Act was formally enacted in 2024 as the world's first comprehensive AI law. It adopts a risk-based approach, banning certain AI uses (like social scoring) and regulating high-risk applications.

Q8. What does 'Generative AI' refer to?

A) AI that only classifies data

B) AI that generates new content such as text, images, and code

C) AI used exclusively in robotics

D) AI that manages power generation systems

✓ Answer: B) AI that generates new content such as text, images, and code

Explanation: Generative AI creates new original content. Examples: ChatGPT (text), DALL-E/Midjourney (images), GitHub Copilot (code). It is powered by Large Language Models and Diffusion Models.

Q9. India's 'IndiaAI Mission' (2024) has a budget outlay of approximately:

A) Rs 5,000 crore

B) Rs 10,372 crore

C) Rs 25,000 crore

D) Rs 1,000 crore

✓ Answer: B) Rs 10,372 crore

Explanation: The Union Cabinet approved the IndiaAI Mission in March 2024 with an outlay of Rs 10,372 crore over 5 years. It aims to build AI compute infrastructure, data platforms, and an AI startup ecosystem.

Q10. Which AI tool developed by the Supreme Court of India assists in translating court judgements?

A) UIDAI-AI
B) SUVAS
C) DigiYatra
D) Bhashini

✓ Answer: B) SUVAS

Explanation: SUVAS (Supreme Court Vidhik Anuvaad Software) is an AI-powered translation tool developed by the Supreme Court of India to translate judgements into regional languages, improving judicial access.

Q11. 'Hallucination' in AI context means:

A) AI systems overheating during computation
B) AI generating confident but factually incorrect outputs
C) AI failing to respond to user queries
D) Biometric errors in facial recognition

✓ Answer: B) AI generating confident but factually incorrect outputs

Explanation: AI Hallucination refers to when a model generates plausible-sounding but false or fabricated information. It is a major reliability challenge for LLMs like ChatGPT. Exam tip: A common question in tech interviews.

Q12. Which branch of AI enables computers to understand and generate human language?

A) Computer Vision
B) Robotics
C) Natural Language Processing (NLP)
D) Expert Systems

✓ Answer: C) Natural Language Processing (NLP)

Explanation: NLP is the AI discipline dealing with human language. It powers chatbots, search engines, translation, and sentiment analysis. Subcategories include NLU (Understanding) and NLG (Generation).

Q13. In Machine Learning, which type involves training on labelled data?

A) Unsupervised Learning
B) Reinforcement Learning
C) Supervised Learning
D) Federated Learning

✓ **Answer: C) Supervised Learning**

Explanation: Supervised Learning uses labelled input-output pairs to train models. Examples: email spam detection, image classification. Unsupervised uses unlabelled data; Reinforcement Learning uses rewards/penalties.

Q14. The concept of 'Technological Singularity' in AI is associated with which futurist?

A) Elon Musk
B) Ray Kurzweil
C) Jeff Bezos
D) Sam Altman

✓ **Answer: B) Ray Kurzweil**

Explanation: Ray Kurzweil, Director of Engineering at Google, popularised the concept of Singularity in 'The Singularity is Near' (2005). He predicted that AI would surpass human intelligence by 2045.

Q15. Which of the following best describes 'Deep Learning'?

A) A branch of robotics using physical sensors
B) A subset of ML using multi-layered artificial neural networks
C) The process of storing large datasets for AI training
D) A type of quantum computing architecture

✓ **Answer: B) A subset of ML using multi-layered artificial neural networks**

Explanation: Deep Learning uses multi-layered neural networks (deep neural networks) to learn complex patterns. It requires large datasets and computational power (GPUs). It powers modern image recognition, voice assistants, and LLMs.

Q16. According to the IMF (2024), what percentage of global jobs could be exposed to AI disruption?

A) 15%
B) 25%
C) 40%
D) 60%

✓ **Answer: C) 40%**

Explanation: The IMF's January 2024 report stated that approximately 40% of global jobs are exposed to AI, with advanced economies facing higher exposure (60%). The impact could be positive (productivity) or negative (displacement).

Q17. IBM's Deep Blue defeated chess Grandmaster Garry Kasparov in which year?

A) 1990
B) 1997
C) 2001
D) 2011

✓ **Answer: B) 1997**

Explanation: IBM Deep Blue defeated Garry Kasparov in a 6-game match in May 1997 (3.5-2.5). This was a watershed moment in AI history, marking the first time a computer defeated a reigning world chess champion under standard tournament conditions.

Q18. India's 'Bhashini' platform is primarily associated with:

A) AI-based crop disease detection
B) AI-powered translation for Indian languages
C) Facial recognition for border security
D) Algorithmic trading in stock markets

✓ **Answer: B) AI-powered translation for Indian languages**

Explanation: Bhashini (Digital India Bhashini) is an AI-powered language translation platform for Indian languages, launched by the Ministry of Electronics and IT. It supports digital inclusion by bridging the language barrier in online services.

Q19. Which of the following AI types can understand emotions and mental states of other agents?

A) Reactive Machine

B) Limited Memory AI

C) Theory of Mind AI

D) Self-Aware AI

✓ Answer: C) Theory of Mind AI

Explanation: Theory of Mind AI (Type 3 in Arend Hintze's classification) can understand emotions, beliefs, and intentions of others. It is largely in the research stage. Hanson Robotics' Sophia is a partial example. Self-Aware AI goes further — it has its own consciousness.

Q20. The G20 AI Principles championed by India during its 2023 presidency focused on:

A) AI arms control

B) AI for All — inclusive and equitable AI development

C) AI taxation framework

D) AI chip manufacturing standards

✓ Answer: B) AI for All — inclusive and equitable AI development

Explanation: During India's G20 presidency (2023), the theme 'AI for All' emphasised inclusive AI governance, bridging the AI divide between developed and developing nations, and ensuring AI benefits are universally accessible.

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