Computational Thinking and Artificial Intelligence

Classes 3-8

Curriculum

Foreword

The National Education Policy (NEP) aims to position India as a leader in emerging knowledge fields by integrating technologies like AI, Machine Learning, Big Data, and Computational Thinking into school education. It promotes technology-enabled, interactive, and gamified learning using tools such as Augmented Reality (AR), Virtual Reality (VR), and virtual labs to foster creativity, problem-solving, and interdisciplinary exploration. NCFSE 23 carries this recommendation further for implementation.

AI can be defined as a broad collection of technologies that enable machines to carry out tasks typically associated with human intelligence, such as learning, comprehension, reasoning, problem solving and understanding natural language. Computational thinking is a structured approach to problem-solving that breaks larger problems into smaller, logical pieces. It allows to build precise, step-by-step solutions that either a person or a machine can easily follow. While Artificial Intelligence (AI) is an important requirement, Computational Thinking (CT) is a broader skill, developing a foundation for learning.

Under the guidance of the Ministry of Education, Govt. of India, CBSE presents the Curriculum Framework for Computational Thinking and Artificial Intelligence for classes 3 to 8.

This document posits to integrate Computational Thinking with Artificial Intelligence and other technological advancements, without dependence on any platform. It focusses on curricular goals, competencies, learning outcomes and syllabus with necessary details such as pedagogy, resources, assessment and implementation guidelines etc.

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1. Introduction

The National Education Policy (NEP) aims for India to emerge as a global leader in new emerging knowledge domains such as artificial intelligence, machine learning, data analytics, 3-D machining and so on. To realise this goal, the policy suggests teaching students Mathematics and Computational Thinking, along with new subjects like Artificial Intelligence, Machine Learning, Coding, and Data Science during their school education. The policy also focuses on technology-enabled learning and classrooms by using tools like artificial intelligence, machine learning, and adaptive testing to create knowledge.

The National Curriculum for School Education draws from this policy aspiration and emphasizes the need to introduce these emerging domains of study and technologies in the school curriculum. It recommends inclusion of subjects such as design thinking, augmented reality, virtual reality, artificial intelligence, and computational thinking. Additionally, it promotes the use of gamified content, interactive content, and immersive experiences (such as AR, VR, or virtual labs) to enhance student learning. In a variety of subjects, including design, music, art, and sciences, these resources support students in knowledge creation and exploration, and development of capacities such as problem-solving, critical and creative thinking.

2. Summary

This curriculum aims to develop AI-Ready learners, by focussing on Computational Thinking Skills. The AI-readiness, so inculcated through CT Skills, will help *develop the capacities of learners to use computational thinking, such as logical thinking, problem solving, pattern recognition, and so on, and understand the role and use of Artificial Intelligence in daily life. The Curriculum aims to build strong foundations in computational thinking, digital literacy, and responsible use of technology, along with nurturing innovation, critical thinking, and ethical decision-making capacities.*

The curriculum aims that learners develop the ability to think logically, approach and solve problems systematically, find patterns, apply technology for solving day-to-day life and understand ethical use of technology. It helps them realise the relevance and importance of Artificial Intelligence (AI) in our life and builds strong foundations in computational thinking, digital literacy, and responsible technology use. It encourages students to think creatively, solve problems, and make ethical choices and equips them with the capacities and tools needed for higher education, profession and everyday life.
Research articles present computational thinking as the underlying foundation for AI, showing that skills like breaking problems into parts, spotting patterns, filtering essential

information, and designing step-wise procedures are the same reasoning processes that power AI and ML systems. The curriculum positions CT as a foundation needed for learning all the subjects including AI. The curriculum envisages integration of CT across school subjects and beyond Mathematics as a cross-cutting theme.

Progression Across Class Levels:

Class 3-5: At present, Computational Thinking is part of Mathematics curriculum in the school curriculum. The curriculum recommends embedding CT in all the subjects such as TWAU (The World Around Us) and Mathematics with focused learning experiences through workbooks.

Class 6-8: At this stage CT is again incorporated into all the school subjects through worksheet-based and project-based learning along with introduction to foundational concepts of AI (AI literacy).

This progressive and phased approach develops a strong foundation in CT and AI in students making them capable of contributing to the needs of technology enabled societies. The curriculum suggests 50 hours and 100 hours for class 3-5 and 6-8 respectively.

The curriculum articulates the curricular goals and competencies for various school stages. These are articulated as general human capacities that can be seamlessly embedded in all the subjects of school curriculum. This approach fosters holistic learning experience, promotes multidisciplinary and cohesive understanding in learners, resulting in a broad range of capacities in the learners. The curriculum provides details of the content, pedagogy and assessment approaches, along with illustrative examples.

The teaching of CT and AI should reflect real-world challenges focusing on hands-on experiences. To achieve this, a variety of engaging pedagogical methods such as puzzles, structured problems, collaborative and individual projects, demonstrations, practice sessions, discussions, debates and reflective exercises are crucial. Students should be allowed to explore the practical challenges faced by the community, devise solutions for them, apply the knowledge beyond the classrooms. Teachers would need to provide the mentorship needed for such explorations.

The assessment methods need to align with these curricular intentions and the pedagogical practices, to ensure authentic assessment. For Classes 3-5, assessments will be linked to core subjects such as Mathematics and TWAU. From Class 6 onwards,

evaluations will focus on project presentations, assignments, reflective journals, and assigned tasks. Teachers need to create clear and consistent rubrics to evaluate student performance, ensuring consistency and clarity in the assessment process.

Computational Thinking forms the basis of learning AI. So, the curriculum will begin with the introduction of CT and deepen it as we move across the stages. AI is introduced later, once pre-requisite knowledge of CT is built for understanding AI. Implementation across classes follows this principle of a phased approach.

Thus, for Classes 3-5, Mathematics and other subject teachers will deliver the Computational Thinking syllabus. For Classes 6-8, the curriculum entails advanced CT, interdisciplinary projects and basic concepts of AI. This requires collaboration among teachers of various subjects.

Resources: For effective implementation of the curriculum, supportive materials such as teacher manuals and resource books will be provided. There will be a flexibility for schools to choose the platform for executing projects and assignments, without being tied to specific software or technology. The curriculum framework recommends harnessing the potential of free and open source, to ensure accessibility and adaptability for all institutions.

3. Approach

3.1 Approach to Learning Standards

Learning standards are derived using the approach suggested with and are aligned to NCF SE- 2023. As articulated in NCF-SE, the approach used is below.

"NEP 2020 has articulated the vision and purpose of education. NCF has drawn the Aims of School Education from this vision, which informs the knowledge, capacities, values, and dispositions that must be developed in students in order to achieve the aims of education. The aforementioned desirable knowledge, capacities, values, and dispositions are thereby reflected in the aims of each subject of study, and also in the recommended school culture and practices.

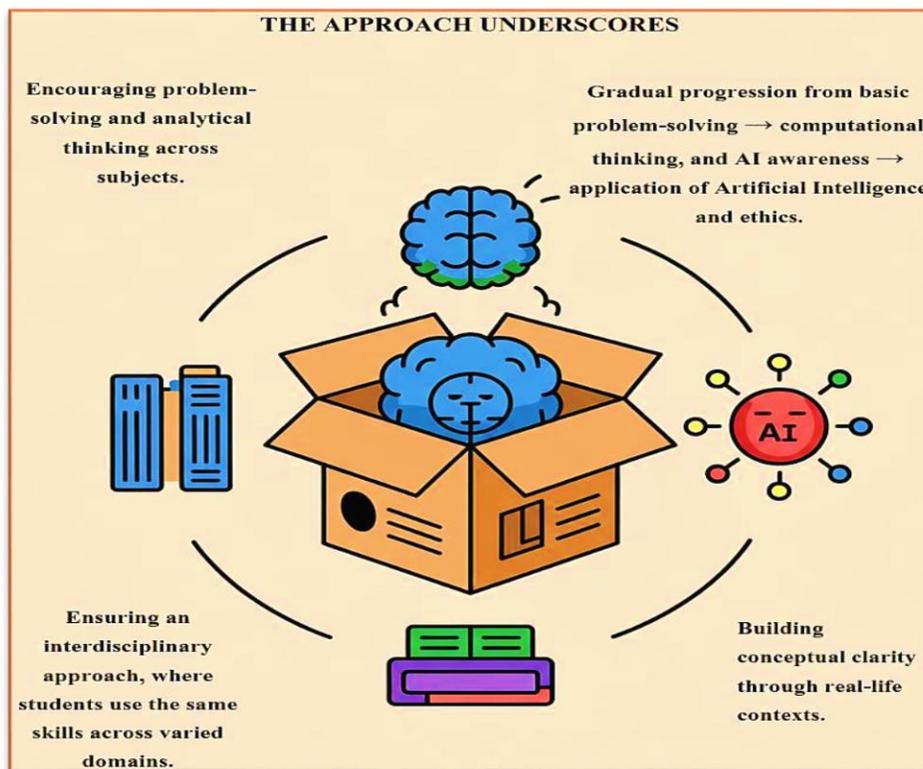The Curricular Goals are, in turn, derived from the Aims of Education, along with other relevant considerations. The Competencies are then drawn from these Curricular Goals, and the Learning Outcomes from those Competencies" (NCF-SE Pg. no. 90).

For this curricular area, learning standards are designed as foundational capacities that cut across disciplines, progressive, and age-appropriate. They are integrated into

Mathematics, Science, Language, and Social Sciences in the lower class and evolve into subjects in the higher class.

The approach underscores*:*

● Problem-solving and analytical thinking as a core across subjects.

● Gradual progression in the curriculum: The progression is from basic problem-solving → Computational Thinking, and AI awareness → application of Artificial Intelligence and ethics.

● Interdisciplinary approach, where students are exposed to CT & AI across varied domains.

● Building conceptual clarity through real-life contexts and experiential learning.

THE APPROACH UNDERSCORES

Encouraging problem-solving and analytical thinking across subjects.

Gradual progression from basic problem-solving → computational thinking, and AI awareness → application of Artificial Intelligence and ethics.

Ensuring an interdisciplinary approach, where students use the same skills across varied domains.

Building conceptual clarity through real-life contexts.

3.2 Content

The content is reinforced and advanced through spiral arrangement across class. The National Curriculum Framework for School Education (NCF-SE) serves as the foundation for selecting the content. In the lower classes, it is built upon the content prescribed in NCF-SE and is enriched further. As students' progress to higher classes, the content may evolve into distinct subjects.

The outline of the key content areas across various class levels are as below-

- *Preparatory Stage (Class 3–5)*: Puzzles, visual reasoning, problems that require analytical thinking, logical deduction and basic problem-solving with everyday contexts.

- *Middle Stage (Class 6–8)*: Advanced computational thinking, data organisation, representation and analysis, AI awareness, and ethical aspects of AI.

3.3 Pedagogy and assessment

Pedagogy:

The pedagogy suggested is activity-based and experiential methods, engaging students through interactive and hands-on experiences.

For class 3-5, pedagogy suggested includes use of worksheets based on games, puzzles and activities to enhance learners' Computational Thinking Skills and creativity.

For class 6-8, Use hands-on and real world problems, collaborative and group work to solidify and apply multidisciplinary foundational knowledge on Coding, Data Analysis and Artificial Intelligence tools aiming to learn advanced Computational Thinking and problem-solving skills.

Assessment:

Assessment approaches need to move away from traditional summative assessment to continuous, formative, and competency-based assessment. A range of assessment tools such as problem-solving tasks, project work, reflective journals, and discussions/debates on ethical dilemmas are to be used to assess student learning. The focus of assessment should be on the ability to apply knowledge, assessing creativity, and development of ethical reasoning skills, rather than assessing rote memorization. With its focus on practical application and critical thinking, these assessment strategies aim to provide a more comprehensive understanding of student learning and development.

3.4 Time allocation

- **Preparatory stage (Class 3–5):** 50 hours annually (integrated into Mathematics & TWAU). CT will be integrated with the existing textbook content, with additional CT questions and activities added into appropriate chapters. These additional activities will be in the form of a resource book.

- **Middle stage (Class 6–8):** 100 hours annually. This will include the time for specific topics on basics of AI and interdisciplinary projects.

The above time allocation is suggested to keep the existing curriculum load in mind to ensure balance without overburdening students with additional content load. It is flexible and schools can go beyond the allocated time depending on the needs of the school.

4. Significance of Computational Thinking (CT) and Artificial Intelligence (AI) in school curriculum

What is CT:

Computational Thinking is a problem-solving approach that comprises Decomposition, Pattern Recognition, Abstraction, Algorithm Design, Data Analysis and Troubleshooting. Computational Thinking Skills involve solving complex problems that promote thinking skills such as critical & creative thinking, abstraction and pattern recognition, as well as algorithmic thinking. Problem identification and problem solving necessitates application of multidisciplinary understanding for creating effective solutions.

What is AI:

Artificial intelligence is a cutting-edge technology that empowers machines and computers to perform tasks that usually require mimicking human intelligence. These machines can perform complex human thinking processes such as data analysis, pattern recognition, prediction of trends, solving problems and decision making. Thus, AI involves automation of cognitive processes associated with human intelligence and is widely applicable in various sectors such as banking, health care, defense, education, entertainment, agriculture and others for processing information, solving intricate problems and for planning.

Why a Curriculum for Computational Thinking and Understanding AI?

Research articles present computational thinking as the underlying foundation for AI, showing that skills like breaking problems into parts, spotting patterns, filtering essential information, and designing step-wise procedures are the same reasoning processes that power AI and ML systems. It suggests that when students practice CT in real STEM problem-solving, they are naturally building the cognitive structures required to understand

and eventually create AI-driven solutions. Thus CT is positioned not as a side skill, but as the intellectual backbone through which meaningful AI literacy and capability develop. [1]

Research also proposes that computational thinking constitutes a foundational cognitive framework for engaging with artificial intelligence, insofar as its core elements—such as abstraction, decomposition, and algorithmic reasoning—provide the essential scaffolding for understanding how intelligent systems operate.

The future of education lies not in avoiding AI, but in integrating it with thoughtful, disciplined, and human-centered learning. Regular instruction on AI ethics teaches students to verify information, detect bias, and recognize when AI reliance crosses into cognitive delegation or cognitive over-reliance.

In the above context, CBSE proposes a curriculum, *Computational Thinking and Understanding AI:* Building AI-Readiness from class 3 onwards to develop AI-Ready learners. The AI-readiness, so inculcated through CT Skills, will help *develop the capacities of learners to use computational thinking, such as logical thinking, problem solving, pattern recognition, and so on, and understand the role and use of Artificial Intelligence in daily life. The Curriculum aims to build strong foundations in computational thinking, digital literacy, and responsible use of technology, along with nurturing innovation, critical thinking, and ethical decision-making capacities.*

We need this curriculum for:

1. **Preparing for the future:** To contribute to the world of work in modern societies, individuals need capabilities such as problem solving, using data effectively, identifying patterns, and applying AI ethically for various purposes in life. Study of AI and CT equips individuals with such capacities.
2. **Holistic Development:** Study of CT and AI contributes to development of reasoning, logical thinking, creative problem-solving skills, critical thinking, ethical decision making abilities, leading to individual flourishing. It leads to creation of responsible **digital citizens** in society.

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[1] Embracing Computational Thinking as an Impetus for Artificial Intelligence in Integrated STEM Disciplines through Engineering and Technology Education https://jte-journal.org/articles/10.21061/jte.v34i2.a.3 accessed at 14. 46 hrs on 26.11.2025

3. **Interdisciplinary Relevance:** Embedding CT and AI concepts in the school curriculum helps students to develop an integrated view of the world by **connecting various disciplines** such as Mathematics, Science, Humanities etc. This will lead to **enriched learning experience** and helps students realise knowledge is not compartmentalised.
4. **Innovation and Entrepreneurship:** At the core CT and AI is about solving problems, devising innovative solutions and recreating human thinking. This leads to an entrepreneurial and innovative mindset in the learners.
5. **Ethical Awareness:** While CT and AI eases life, it calls for responsible use to promote better life for individuals. Study of CT & AI will sensitise learners about the misuse and bias, fairness and inclusivity in AI systems.

In essence, the aim of CT &AI curriculum is to transform learners into informed, creative and ethically aware digital citizens committed to the use of technology for human welfare by empowering learners with the knowledge, capacities and dispositions needed to thrive in a technology-driven society.

5. Aims of the Curriculum

Development of cognitive capacities

Study of CT and AI enables the capacity to approach problems systematically through structured approaches in individuals. This results in the development of cognitive capacities such as logical thinking, critical thinking, visual and spatial thinking and analytical thinking. This enables learners to face real life problems with confidence and overcome the challenges of day-to-day life by analysing complex problems into sub components, ability to see patterns, and creating innovative solutions. The learners attain fluency in using the systematic and methodical approaches to solve problems and create more efficient and effective solutions to the problems in various aspects of life.

Integration of knowledge across the curriculum

Designing solutions to real life problems requires an integrated and holistic approach. This requires learners to seamlessly integrate ideas from various disciplines such as Mathematics, Science, Humanities, Technology and so on. CT and AI provide opportunities for learners to bring these knowledge domains together while they design creative solutions to the problems they encounter everyday, both at the individual and societal level. They will explore the interconnections among these knowledge domains and leverage one domain for deepening the understanding of the other domain. This will also help them appreciate the relevance of these domains in their daily life.

This interdisciplinary perspective gives them a holistic and deeper understanding of the world and prepares individuals to adapt and thrive in the modern world marked by a complex and dynamic environment.

Readiness for an AI-Driven World

Modern life is technology driven and various tools of technology such as Python programming helps in modeling, stimulating and solving real world problems, Machine learning that is widely used to find pattern recognition, predict and make varied kinds of representations. To prepare learners for this technology-driven future, it is important to build foundational competencies in Computational Thinking (CT) and an understanding of Artificial Intelligence.

Computational Thinking in classes 3-5 would encourage learners to approach problems in a systematic and logical manner by applying processes such as decomposition, pattern recognition, abstraction, and algorithmic thinking.

Through exposure to AI and CT concepts at the middle school level in classes 6-8, learners develop important 21st-century skills such as problem-solving, logical reasoning, creativity, collaboration, ability to adapt and keep pace with evolving technologies, and informed decision-making. It will also help them in understanding the responsible and ethical use of technology and also enabling them to think critically on how technology impact individuals, communities, and society. Mastery of these skills will help individuals navigate complex challenges, drive technological advancements, and make decisions that positively impact society, ultimately becoming adept at applying technology for self and societal welfare.

Promoting Core Competencies

To succeed in personal and professional lives, learners need to develop capacities such as clarity of thought and expression, communicate it to others, accommodate diverse views and collaborate with each other. Working in collaborative groups ensures collective success, team work, mutual respect and appreciation. By enhancing collaborative learning and adaptability, individuals can remain relevant and effective throughout their lives, whether through lifelong learning or peer learning. This leads to a growth mindset, staying ahead of the curve in an ever-evolving landscape.

5.1 Learning Standards

Learning standards have been contextualized mapping them across all subjects and viewed as a foundational capacity to be used across all subjects, thereby encouraging inter-disciplinary approach.

6. Curricular Goals and Competencies

STAGE	CURRICULAR GOALS	COMPETENCIES
Class 3 - 5	**CG-1** Develops basic problem-solving skills with procedural fluency to solve daily-life problems, and as a step towards developing computational thinking. **CG-2** Develop basic capacities of analytical thinking, verbal, and visual reasoning. **CG-3** Demonstrate understanding of basic concepts of computers and knowledge of hardware and software.	**C-1** Solves puzzles and daily-life problems through visual representations, interpreting the texts and analyzing the given information. **C-2** Solve problems and understand complex ideas by identifying patterns, applying patterns to new cases, rules, and relationships in abstract, non-verbal information, such as shapes, symbols, and diagrams. **C-3** Learns to systematically count and list all permutations or combinations given a constraint, in simple situations. (e.g., how to form a committee of two people from a group of five people) **C-4** Selects appropriate methods and tools for computing simple data, such as mental computation, estimation, or paper and pencil calculation, in accordance with the context. **C-5** Makes connections among concepts, procedures, and representations in problem-solving contexts. **C-6** Develops familiarity with parts of the computer & other input-output devices, file management, basic internet safety, use of educational software and block-based coding like Scratch.

Class 6 - 8	CG-1 Develops skills and capacities of computational thinking, namely, decomposition, pattern recognition, data representation, generalisation, abstraction, and algorithms to solve problems where such techniques of computational thinking are effective. CG-2 Develops spatial and visual reasoning. CG-3 Gain foundational knowledge of AI, its types, and domains. CG- 4 Understand key ethical terms such as bias and fairness in relation to AI. CG-5 Demonstrates proficiency to use Computer & other devices, computer applications for learning and practical purposes such as data analysis, preparation of visual representations and communication of ideas.	C-1 Approaches problems using programmatic thinking techniques such as iteration, symbolic representation, and logical operations, and reformulates problems into a series of ordered steps. C-2 Learns systematic arithmetic reasoning, iterative patterns, and multiple data representations; to devise and follow algorithms, with an eye towards understanding correctness, effectiveness, and efficiency of algorithms. C-3 Learns to visualize, manipulate, represent, and understand the relationships between objects in space. C-4 Applies abstraction and generalization to identify core structures and patterns in problems, enabling the design of reusable procedures and models across varied contexts. C-5 Demonstrate the knowledge of AI tools through different projects and activities. C-6 Identifies ethical issues and applies ethical principles to make informed decisions regarding AI usage. C-7 Uses computers or any other appropriate devices & software/applications for creating visual representations of ideas, organizing and analyzing data, conducting simple online research, gathering images, and designing infographics.

7. Approach across school stages

7.1 Class 3–5

● Begin with the integration of CT across subjects taught at this stage, i.e., in Mathematics and The World Around Us

- Mathematics at this stage has already been integrated into CT, but it needs further emphasis. The curriculum suggests Computational Thinking (CT) worksheets and resource books to enrich Math lessons.

- Similarly, for other subjects additional CT worksheets are to be designed to enrich the existing chapters.

- The goal at this stage is to develop foundational CT skills such as the capacity to think logically, find patterns, and arrange things in order using fun math games, puzzles, and exercises.

- Use simple digital tools and hands-on activities to help children think in an organized way and solve problems effectively.

7.2 Class 6–8

- At this stage CT skills are furthered to the advanced level and introduction to foundational understanding of AI will be done.
- The best approach is to have a combination of CT worksheets along with an introduction to basic AI theory, and interdisciplinary projects that combine both CT and AI in the middle school stage.
- Use additional materials, such as worksheets, and teacher and student handbooks to integrate Computational Thinking (CT) with other subjects. Include more challenging questions than those in Class 3–5.
- Teaching students the fundamentals of artificial intelligence with relatable real-world examples will help them understand AI's role in society.
- Using project-based learning with AI tools, basic data analysis, and Computational Thinking will help students create solutions to real-world issues.
- Introducing conversations about digital footprints, bias, privacy, and fairness in AI systems to cultivate conscientious, ethical, and thoughtful digital citizens.
- Encourage critical thinking, creativity, and curiosity through experiential, inquiry-based learning opportunities.

8. Materials and Resources

8.1 Who Will Teach?

Class 3–5

- Computational Thinking (CT) will be taught as part of Mathematics and other subjects.
- Special worksheets and handbooks would be given to both teachers and students.

- These worksheets will follow the same topics as the textbooks in the respective subjects and would include CT-based questions and activities for various chapters.
- CT activities would be integrated with the concepts of each subject. Teachers will use these resources during their regular classes which will help the students to practice Computational Thinking while understanding subject concepts.

Class 6–8

- The Middle Stage curriculum will comprise two core components: Intermediate Computational Thinking (CT) and Introduction to AI Literacy.
- Related content transactions will be facilitated through a combination of dedicated CT worksheets and handbooks, an AI Foundation Handbook, and project-based learning modules.
- In alignment with the approach adopted for class 3–5, CT Resource Books will integrate CT based questions and activities within chapters.
- Teaching will be collaboratively done by respective subject teachers (for CT resources) and Computer teachers (for AI Literacy resources).
- Projects integrating concepts from both CT and AI will form a key part of the learning process and will be assessed by the Computer teacher.

8. 2 Materials

- For Class 3-5, a resource book with additional CT questions and activities would be provided for students and teachers.
- For Class 6-8, a resource book would be provided that includes more complex CT questions, AI foundation concepts, and details of interdisciplinary projects. Corresponding teacher manuals will also be available to support effective classroom use.

9. Pedagogy and Assessment

9.1 Pedagogical Approaches

Class 3–5
- Hands on activities, games and puzzles to teach problem solving using the worksheets.
- Allowing students to interpret charts, diagrams and any other visual representations
- Teach students to break larger problems into smaller problems to develop problem solving skills.

● Use collaborative tasks, peer discussions while solving the problems using the worksheets.

Class 6–8
● Use complex puzzles, riddles and games to build on the computational thinking abilities taught in the previous stage.
● Deliver fundamental concepts of AI through explanations, demonstrations and hands-on experience.
● Organise group discussions, design collaborative projects that integrate CT & AI. Offer guidance to students to carry out these projects.
● Independent activities for students such as data collection, organisation and analysis, varied forms of representations, creation of diagrams and flow charts etc. created using digital tools or manually.
● Discussions, debates and case studies on ethical use of AI.

9.2 Assessment Approaches
Assessment approaches should focus on demonstrable outcomes to assess students' abilities to apply, design solutions and ethical use of AI. This necessitates the use of a variety of assessment methods such as hands-on activities, collaborative & individual projects, reflective journals, peer assessment, observation by the teachers. Below are the suggestive stage-specific assessment methods:

Classes 3–5

● Written tests involving CT questions and puzzles.
● Interactive Group activities like treasure hunts.
● Teacher Observation Journal.

Classes 6–8

● Written Tests
● Interactive Group activities like treasure hunts
● Practical Examinations
● Teacher Observation Journal
● Thematic Projects
● Reflections and Group Discussions

10. Syllabus

10.1 Class 3-5

The Computational Thinking (CT) will be embedded into the existing mathematics and TWAU curriculum for class 3 to 5 and will align closely with the content of the textbooks of these two subjects. Each class will be provided with a resource book that includes additional CT-focused questions designed to strengthen a range of CT skills. The resource book will maintain the same table of contents as the subject textbook, with CT questions integrated into each chapter. This structure will enable teachers to seamlessly address these questions while teaching the corresponding subject concepts.

10.1.1 Learning Outcomes

Grade 3:

ABSTRACT THINKING
Students will be able to solve problems with hidden or unseen ideas, using:
- Different viewpoints of 3D objects
- Changes in shapes after flips, turns, folds, or rotations
- Hidden or missing parts in incomplete shapes or patterns

PATTERN RECOGNITION
Students will be able to identify simple patterns involving 1 or 2 changes in consecutive terms, formed using:
- Numbers
- Shapes or images
- Letters
- Or a mix of the above

DECOMPOSITION
Students will be able to break down problems involving 2–3 clues, using information from:
- Number clues or number names
- 3D objects and their parts (faces, edges, corners)
- Step-by-step exchanges or transfers (money, objects, digits)
- Tables or charts with multiple pieces of information

ALGORITHMIC THINKING

Students will be able to follow clear step-by-step rules to solve problems involving:

- Number sequences formed using simple operations
- Movements on grids or direction-based paths
- Events arranged using before/after/in-between clues
- Values that increase or decrease across steps

Multi-step instructions involving moves, changes, or transfers

Grade 4:

ABSTRACT THINKING

Students will be able to solve moderate to highly moderate problems with partially visible or incomplete ideas, using:

- Different viewpoints of 3D objects
- Changes in shapes after flips, turns, cuts/folds, or rotations
- Hidden or missing parts in incomplete shapes or patterns
- Mirror images and identical halves based on symmetry

PATTERN RECOGNITION

Students will be able to identify patterns involving one or more changes in consecutive terms, formed using:

- Numbers
- Shapes or images
- Letters
- Or a mix of the above

DECOMPOSITION

Students will be able to break down problems involving a cluster of moderate clues, using information from:

- Number clues (place values, sum/difference/product)
- 3D objects and their parts (faces, edges, corners)
- Step-by-step exchanges or transfers (money, objects, digits, quantities)
- Tables or charts with multiple pieces of information
- Conditions for counting/grouping/sorting items

ALGORITHMIC THINKING

Students will be able to follow a set of well-defined, elaborate conditions to solve moderate to complex problems involving:

- Number sequences formed using simple operations
- Movements on grids or direction-based paths
- Values that increase or decrease across steps
- Multi-step instructions involving moves, changes, transfers, swaps
- People/Events arranged in an order using attributes or chronological clues
- Simple counting instructions

Grade 5:

ABSTRACT THINKING

Students will be able to solve complex problems with multi-layered hidden cues, using:

- Different viewpoints of 3D objects
- Changes in shapes after flips, turns, cuts/folds, or rotations, and changes in order and directions (clockwise or counterclockwise)
- Hidden or missing parts in incomplete shapes or patterns
- Mirror/Water images and identical halves based on symmetry

PATTERN RECOGNITION

Students will be able to identify progressive patterns involving multiple changes in consecutive terms, formed using:

- Numbers
- Shapes or images
- Letters
- Or a mix of the above

DECOMPOSITION

Students will be able to break down higher-order problems involving interconnected clues, using information from:

- Number clues (place values, sum/difference/product)
- 3D objects and their parts (faces, edges, corners)
- Step-by-step exchanges or transfers (money, objects, digits, quantities)
- Tables or charts with multiple pieces of information
- Conditions for counting/grouping/sorting items
- Pictures or visuals that represent certain numerical values

ALGORITHMIC THINKING

Students will be able to follow multi-layered rules to solve advanced problems involving:

- Number sequences formed using simple operations
- Movements on grids or direction-based paths
- Values that increase or decrease across steps
- Multi-step instructions involving moves, changes, transfers, swaps
- People/Events arranged in an order using attributes or chronological clues
- Simple counting instructions

10.2. Syllabus for Class 6-8

For class 6-8, the syllabus will comprise the following:

- Advanced CT skills
- Introductory concepts of AI
- Interdisciplinary projects

Advanced CT skills- The syllabus will be built on from the earlier classes and provides opportunity to apply CT skills for complex situations and in tandem. Total time allocated to this is 40 hrs. per academic year.

Introductory concepts of AI- The syllabus extend the Computational Thinking Skills the students have gained to AI. They will be introduced to the fundamental concepts of AI and exposure to AI tools in this school stage. Total time allocated to these concepts is 20 hrs in an academic year.

Interdisciplinary projects- The interdisciplinary projects encourage students to use their understanding of Computational Thinking (CT) and Artificial Intelligence (AI) to analyse problems, draw connections across disciplines, and design creative, data-driven solutions. These projects are designed to integrate concepts from various subjects, such as Mathematics, Science, Social Studies, and English, allowing students to apply their learning in authentic, real-world contexts. Each activity is carefully curated to make learning engaging and hands-on rather than academically demanding, promoting curiosity, collaboration and innovation. *Through these experiences, students not only strengthen their CT and AI skills but also develop critical thinking and an appreciation for the interconnected nature of knowledge.*

10.2.1 Learning Outcomes:

Class 6: Learning Outcomes

Computational Thinking (CT) Learning Outcomes

ABSTRACT THINKING
Students will be able to interpret and solve multi-step problems with layered and abstract clues, using:
- Advanced viewpoints and cross-sections of 3D objects
- Combined transformations of shapes (multiple flips, rotations, reflections, cuts/folds)
- Changes in orientation, position, order, and direction (clockwise, anticlockwise, diagonal)
- Identifying hidden, overlapping, or implied parts in complex visual patterns
- Symmetry across multiple axes and composite mirror/water image reasoning
- Visual reasoning involving scale, proportion, and spatial relationships

PATTERN RECOGNITION
Students will be able to identify, extend, and justify complex patterns involving multiple simultaneous changes, formed using:
- Numbers with mixed operations and logical rules
- Shapes/images with changing attributes (size, position, count, orientation)
- Letters and symbols with positional or alphabetical logic
- Patterns involving alternation, skipping, grouping, or cyclic behaviour
- Mixed patterns combining numbers, shapes, and letters with dependency rules

DECOMPOSITION
Students will be able to break down higher-order problems involving interdependent clues and constraints, using information from:
- Numerical clues involving place value, operations, factors, multiples, and comparisons
- Properties of 2D and 3D shapes (faces, edges, vertices, diagonals, angles
- Multi-step transfers or exchanges (money, quantities, digits, objects) with conditions
- Tables, grids, or charts requiring cross-referencing of multiple data points
- Conditional rules for counting, grouping, sorting, or eliminating possibilities
- Visual representations that encode numerical or logical values

ALGORITHMIC THINKING

Students will be able to follow, analyse, and apply multi-layered rules and procedures to solve complex problems involving:

- Number sequences formed using combined operations and logical conditions
- Movement on grids involving direction, distance, turns, and path constraints
- Step-wise changes where values increase/decrease based on rules
- Multi-step instructions involving swaps, shifts, transfers, and rearrangements
- Ordering people, objects, or events using multiple attributes or clues
- Logical flow of steps, identifying necessary vs redundant information

Artificial Intelligence (AI) Learning Outcomes

Learners will be able to:

- Summarise the basic ideas and concepts of AI and its application
- Describe key differences between machine intelligence and human intelligence
- Explain the difference between automation and AI using practical, real-world cases.
- Differentiate the three fundamental AI methodologies, namely supervised, unsupervised, and reinforcement learning
- Develop the skill of organizing and representing data and its various forms, including text, numbers, images, and sounds
- Recognize simple patterns in data and make decisions based on observations
- Demonstrate an understanding of ethics and digital responsibility in the use of AI, including digital footprints, privacy, and responsible technology behaviour.
- Practice essential internet safety protocols, such as creating secure passwords, maintaining safe online behaviour, and applying basic privacy measures while using digital and AI tools.
- Apply conceptual knowledge of AI to everyday activities by recognising human-centred design and ethical principles in how AI works and interacts with people.

Class 7: Learning Outcomes

Computational Thinking (CT) Learning Outcomes

ABSTRACT THINKING

Students will be able to interpret and solve complex, multi-layered problems by:

- Visualising and analysing 3D objects and their transformations, including rotations, reflections, cross-sections, and nets

- Understanding compound transformations involving multiple flips, turns, folds, and rearrangements
- Identifying hidden relationships and constraints within incomplete figures, patterns, or logical setups
- Analysing symmetry, congruence, and proportional reasoning across different representations
- Interpreting relative positions, orientations, and viewpoints of objects in advanced visual scenarios

PATTERN RECOGNITION

Students will be able to recognise, extend, and predict complex patterns involving:

- Multi-rule numerical sequences, including alternating, nested, and dependent patterns
- Algebraic patterns using variables, expressions, and functional relationships
- Visual and geometric patterns formed through transformations or growth rules
- Letter and symbol-based patterns involving positional and logical dependencies
- Integrated patterns combining numbers, shapes, symbols, and logical conditions

DECOMPOSITION

Students will be able to break down real-world and abstract problems by:

- Separating interconnected conditions and constraints into manageable components
- Analysing number properties (factors, multiples, ratios, percentages, powers) within layered clues
- Deconstructing problems involving spatial reasoning, measurements, and geometry
- Interpreting tables, grids, charts, and flow-based information with multiple dependencies
- Breaking multi-step logical situations (movement, exchanges, comparisons, scheduling) into ordered steps
- Translating visual or verbal information into structured data for systematic analysis

ALGORITHMIC THINKING

Students will be able to design and follow logical procedures to solve advanced problems involving:

- Rule-based sequences and algorithms with conditional branching
- Grid-based navigation and pathfinding with constraints and decision points
- Step-wise transformations involving calculations, swaps, transfers, or positional changes
- Ordering and arranging elements (people, objects, events) using multiple attributes and logical clues

- Solving problems using if–then reasoning, elimination strategies, and logical consistency checks
- Creating or analysing procedural steps to reach an optimal or valid solution

Artificial Intelligence (AI) Learning Outcomes

Learners will be able to:
- Distinguish key predictive techniques such as:
  - **Regression:** The method of predicting a number based on patterns in past data
  - **Classification:** The process by which a machine arranges things in a group based on what it has learned
  - **Clustering:** The process by which a system automatically puts similar items together
- Explain about the key domains of AI, namely:
  - **Data Science:** learn to manage and extract insights from data
  - **Computer Vision:** learn the basics of how machines understand and respond to visual information
  - **Natural Language Processing:** understand the basics and limitations of how computers process and handle natural language inputs
- Explain what bias in AI means, and identify situations where AI can give unfair results
- Demonstrate courteous, safe, and responsible use of technology as part of good digital citizenship
- Use safe practices for maintaining data privacy, including giving informed consent before personal data is collected, used, shared, archived, or deleted
- Collect and organize simple structured data, interpreting patterns and trends, and create bar charts, line graphs and pie charts
- Apply basic predictive approaches/techniques to a small dataset
- Explain uses of AI in healthcare, education, transport, and communication

Class 8: Learning Outcomes:

Computational Thinking (CT) Learning Outcomes

ABSTRACT THINKING

Students will be able to solve advanced, multi-layered problems involving abstract relationships and hidden structures, using:
- Properties and relationships of numbers (powers, factors, remainders, divisibility)
- Generalization across different number systems (decimal, binary, ternary, Roman, Chinese numerals)

- Spatial visualization of 2D and 3D figures, including overlaps, intersections, and transformations
- Logical interpretation of symbols, codes, and operations representing numerical or algebraic ideas
- Identification of essential information by ignoring irrelevant or misleading data

PATTERN RECOGNITION

Students will be able to identify, compare, and extend complex patterns involving multiple simultaneous changes, formed using:
- Powers, exponents, and numerical structures
- Relationships across different representations of the same number
- Geometric configurations and shape-based sequences
- Conditional patterns based on rules, constraints, or dependencies
- Mixed patterns involving numbers, symbols, shapes, and movement

DECOMPOSITION

Students will be able to break down high-order logical problems into manageable components by:
- Separating given conditions, constraints, and goals
- Analyzing multi-step processes such as distribution, transfers, and exchanges
- Breaking numerical expressions into simpler equivalent forms
- Interpreting tables, grids, networks, and diagrams with multiple dependencies
- Structuring problems involving multiple variables, positions, or cases

ALGORITHMIC THINKING

Students will be able to design, follow, and evaluate multi-step logical procedures to solve problems involving:
- Rule-based transformations of numbers or symbols
- Stepwise movement on grids, tracks, or paths with constraints
- Conditional instructions (if–then, either–or, must/must not)
- Sequential decision-making under given limitations
- Optimization problems involving maximum or minimum outcomes

Artificial Intelligence (AI) Learning Outcomes

By the end of Grade 8, learners will be able to:
- Describe the stages of the AI project cycle as a stepwise structure (Define Problem, Collect Data, Test AI Tools, Reflect and Improve)

- Apply no-code tools to tackle real-world problems and reflect on their utility/effectiveness
- Explain how AI uses data, find and research sources of bias in datasets, and apply basic strategies to ensure fairness and inclusivity
- Recognize how bias in AI leads to unfair conclusions and realize the importance of accountability, privacy, and serving human interests
- Explain the uses of AI in daily life and understand AI as a specific type of algorithm that uses datasets, learning, and prediction
- Analyse contributions of AI to fields like healthcare, automation, and education, understanding both benefits and risks
  Describe AI ethics as the values and guidelines that ensure AI is created and used responsibly

10.2.2 Syllabus for Advanced CT skills:

For class 6 to 8, the Computational Thinking (CT) curriculum will build upon the foundational skills developed in class 3 to 5, introducing more advanced applications and problem-solving tasks. The design of the curriculum will be closely aligned with the mathematics textbooks for each class, ensuring a seamless integration of CT concepts into existing topics. The accompanying resource book will parallel the structure of the mathematics textbook while incorporating targeted CT exercises in every chapter. This approach will allow teachers to naturally reinforce and expand CT skills as they progress through the mathematics curriculum.

10.2.3 Syllabus for early AI
Duration: 20 hrs

Class 6:

Sr. No.	Content	Hours
1	**Introduction to AI & Everyday Examples:** Understanding what AI is, Difference between AI and Automation; Comparison between human and machine intelligence; Introduction to AI concepts and its types (supervised, unsupervised, and reinforcement learning)	05
2.	**Basic Data Concepts:** Introduction to data types (numbers, text, images, sound); Simple data organisation and representation using tables or charts.	05

Sr. No.	Content	Hours
3	**Simple Pattern Recognition & Decision Making:** Identifying patterns in data or daily routines; Making simple decisions based on observations.	05
4	**Ethics and Digital Responsibility:** Basic online safety, privacy, passwords, and ethical use of technology; Understanding digital footprints.	05

Class 7:

Sr. No.	Content	Hours
1	**AI Domains**: Introduction to predictive techniques: classification, regression, and clustering, with hands-on practice applying them to a small dataset using AI tools. Understanding Computer Vision, Natural Language Processing (NLP), and Data Science; Examples like chatbots, image recognition, and translation tools.	05
2.	**AI in Industries:** Applications in healthcare, education, transport, and communication; How AI improves accuracy, efficiency, and productivity.	05
3	**Data Visualization & Analysis:** Collecting structured data; Creating bar charts, line graphs, or pie charts; Interpreting patterns.	05
4	**Ethics & AI Bias Awareness:** Introduction to bias in AI; Case examples; Responsible and fair use of AI; Digital citizenship.	05

Class 8:

Sr. No.	Content	Hours
1	**AI Project Lifecycle (Conceptual):** Understanding stages of AI projects – Define Problem, Collect Data, Test AI Tools, Reflect and Improve; How AI learns from patterns in data.	05
2	**Deeper Dive into AI Applications**: Exploring AI in the environment, healthcare, automation, and education; connecting AI systems to real-world problem-solving; hands-on experience with simple no-code AI tools (image classifiers, chatbots & data prediction apps).	05
3.	**Data and Fairness:** Understanding how AI uses data; Identifying bias in datasets; Simple strategies to ensure fairness and inclusivity.	05
4	**Ethics and Responsible AI:** Recognising privacy issues, misinformation, and social impact; Responsible use of AI and digital tools; Reflection on real-world challenges.	05

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