Technology & Engineering Topics
Grades 10-11

1. Engineering Design, Innovation, and Project Management

- Upper-secondary design cycle: define, research, ideate, prototype, test, iterate
- Human-centred design and problem definition: user needs, accessibility, usability, inclusivity, personas, use-cases, and user stories
- Design criteria, constraints, and trade-offs: cost, safety, performance, sustainability, accessibility, usability, and user needs
- Planning: timelines, milestones, risk management, and documentation
- Decision-making tools: weighted criteria matrices and design justification
- Verification vs validation: meeting specification vs meeting user need
- Iteration and improvement using test evidence
- Communicating designs through technical reports, diagrams, and annotated sketches

2. Programming, Software Engineering, and Testing

- Structured programming: sequence, selection, iteration in a high-level language
- Data structures: lists/arrays and introductory dictionaries/records where appropriate
- Functions/procedures, modular design, and code reuse
- String processing and file input/output at an introductory level
- Algorithm design and trace testing
- Debugging strategies: logic, runtime, edge cases
- Test planning: normal, edge, invalid cases and systematic verification
- Code readability, introductory version habits, and documentation

3. Computational Thinking and Algorithms

- Decomposition, abstraction, and modelling of complex problems
- Algorithmic patterns: searching, sorting concepts, introductory optimisation heuristics
- Efficiency ideas: comparing algorithm efficiency and identifying better vs worse approaches
- Boolean logic and introductory truth tables
- Pseudocode and flowcharts for complex workflows
- Simulation thinking: rules, state, iteration
- Correctness: checking whether an algorithm remains correct and using step-by-step reasoning
- Ethics in automated decision-making at an introductory level

4. Data, Databases, and Analytics for STEM Decisions

- Data types, quality, and cleaning: missing data, outliers, measurement error
- Project-level spreadsheets: formulas, functions, validation, charts
- Database concepts: tables, records, fields, keys
- Query thinking: filtering, sorting, and simple selection logic
- Visualisation choices: best chart for purpose and misleading visuals
- Interpreting trends and introductory correlation vs causation
- Bias in data and fairness: sampling, representation, measurement bias
- Data-driven decision making in STEM projects

5. Computer Systems, Networks, and Cybersecurity

- Hardware architecture: CPU, memory, storage, performance constraints
- Operating systems: processes, files, permissions at an introductory level
- Networking fundamentals: LAN/WAN, IP idea, client-server, protocols
- Web systems: requests/responses, hosting, latency concepts
- Cybersecurity threats: malware, phishing, social engineering, weak authentication, insecure networks, and unsafe sharing
- Security controls: updates, backups, encryption concept, MFA, access control, permissions, and incident prevention at an introductory level
- Privacy, digital footprint, and secure project practice
- Ethical and legal use of technology at an introductory level

6. Electronics, Embedded Systems, and Control

- Circuit fundamentals: voltage, current, resistance, safe working
- Series and parallel circuits and practical circuit analysis
- Sensors and actuators: measurement, calibration, thresholds
- Microcontrollers and embedded control at an introductory level
- Feedback and control loops: stability and tuning ideas
- Troubleshooting electrical and control faults using evidence
- Power, energy use, efficiency, and safety in devices
- Designing and testing a functional control-system prototype

7. Materials, Manufacturing, and CAD/CAM

- Material properties: strength, stiffness, toughness, conductivity, corrosion, sustainability
- Material selection using constraints, performance needs, repairability, and sustainability
- Manufacturing processes: forming, machining, joining, additive manufacturing
- Tolerances and fit: why precision matters
- CAD principles: dimensioned drawings, constraints, basic assemblies
- CAM/production planning: toolpath concept, build steps, quality checks
- Testing prototypes: strength, stability, wear, and refining design
- Sustainability in materials and manufacturing: life-cycle thinking, repairability, waste reduction, and environmental footprint

8. Mechanics, Robotics, and Systems Integration

- Mechanisms: gears, linkages, cams, belt/chain drives
- Mechanical advantage, torque, and speed-force trade-offs at an introductory level
- Robotics architecture: sense-think-act and subsystems
- Navigation and control: basic logic, calibration, error sources
- Reliability: failure modes and introductory redundancy concepts
- Integration: combining mechanical, electronic, and software subsystems
- Testing integrated systems: performance criteria and repeatability
- Safety and risk in automated systems

9. Emerging Technologies and Responsible Innovation

- AI systems overview: what they do and what they do not do
- Model limits: bias, model limitations, hallucinations, uncertainty, and overfitting at a very introductory level where appropriate
- Human-in-the-loop decision making and accountability
- Ethics: privacy, surveillance, fairness, safety, transparency
- Technology impacts: environmental footprint, labour, access, equity
- Standards and safety culture: testing, documentation, safety awareness, and standards awareness
- Responsible use of tools and sources: originality, attribution
- Risk-benefit analysis for technology adoption

10. STEM Media Analysis and Technical Communication

- Extracting claims, variables, and evidence from STEM media, technical diagrams, and demonstrations
- Distinguishing observation vs inference vs explanation
- Checking whether conclusions follow from evidence
- Identifying missing controls or alternative explanations
- Communicating findings: technical summaries, diagrams, brief reports
- Designing a follow-up test or prototype inspired by a STEM media example, diagram, or demonstration
- Presenting results clearly: data, conclusion, limitations
- Peer review: giving and receiving technical feedback