3 Engineering representations

Criteria	Range	Resource identified
3.1 Drawings and information conveyed by drawings.	Computer aided design models	https://www.autodesk.co.uk/solutions/cad-software https://www.hubs.com/knowledge-base/3d-modeling-cad-software/ https://www.bbc.co.uk/bitesize/guides/zffhsrd/revision/7
	Freehand sketching	https://www.youtube.com/watch?v=Ess0dmJB2lo https://engineeringdrawingbasics.com/free-hand-sketching-in-engineering-graphics/ https://www.bbc.co.uk/bitesize/guides/z6jkw6f/revision/3
	Orthographic projection (first angle, third angle, section, assembly, general arrangement)	https://www.makeuk.org/insights/blogs/how-to-read-engineering-drawings-a-simple-guide https://designmuseumfoundation.org/orthographic-projection/ https://technologystudent.com/designpro/ortho1.htm https://technologystudent.com/designpro/ortho2.htm https://engineeringdrawingbasics.com/sections-and-section-views-on-engineering-drawings/
	Exploded views	https://www.bbc.co.uk/bitesize/guides/zrx7xfr/revision/6 https://technologystudent.com/despro2/expld1.htm
	Block diagrams	https://www.tutorialspoint.com/control_systems/control_systems_block_diagrams.htm https://www.electronics-tutorials.ws/systems/closed-loop-system.html https://www.electronics-tutorials.ws/systems/electronic-system.html https://www.electronics-tutorials.ws/systems/open-loop-system.html https://www.bbc.co.uk/bitesize/guides/z7pbn9q/revision/1 https://electronicsclub.info/blockdiagrams.htm
	Flowcharts	https://en.wikipedia.org/wiki/Flowchart https://www.smartdraw.com/flowchart/flowchart-symbols.htm http://www.mrbillington.com/flowchart-programming.html https://www.instructables.com/Starting-programming-with-a-flow-chart/

	Circuit diagrams	https://electronicsclub.info/circuitsymbols.htm https://electronicsclub.info/circuitdiagrams.htm https://www.savemyexams.co.uk/notes/a-level-physics-cie/10-d-c-circuits/10-1-dc-practical-circuits-kirchhoffs-laws/10-1-1-circuit-symbols/ https://isaacphysics.org/concepts/cp_electrical_components?stage=all
	Schematics (wiring diagrams, pneumatics, hydraulics)	https://www.smartdraw.com/wiring-diagram/ https://www.youtube.com/watch?v=C2I68EUxJEc https://library.automationdirect.com/pneumatic-circuit-symbols-explained/ https://www.e4training.com/hyd_princip/hydraulic_symbols1.php
	Scale	https://sciencing.com/list-7612075-scales-used-technical-drawings.html https://www.engineeringtoolbox.com/scaling-blueprint-drawings-d_1704.html
	Title block	https://www.engineersedge.com/drafting/drawing_title_block.htm https://roymech.org/Useful_Tables/Drawing/Title_blocks.html https://www.makeuk.org/insights/blogs/how-to-read-engineering-drawings-a-simple-guide
	Projection symbols, view (elevation, plan, end, section, auxiliary)	https://www.sciencedirect.com/topics/engineering/angle-projection https://www.gdandtbasics.com/how-does-1st-angle-projection-work/ https://www.nda.ac.uk/blog/identify-plans-elevations-sections/
	Types of line (outlines, hidden detail, centre line, projection, dimension, leader, construction)	https://engineeringdrawingbasics.com/different-line-types-used-on-engineering-drawings/ https://www.cobanengineering.com/GeometricDimensioningAndTolerancing/TechnicalDrawingLines.asp https://en.wikipedia.org/wiki/Engineering_drawing

	Surface finish	https://www.gdandtbasics.com/basics-of-surface-finish/ https://www.theengineerspost.com/surface-finish-surface-roughness-symbols/
	Manufacturing detail	https://www.bluentcad.com/blog/difference-between-manufacturing-drawings-and-engineering-drawings/
	Standard features (screw threads, nuts, bolts, pins, repeated items, counterbore, countersink, centre mark)	http://engineeringessentials.com/ege5/files/ege/dim/dim_page4d.htm https://engineersbible.com/types-of-holes/ https://www.gdandtbasics.com/using-centerlines-correctly/ https://knowledge.autodesk.com/support/autocad/learn-explore/caas/CloudHelp/cloudhelp/2018/ENU/AutoCAD-Core/files/GUID-C078E9E4-FF38-4BA7-B72B-F2DAB92AFC99-htm.html
	Abbreviations (across flats, centre line, diameter, drawing, material, square, chamfer, countersunk, hexagon head, radius, thread, undercut, pitch circle diameter)	https://blog.draftsperson.net/acronyms-and-abbreviations-in-engineering/ https://en.wikipedia.org/wiki/Engineering_drawing_abbreviations_and_symbols https://www.cnclathing.com/guide/engineering-drawing-abbreviations-and-symbols-technical-mechanical-design-symbols-cnclathing

3.2 Dimensions and tolerancing on engineering drawings.	Dimensions (linear, diameter, radius, angular)	
	Tolerances	https://engineeringdrawingbasics.com/how-are-tolerances-shown-on-an-engineering-drawing/ https://fractory.com/engineering-tolerances/ https://www.smlease.com/entries/tolerance/limits-fit-and-tolerance/
	Limits and fits	https://www.joshuanava.biz/engineering-3/limits-and-fits.html https://roymech.org/Useful_Tables/ISO_Tolerances.html https://fractory.com/limits-and-fits/ https://en.wikipedia.org/wiki/Engineering_fit https://fractory.com/engineering-tolerances/ https://www.smlease.com/entries/tolerance/limits-fit-and-tolerance/
	Geometric dimensioning and tolerancing (GDT) symbols (datum, parallelism, perpendicularity, concentricity, straightness)	https://www.gdandtbasics.com/gdt-symbols/ https://en.wikipedia.org/wiki/Geometric_dimensioning_and_tolerancing