







Unit A: Fitting and Machining

Tool Summary Sheet

This Tool Summary Sheet serves as a quick reference guide for measuring, marking, cutting, finishing, and holding tools used in workshop setting. It helps participants understand the purpose and proper use for each tool, ensuring accuracy in their work while maintaining safety.





Important: This summary sheet is intended for learning and reference purposes only. It must not replace Safe/Standard Operating Procedures (SOPs), risk assessments, or relevant manuals. Always consult official documentation to ensure compliance with safety protocols.

Measuring Tools


Tool	Description	Purpose	Quick Step Guide
Steel Rule 	A flat, straight ruler made of stainless steel with etched markings in millimeters and inches.	Measures linear distances with precision.	<ol style="list-style-type: none">1. Place the steel rule flat on the surface to avoid errors.2. Align the zero mark with the starting point.3. Read the measurement from a direct overhead angle to prevent distortion.
Caliper 	Precision measuring tools with adjustable jaws for measuring external, internal, and depth dimensions.	Used for highly accurate measurements in mechanical and engineering work.	<ol style="list-style-type: none">1. Ensure the jaws are clean and calibrated before measuring.2. Gently slide the jaws over the object and apply light consistent pressure to get an accurate reading.3. Use the scale or digital display to note the measurement.
Engineers Square 	A hardened steel tool shaped like an L, used to check and mark right angles.	Ensures right-angle precision for accurate marking and cutting.	<ol style="list-style-type: none">1. Place the square against the edge of the material to check alignment.2. Use a scribe or pencil to mark a precise right angle.3. Double-check squareness before proceeding with cuts or assembly.
Combination Square 	A multi-purpose tool with a ruled blade and interchangeable heads (square, protractor, center finder).	Measures angles, checks squareness, depth, and 45° layout	<ol style="list-style-type: none">1. Slide the head to the required measurement along the rule.2. Lock in place using the knob.3. Use for measuring or checking angles, depths, or perpendicularity.



Measuring Tools







Tool	Description	Purpose	Quick Step Guide
Vernier Height Gauge 	A vertical measuring instrument with fine adjustment features.	Measures heights and distances with high precision.	<ol style="list-style-type: none">1. Place gauge on a stable surface.2. Adjust height to the measurement point.3. Lock and read scale.
Micrometer 	A measuring tool for fine tolerances.	Measures small dimensions with high precision.	<ol style="list-style-type: none">1. Position object between jaws.2. Rotate spindle until snug.3. Read measurement without excessive force.
Protractor 	A semicircular or circular tool.	Measures and marks angles.	<ol style="list-style-type: none">1. Align base with the reference edge.2. Position center at the angle vertex.3. Read and mark the correct angle.
Tape Measure 	A flexible measuring tape often housed in a retractable case.	Measures, lengths, widths, or heights of objects or spaces.	<ol style="list-style-type: none">1. Extend tape to the desired point.2. Hook or hold end securely.3. Read measurement from the marked scale.4. Retract tape carefully after use.

Marking Tools

Tool	Description	Purpose	Quick Step Guide
Scriber 	A sharp-pointed tool designed for marking fine lines on metal surfaces.	Creates fine, permanent lines for precise cutting and shaping.	<ol style="list-style-type: none">1. Hold the scriber at a low angle for a fine, clear mark.2. Apply steady pressure to score the surface without damaging it.3. Use a ruler or square as a guide for straight lines.4. Mark before applying machining processes to maintain reference lines.




Marking Tools





Tool	Description	Purpose	Quick Step Guide
Engineers Chalk (<i>Welder's Chalk / Soapstone</i>) 	A temporary marking tool that leaves bright and visible lines on surfaces.	Used for layout and alignment purposes before permanent marking.	<ol style="list-style-type: none">1. Rub chalk on an abrasive surface to sharpen for finer markings.2. Apply light strokes to avoid smudging.3. Use it for temporary layouts before making permanent markings.
Engineer's Blue (<i>Marking Ink</i>) 	A marking compound used in precision engineering and machining.	Used in metalworking layouts to create clear, visible markings before machining.	<ol style="list-style-type: none">1. Apply a thin, even layer on the workpiece.2. Use layout tools or templates to mark critical dimensions.3. Inspect markings to ensure proper alignment before machining.
Divider 	A tool with two pointed legs used for measuring and marking circles and distances.	Transfers measurements, marks circles, and sets distances for accurate layouts.	<ol style="list-style-type: none">1. Set the desired distance by adjusting the legs carefully.2. Place one leg firmly at the starting point while pivoting the other.3. Use for marking circles or transferring measurements precisely.
Centre Punch 	A pointed tool used before drilling.	Creates indentations to guide drill bits.	<ol style="list-style-type: none">1. Position at the marking point.2. Strike firmly with a hammer.3. Ensure indentation is deep enough.
Number/Letter Punch Set 	Engraved metal punches.	Stamps permanent markings on metal.	<ol style="list-style-type: none">1. Position punch correctly.2. Hold firmly and strike with a hammer.3. Check impression for clarity.
Permanent Marker Pen 	A felt-tip pen that leaves bold, high-contrast ink marks on various surfaces.	Used for quick, visible layout lines or labelling non-critical areas.	<ol style="list-style-type: none">1. Shake if required and uncap the pen.2. Mark directly onto clean, dry surfaces.3. Use for general layout or labelling; avoid on hot or oily surfaces.



Marking Tools








Tool	Description	Purpose	Quick Step Guide
Ball Pein Hammer 	A striking tool with a flat face for general use and a rounded pein for shaping metal.	Used for striking punches, shaping metal, and light assembly tasks.	<ol style="list-style-type: none">1. Select the correct hammer size.2. Grip handle firmly near the end for control.3. Strike tool or surface with controlled force using the flat face.4. Use the mounded pein for shaping or peening metal edges.

Cutting & Finishing Tools

Tool	Description	Purpose	Quick Step Guide
Centre Drill 	A small, stiff drill bit.	Creates starter holes for drilling.	<ol style="list-style-type: none">1. Align drill with mark.2. Drill slowly for precision.3. Switch to a regular drill bit for the final hole.
Twist Drill Set 	Spiral-fluted drill bits.	Drills holes in metal, plastic, and wood.	<ol style="list-style-type: none">1. Secure material before drilling.2. Use correct drill bit size.3. Apply steady pressure while drilling.
Hole Debur Tool 	A rotating tool for smoothing edges.	Removes sharp burrs from drilled holes.	<ol style="list-style-type: none">1. Insert tool into hole.2. Rotate smoothly around edge.3. Inspect for clean finish.
Hacksaw 	A handheld cutting tool.	Cuts metal, plastic, and wood.	<ol style="list-style-type: none">1. Secure material properly.2. Use steady strokes with minimal pressure.3. Keep blade tension correct.







Cutting & Finishing Tools

Tool	Description	Purpose	Quick Step Guide
Flat File 	A rectangular file with flat surfaces.	Smooths and shapes flat metal or wood surfaces.	<ol style="list-style-type: none">1. Hold file with both hands.2. Push forward with even pressure.3. Lift on return stroke to avoid dulling.
Half-Round File 	A file with one flat and one curved surface.	Shapes both flat and concave surfaces; ideal for internal curves.	<ol style="list-style-type: none">1. Choose flat or curved side as needed.2. File in one direction with light pressure.3. Clean teeth regularly.
Round File 	A cylindrical file, often tapered.	Enlarges round holes and smooths curved grooves or internal radii.	<ol style="list-style-type: none">1. Insert into hole or groove.2. Rotate or push-pull gently.3. Use progressively finer files for smooth finish.
Emery Paper 	A flexible abrasive paper coated with emery mineral.	Smooths, polishes, and removes fine imperfections from metal surfaces.	<ol style="list-style-type: none">1. Select appropriate grit for the task.2. Wrap around a block or use by hand.3. Sand in one direction for a consistent finish.4. Wipe surface clean after sanding.
Hole Chamfer Tool 	A tool designed to bevel hole edges.	Smooths sharp edges and prepares surfaces for fasteners.	<ol style="list-style-type: none">1. Insert chamfer tool into the drilled hole.2. Rotate smoothly to create a clean, beveled edge.3. Inspect for depth and repeat for a uniform finish.
Countersinks 	A cutting tool that enlarges and bevels hole edges.	Prepares holes for flush-fitting screws or bolts.	<ol style="list-style-type: none">1. Select the correct countersink tool size.2. Align tool with hole and apply steady pressure.3. Rotate to achieve a smooth, chamfered edge, checking depth periodically.
Hand Deburring Tool 	A handheld tool with a rotating blade or scraper tip.	Removes burrs and sharp edges from holes, cuts, or machined surfaces.	<ol style="list-style-type: none">1. Secure the workpiece in a vice or clamp.2. Insert the blade into the burr area.3. Rotate or scrape gently to remove sharp edges.4. Inspect and repeat if needed for a smooth finish.








Cutting & Finishing Tools

Tool	Description	Purpose	Quick Step Guide
Angle Grinder 	Handheld power tool with rotating abrasive disc.	Cut, grind, polish, or remove rust from metal surfaces.	<ol style="list-style-type: none">1. Choose correct disc type.2. Secure material and wear PPE.3. Hold at 15–30° angle and gently engage surface.4. Let disc do the work – avoid forcing.
Cold Saw 	Circular saw with toothed blade and coolant system.	Make precise, burr-free cuts in metal with minimal heat.	<ol style="list-style-type: none">1. Clamp material securely.2. Select correct blade and speed.3. Start coolant flow.4. Lower blade slowly to cut.
Metal Cut-Off Saw 	Abrasive saw with pivoting arm and clamping base.	Cut through metal pipes, rods, and profiles.	<ol style="list-style-type: none">1. Clamp workpiece firmly.2. Select correct abrasive disc.3. Power on and let blade reach full speed.4. Lower blade steadily to cut.
Cordless Drill 	Battery-powered drill with variable speed and torque settings.	Drill holes or drive screws into various materials.	<ol style="list-style-type: none">1. Insert correct bit.2. Adjust speed/torque.3. Secure material.4. Drill or drive with steady pressure.5. Reverse if removing screws.





Holding Tools



Tool	Description	Purpose	Quick Step Guide
Bench Vice 	A sturdy clamp mounted on a workbench.	Holds workpieces securely for cutting, drilling, or filing.	<ol style="list-style-type: none">1. Open jaws and position material properly.2. Tighten securely for a firm grip.3. Ensure stability before working.
Machine Vice 	A heavy-duty clamping device mounted on machine tables.	Holds workpieces securely during machining operations like drilling or milling.	<ol style="list-style-type: none">1. Mount vice on machine table.2. Align jaws.3. Insert workpiece.4. Tighten jaws.
G-Clamp 	A C-shaped clamp with a threaded screw for tightening.	Temporarily holds materials together during gluing, cutting, or drilling.	<ol style="list-style-type: none">1. Open jaws.2. Position over workpiece.3. Tighten screw until secure.
F-Clamp 	A clamp shaped like an "F" with a sliding arm and screw mechanism.	Clamps larger or irregular objects; ideal for woodworking and metalworking.	<ol style="list-style-type: none">1. Slide jaw to fit.2. Position clamp.3. Tighten screw to secure.
V Block 	A precision metal block with V-shaped groove.	Holds cylindrical workpieces steady during inspection and machining.	<ol style="list-style-type: none">1. Place V block on flat surface.2. Insert round object.3. Secure with clamp if needed.



Holding Tools







Tool	Description	Purpose	Quick Step Guide
Parallel Blocks 	Matched steel blocks with precise flat surfaces and equal height.	Support workpieces parallel to the machine table or vice jaws.	<ol style="list-style-type: none">1. Place blocks in vice.2. Rest workpiece on top.3. Clamp gently.
Soft Jaws / Vice Liners 	Removable jaws covers made of soft material like aluminum or plastic.	Protect delicate workpieces from damage during clamping.	<ol style="list-style-type: none">1. Insert liners into vice.2. Place workpiece.3. Tighten vice as usual.

Threading & Fastening

Tool	Description	Purpose	Quick Step Guide
Die and Die Stock 	A hardened steel tool used to cut external threads; the die stock holds the die securely for manual operation.	Cuts external threads on rods, bolts, or shafts.	<ol style="list-style-type: none">1. Secure the rod or shaft in a vice.2. Insert the die into the die stock and tighten,3. Align the die square to the rod and apply cutting oil.4. Rotate the die stock clockwise to start threading.5. Reverse every few turns to clear chips and reduce strain.6. Continue until desired thread length is reached.
Thread Gauge 	A handheld tool with multiple blades or leaves, each marked with a thread pitch.	Identifies the pitch and type of threads on screws, taps, or holes.	<ol style="list-style-type: none">1. Select the correct gauge leaf for the thread type (metric or imperial).2. Match the leaf to the thread by sliding it into the grooves.3. Read the pitch marking on the leaf that fits snugly.4. Record or compare the pitch to select the correct tap or fastener.








Threading & Fastening

Tool	Description	Purpose	Quick Step Guide
Taps 	Thread-cutting tools for internal threads in holes.	Forms screw threads for bolts and fasteners.	<ol style="list-style-type: none">1. Choose the correct tap size for the hole.2. Apply tapping compound to reduce friction and prevent breakage.3. Turn the tap slowly while maintaining straight alignment.
Tap Handle 	A tool used to manually hold and turn taps.	Provides controlled threading in drilled holes.	<ol style="list-style-type: none">1. Secure the tap in the handle for stability.2. Align tap with hole and apply downward pressure.3. Rotate steadily to cut clean internal threads.
Tap Guide Block 	A block with precision holes to guide taps during threading.	Keeps taps straight to prevent breakage and ensure accurate threads.	<ol style="list-style-type: none">1. Select the correct hole size for your tap.2. Place the block over the drilled hole.3. Insert tap through the guide and begin tapping.4. Remove guide once thread is started.5. Finish tapping as needed.
Bolts 	Threaded fasteners with a head, used with nuts or threaded holes.	Joins two or more parts together using a nut or threaded hole.	<ol style="list-style-type: none">1. Select the right size and type of bolt.2. Insert bolt through aligned holes.3. Secure with a nut or thread into a tapped hole.4. Tighten using a wrench or spanner.
Nuts 	Hexagonal metal blocks with internal threads.	Secure bolts or threaded rods in place.	<ol style="list-style-type: none">1. Choose the correct size to match the bolt.2. Screw onto the bolt's thread.3. Tighten using a spanner or socket tool.
Washers 	Thin, round metal discs with a central hole.	Distribute load and prevent damage when tightening fasteners.	<ol style="list-style-type: none">1. Place washer over the bolt before the nut.2. Position it between the surface and the nut/bolt head.3. Tighten nut or bolt as usual.






Threading & Fastening

Tool	Description	Purpose	Quick Step Guide
Spanners 	Hand tools with open or ring ends, sized to fit nuts and bolts.	Tighten or loosen nuts and bolts.	<ol style="list-style-type: none">1. Select the correct size spanner.2. Fit it snugly on the nut or bolt head.3. Turn to tighten or loosen as needed.
Screws 	Threaded fasteners with slotted or cross-shaped heads.	Join materials together, often with a screwdriver.	<ol style="list-style-type: none">1. Choose the correct length and type.2. Align it with the material.3. Turn with screwdriver to insert.
Screwdrivers 	Tools with shaped tips to match screw heads.	Drive screws in or out of materials.	<ol style="list-style-type: none">1. Match the tip to the screw type (flat, Phillips, etc.).2. Press into the screw head.3. Turn to tighten or loosen.
Allen Keys 	L-shaped hexagonal tools used with hex socket screws.	Tighten or loosen hex screws found in machinery or furniture.	<ol style="list-style-type: none">1. Select the correct size.2. Insert into the hex socket.3. Turn gently to tighten or remove.
Cordless Drill  Note: While commonly used for fastening tasks, the cordless drill can also be classified under Cutting Tools category due to its ability to drill holes , which involves material removal.	Battery-powered tool with variable speed, torque settings, and interchangeable bits.	Drill holes, drive screws, and tighten/loosen bolts with socket adapters, quickly and efficiently.	<ol style="list-style-type: none">1. Insert appropriate bit: drill bit for holes, driver bit for screws, socket for bolts, tap for threading.2. Set torque and speed based on task and material.3. For drilling: mark spot, apply steady pressure, and drill to required depth.4. For screws/bolts: align bit with head, press trigger to drive or remove.5. For tapping: use cutting fluid, align tap straight, run drill slowly forward, reverse periodically to clear chips.6. Use reverse setting to loosen or extract fasteners or taps.7. Always wear safety gear and check battery charge before starting.



Lubrication & Cooling Tools

Tool	Description	Purpose	Quick Step Guide
Cutting Fluid 	A specialized fluid used during machining to cool, lubricate, and flush away chips.	Enhances cutting performance by reducing heat, friction, and tool wear.	<ol style="list-style-type: none">1. Select appropriate fluid for the material and operation.2. Apply directly to the cutting zone during machining.3. Maintain proper flow and cleanliness to ensure effectiveness.4. Dispose of used fluid safely according to workshop protocols.
Tapping Compound (or Cutting Paste) 	A lubricant designed for tapping and threading.	Reduces friction and improves cutting efficiency.	<ol style="list-style-type: none">1. Apply compound to tap and hole.2. Begin threading with slow, steady turns.3. Reapply as needed for smooth operation.
Coolant 	A fluid used in machining to reduce heat and friction.	Prevents overheating and increases tool lifespan.	<ol style="list-style-type: none">1. Apply coolant while machining.2. Ensure steadily flow for optimal cooling. <p>Clean residue after use to prevent buildup.</p>



Additional Notes & Observations