Chapter 6: Advance Super Finishing Technology

Repeated Questions:

1. Lapping, Honing, Buffing and Polishing:

- **Q.** Explain/Differentiate between Lapping, Honing, Buffing, and Polishing. **(WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks)**

Answer:

Process	Abrasive/Medium	Purpose	Typical Application
Lapping	Fine abrasive powder in paste/vehicle between lap and workpiece	Correct flatness, size, and very fine finish	Gauge blocks, valve seats, optical flats
Honing	Bonded abrasive stones in a rotating/reciprocating hone	Correct hole geometry, cylindricity, and finish	Engine cylinders, gun barrels, bearings
Buffing	Soft cloth wheel with fine abrasive compound	Remove fine scratches; produce bright/glossy surface	Decorative parts, plated surfaces
Polishing	Abrasive grains on wheels/belts or loose abrasive	Reduce roughness; improve surface appearance	Tools, dies, automotive trim

- **Key Difference:** Lapping uses loose abrasive for flat/precision surfaces; honing uses bonded stones for internal cylindrical surfaces; buffing gives high gloss; polishing reduces roughness.

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2. Burnishing:

- **Q.** Explain the Burnishing process with a neat sketch. **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks OR)**

Answer:

- **Definition:** Burnishing is a surface finishing process in which a hard tool (roller or ball) is pressed against a metal surface and moved over it to plastically deform surface peaks into valleys, producing a smooth, work-hardened surface without removing material.

Process Steps:

- Surface is cleaned and pre-machined to suitable roughness.
- A hardened roller or ball is pressed against the surface with controlled force.
- The tool is fed along the surface; peaks are flattened by plastic deformation.
- Surface roughness decreases; surface layer is cold-worked.
- Lubricant is used to reduce friction and prevent pickup.

Types:

- **Roller Burnishing:** Rollers pressed against external/internal surfaces.
- **Ball Burnishing:** Balls pressed into surface; used for complex shapes.

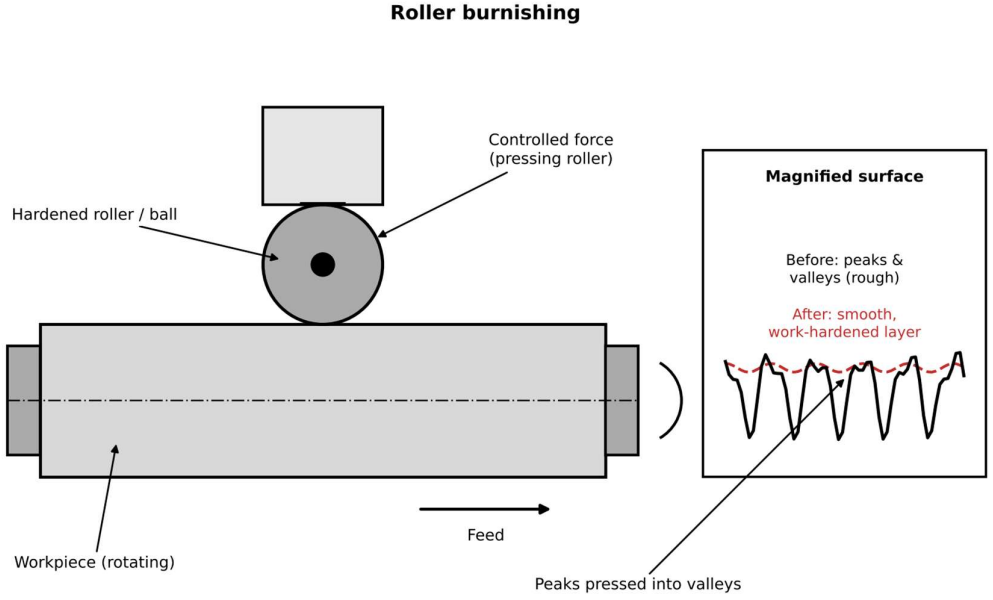
Advantages:

- Improves surface finish and fatigue strength.
- Induces compressive residual stresses; increases wear resistance.
- No material removal; dimensional change is small.

Limitations:

- Requires prior smooth surface; not for brittle materials.
- Force control is critical; excessive force may damage surface.
- **Applications:** Shafts, bores, hydraulic cylinders, bearing seats, aircraft components.

Diagram Description: A hardened roller pressed against a cylindrical workpiece; the roller flattens surface peaks; a magnified view shows peaks deformed into valleys, forming a smooth work-hardened layer.



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3. Need for Surface Finish:

- **Q.** Why do we require high-quality surface finish components? **(SUMMER 2023, 3 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 4 Marks OR)**

Answer:

Need for High-Quality Surface Finish:

- **Functional Performance:** Reduces friction, wear, and noise in moving parts.
- **Fatigue Strength:** Smooth surfaces reduce stress concentration and crack initiation.
- **Corrosion Resistance:** Fewer surface defects reduce corrosion sites.
- **Dimensional Accuracy & Fit:** Improves sealing, mating, and interchangeability.
- **Aesthetic Appeal:** Better appearance for consumer products.

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4. Barrel Tumbling:

- **Q.** Illustrate Barrel Tumbling process with a neat sketch. **(WINTER 2022, 7 Marks; SUMMER 2025, 7 Marks)**

Answer:

- **Definition:** Barrel tumbling is a mass finishing process in which parts are placed in a rotating barrel with abrasive media and compound; relative motion deburrs, cleans, and polishes surfaces.

Process Steps:

- Parts, abrasive media (ceramic/plastic chips), water, and compound are loaded into a barrel.

- Barrel is rotated at controlled speed.
- Parts and media tumble, rub, and impact each other.
- Burrs are removed; edges rounded; surface smoothed.
- Parts are separated from media, cleaned, and dried.

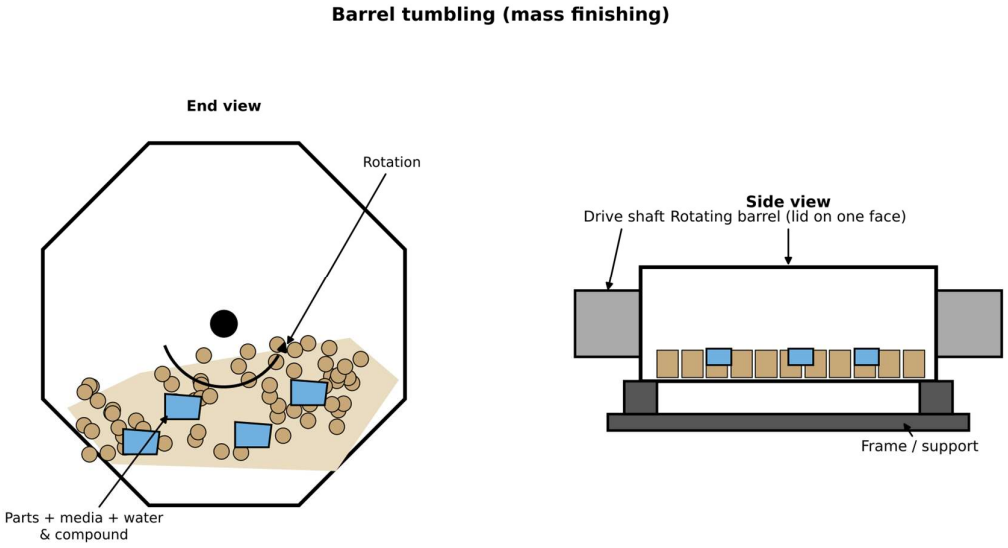
Advantages:

- Economical for batch processing of small parts.
- Uniform finishing of complex shapes; no special tooling.
- Suitable for deburring, descaling, and polishing.

Limitations:

- Slow process; not for large parts.
- Difficult to control selective finishing.
- Media wear and disposal required.
- **Applications:** Fasteners, castings, stamped parts, jewelry, machine components.

Diagram Description: A hexagonal or octagonal barrel mounted on a rotating frame; inside are parts, abrasive media, and water; rotation causes tumbling action; arrows show barrel rotation and media movement.



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5. Super Finishing Processes and Selection:

- **Q.** Enlist types of super finishing processes. Discuss the selection criteria. **(SUMMER 2022, 7 Marks; WINTER 2025, 7 Marks)**

Answer:

Types of Super Finishing Processes:

- Honing
- Lapping
- Superfinishing (microhoning)
- Buffing
- Polishing
- Burnishing
- Barrel tumbling
- Abrasive flow machining

Selection Criteria:

- **Required Surface Finish:** Choose process based on target Ra (e.g., lapping for very fine finish).
- **Tolerance & Geometry:** Flat surfaces → lapping; internal cylinders → honing; complex shapes → abrasive flow.
- **Material:** Hard/brittle materials suit lapping/honing; ductile materials suit burnishing.
- **Production Quantity:** Barrel tumbling for batch small parts; honing for high-volume cylinders.
- **Accessibility:** Internal/remote surfaces may require abrasive flow or honing.
- **Surface Integrity:** Burnishing induces compressive stresses; lapping/honing remove material.
- **Cost & Equipment:** Consider tooling cost, cycle time, and automation.
- **Prior Machining:** Process selected must suit pre-machined roughness and stock allowance.

Other Important Questions:

1. Comparison of Finishing Processes:

- **Q.** Compare various surface finishing processes in terms of tolerance and roughness. **(SUMMER 2023, 3 Marks)**

Answer:

Process	Typical Roughness Ra	Typical Tolerance/Control	Main Use
Lapping	0.05–0.4 µm	High flatness and size control	Precision flat surfaces
Honing	0.1–1.0 µm	Good cylindricity and hole size	Internal cylinders
Superfinishing	0.01–0.2 µm	Very fine finish; low stock removal	Bearing races, journals
Polishing/Buffing	0.05–0.5 µm	Appearance/gloss; limited size control	Decorative surfaces

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- **Q.** How does superfinishing differ from honing? **(SUMMER 2023, 4 Marks)**

Answer:

Feature	Superfinishing	Honing
Abrasive Motion	Rapid oscillation + slow rotation; short strokes	Rotating and reciprocating bonded stones
Pressure & Speed	Very low pressure, high frequency	Higher pressure, lower frequency
Stock Removal	Very small; mainly surface refinement	Removes more stock; corrects geometry
Application	Bearing races, journals; removes amorphous layer	Engine cylinders, bores; improves cylindricity

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2. Super Finishing Processes:

- **Q.** State various super finishing processes. Explain any one super finishing process with neat sketch. **(SUMMER 2026, 7 Marks)**

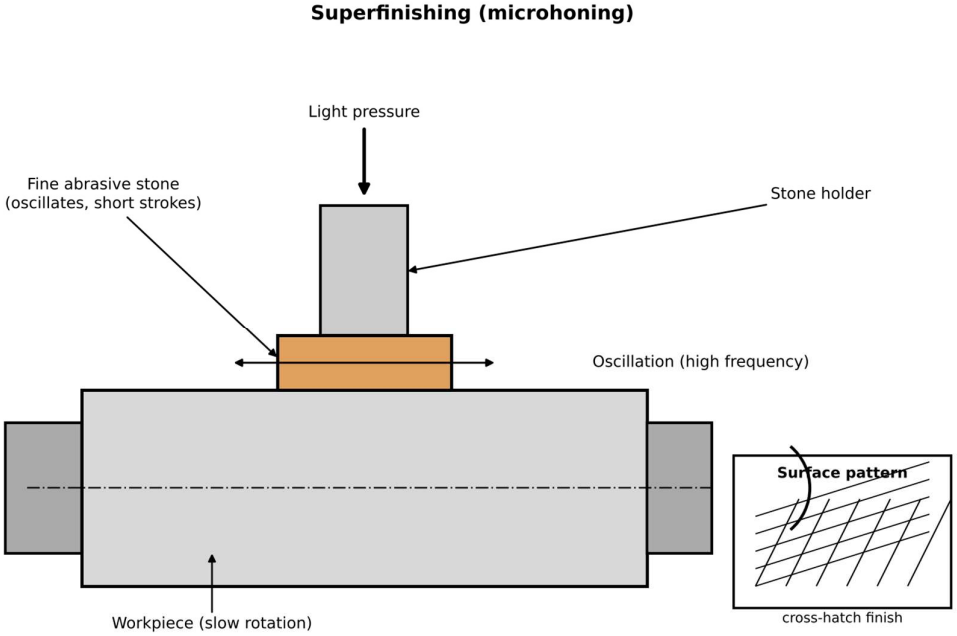
Answer:

- **Various Super Finishing Processes:** Honing, lapping, superfinishing (microhoning), buffing, polishing, burnishing, barrel tumbling, abrasive flow machining.

Superfinishing (Microhoning):

- Uses a fine abrasive stone pressed lightly against a rotating workpiece.
- Stone oscillates rapidly with short strokes while workpiece rotates slowly.
- Low pressure and high frequency produce a very fine cross-hatch finish.
- Removes fragmented/amorphous surface layer; improves fatigue life.
- Used for bearing races, crankshaft journals, hydraulic rods.

Diagram Description: A fine abrasive stone pressed against a rotating cylindrical workpiece; the stone oscillates axially with short strokes; cross-hatch pattern formed on surface; low-pressure contact shown.



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3. Coating Processes:

- **Q.** Elaborate on powder coating process in brief. **(SUMMER 2026, 4 Marks)**

Answer:

Powder Coating Process:

- **Pre-treatment:** Surface is cleaned, degreased, and phosphated for adhesion.
- **Powder Application:** Dry powder (epoxy/polyester) is electrostatically sprayed onto the grounded part; powder adheres by electrostatic attraction.
- **Curing:** Coated part is heated in an oven; powder melts, flows, and cross-links into a continuous film.
- **Cooling & Inspection:** Coating solidifies; thickness and appearance inspected.
- **Advantages:** No solvent emissions; thick durable coating; good corrosion resistance.
- **Applications:** Appliances, automotive parts, furniture, architectural profiles.

- **Q.** What are the applications of ceramic coating? **(SUMMER 2026, 3 Marks OR)**

Answer:

Applications of Ceramic Coating:

- **Thermal Barrier Coatings:** Gas turbine blades, engine components to reduce heat transfer.
- **Wear Resistance:** Cutting tools, dies, pumps, and machine parts.
- **Corrosion Protection:** Chemical vessels, pipelines, marine components.
- **Electrical Insulation:** Substrates, insulators, electronic components.
- **Aerospace & Automotive:** Exhaust parts, piston crowns, brake components.

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