GUJARAT TECHNOLOGICAL UNIVERSITY

BE-4 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK SOLUTION

Subject Name & Code:
Manufacturing Processes (3141908)

UNIT 8: Grinding Machines

Q.1 – How grinding wheel is specified? / Explain Indian standard marking system for grinding wheels. (7 marks)
Appeared in: S25(3), S24(7), S23(7), W24(7), W23(4) → Highest: 7 marks
Ans:
Indian standard (IS 551) marking system for grinding wheels specifies eight parameters:
Sequence:
Prefix (manufacturer's symbol) – **Abrasive** – **Grain size** – **Grade** – **Structure** – **Bond type** – **Manufacturer's record**
Example: A 46 K 5 V 17

Code	Meaning
A	Aluminium oxide (abrasive)
46	Grain size (medium)
K	Grade (medium soft)
5	Structure (dense)
V	Vitrified bond
17	Manufacturer's symbol

Abrasive types: A – Al_2O_3, C – Silicon carbide, D – Diamond
Grain size: Coarse (8–24), Medium (30–60), Fine (70–180)
Grade: Soft (A–H), Medium (I–P), Hard (Q–Z)
Structure: 1 (dense) to 15 (open)
Bond: V – Vitrified, B – Resinoid, R – Rubber, E – Shellac, M – Metal
Real-world application: Select 46K5V for general tool grinding; 60K8V for finishing.

Q.2 – Explain dressing and truing of grinding wheel. (4 marks)
Appeared in: S25(4), S23(4), W24(4), W23(4)
Ans:

Operation	Purpose	Tool used

Operation	Purpose	Tool used
Dressing	Remove loaded material & resharpens abrasive grains, restores cutting ability	Diamond dresser, Star dresser
Truing	Corrects wheel shape (cylindricity, runout) to make it concentric with spindle	Diamond tool traverse

Process:

- Dressing: A diamond tool is fed across wheel face at small depth (0.02–0.05 mm).
- Truing: Same diamond tool but multiple passes to correct geometry.

Real-world: Dressing performed every 10–20 parts to maintain surface finish.

Q.3 – Explain grinding wheel characteristics and wheel selection procedure in detail. (7 marks)

Appeared in: W25(7), W23(7), W22(7)

Ans:

Characteristics of grinding wheel:

1. **Abrasive material** – Al_2O_3 (steel), SiC (cast iron, carbide), CBN (hard steels), Diamond (carbides)
2. **Grain size** – Coarse (rapid stock removal), Fine (finish)
3. **Grade (hardness)** – Soft wheel for hard materials (self-sharpening), Hard wheel for soft materials
4. **Structure** – Open for soft materials (chip clearance), Dense for hard materials
5. **Bond type** – Vitrified (common), Resinoid (cut-off wheels), Rubber (flexible)

Wheel selection procedure:

1. **Material to grind:** Steel → Al_2O_3; Carbide → Diamond.
2. **Stock removal & finish:** Roughing → Coarse grit (24–36), Finishing → Fine (60–80).
3. **Wheel hardness:** Hard material → Soft grade (J–K); Soft material → Hard grade (L–N).
4. **Operation type:** Surface grinding → Medium structure; Cylindrical → Dense structure.
5. **Machine rigidity:** Rigid → Hard wheel; Flexible → Soft wheel.

Example: Grinding HSS tool bit on bench grinder: A 46 K 5 V.

Q.4 – Explain types of grinding wheel and its selection process. (4 marks)

Appeared in: S22(4), W24(4)

Ans: (Brief version of Q.71)

Types:

- Straight wheel
- Cylinder wheel
- Tapered wheel (type 4)
- Cup wheel (for tool grinding)
- Dish wheel
- Cut-off wheel

Selection process: Match abrasive, grain size, grade, structure, bond to workpiece material and operation.

Q.5 – Describe coding of grinding wheel as per ISI. (3 marks)

Appeared in: S25(3), W25(4) → Use 4 marks? Highest is 4 from W25. But separate from Q.69? Q.69 already 7 marks covering ISI. So to avoid duplication, answer concisely.

Ans:

ISI code (IS 551) format:

[Abrasive] [Grain size] [Grade] [Structure] [Bond]

Example: A 46 K 5 V

- A = Al_2O_3, 46 = medium grain, K = medium soft, 5 = dense, V = vitrified.
  Full code may include manufacturer prefix and suffix.

Q.6 – Define dressing of grinding wheel. Which operation alters shape of grinding wheel? (3 marks)

Appeared in: W25(3)

Ans:

Dressing: Process of removing dull grains and loading from wheel face to restore cutting action.

Operation that alters shape: Truing (corrects wheel geometry, e.g., makes it round and concentric).

Note: Dressing changes surface topography, not shape; Truing changes shape.

Q.7 – Explain centerless grinders along with advantages and limitations. (4 marks)

Appeared in: W25(4), W22(4)

Ans:

Centerless grinding: Workpiece is not held between centres but supported by:

- **Regulating wheel** (controls rotation & feed)
- **Grinding wheel** (does actual cutting)
- **Work rest blade** (supports from below)

Working principle:

- Workpiece placed between wheels.
- Grinding wheel rotates at high speed; regulating wheel rotates slower (0.1–10 m/min).
- Axial feed by tilting regulating wheel.

Advantages:

- High production (1000+ parts/hour)
- No centering needed
- Suitable for long thin parts

Limitations:

- Cannot grind non-cylindrical shapes
- Costly setup for small batches
- Less accurate for interrupted surfaces

Real-world application: Needle roller bearing pins (mass production).

Q.8 – Describe cylindrical grinding machine with sketch. (4 marks)

Appeared in: S22(4)

Ans:

Construction:

- Heavy bed with headstock (work rotating) and tailstock.
- Wheelhead (with grinding wheel) moves on cross & longitudinal slides.
- Internal grinding attachment optional.

Working:

- Workpiece rotates between centres or on chuck.
- Wheel rotates at high speed (1500–3000 rpm).

- Wheelhead traverses back & forth (longitudinal feed).

[DG]

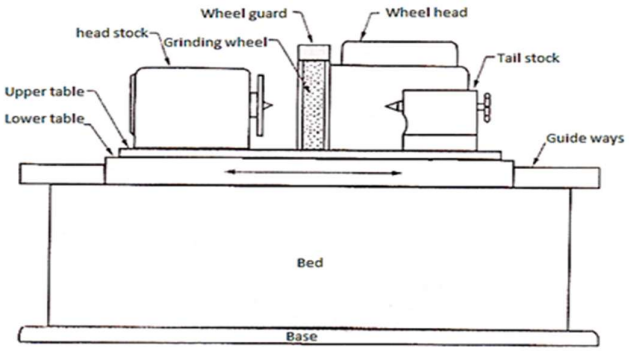


Fig.8.7 – Plain Cylindrical Grinders

Applications: Grinding journal diameters of crankshafts, piston rods.

Q.9 – Illustrate surface grinding machine with neat sketch. (7 marks)

Appeared in: S22(7), W23(7)

Ans:

Two types: Reciprocating table & Rotary table.

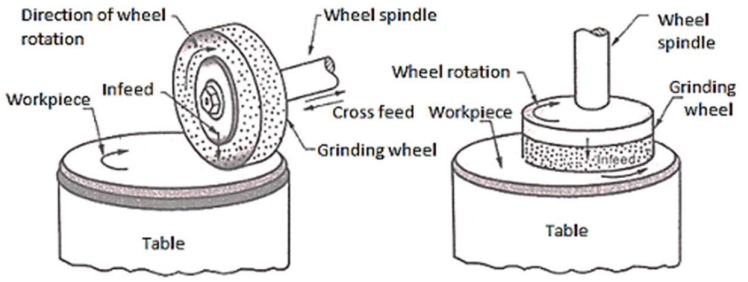
Construction (reciprocating type):

- Base with horizontal table (reciprocates).
- Column with vertical spindle (or horizontal spindle).
- Grinding wheel mounted on spindle.

Working:

- Workpiece clamped on magnetic chuck.
- Table moves left–right (longitudinal feed).
- Wheelhead moves cross & vertical increments.

[DG]



a. *Horizontal spindle rotary table surface grinder*

b. *Vertical spindle rotary table surface grinder*

Fig.8.13 – Surface grinders

Applications:

- Flat surfaces of dies, mould plates
- Precision gauge blocks (finish Ra 0.1 µm)

Advantages: High surface finish, tight tolerances (±0.005 mm).

Limitations: Only flat surfaces; slow for heavy stock removal.

Q.10 – Explain different types of grinding processes. (3 marks)

Appeared in: W22(3)

Ans:

Grinding processes classified by surface generated:

1. **Surface grinding** – Flat surfaces (peripheral or face grinding)
2. **Cylindrical grinding** – External & internal diameters
3. **Centerless grinding** – Through-feed, in-feed
4. **Tool & cutter grinding** – Sharpening drills, end mills
5. **Creep feed grinding** – Deep cuts, low feed (high MRR)
6. **Form grinding** – Contoured shapes

****