GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Name & Code:
Manufacturing Processes (3141908)

UNIT 3: Drilling Machines

Q.1 – Enumerate different types of drilling machines and their particular functions. (3 marks)
Appeared in: S25(3)
Ans:

Type	Function
Portable (hand) drill	Small holes in assembled structures
Bench drill	Light duty, workshop
Pillar drill	Medium holes (up to 25 mm)
Radial drill	Large workpieces with movable arm
Gang drill	Multiple spindles for sequential operations
Multi-spindle drill	Many holes simultaneously in mass production

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Q.2 – Explain any four operations carried out on radial drilling machine. (4 marks)
Appeared in: S25(4), S22(4), W22(4)
Ans:
Radial drilling machine operations:

1. **Drilling** – creating hole with twist drill
2. **Reaming** – finishing hole to precise diameter
3. **Counterboring** – enlarging top portion for bolt head
4. **Tapping** – cutting internal threads

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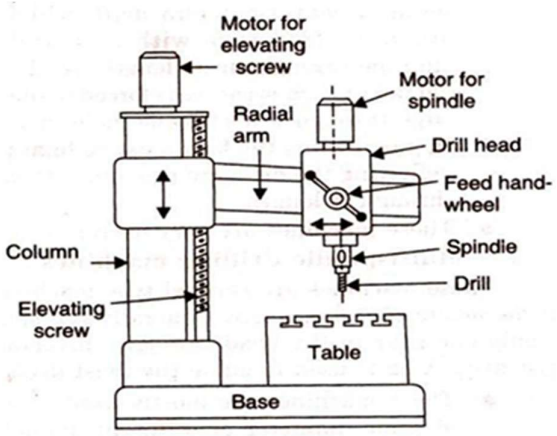


Fig.3.4 Radial Drilling Machine

Real-world application: Flange holes on heavy pump casing (radial drill arm can reach any point).

Q.3 – Describe steps involved in performing an alignment test on a drilling machine. (7 marks)
Appeared in: S25(7)
Ans:
Alignment tests on drilling machine (IS 2527):

1. **Test for perpendicularity of drill spindle to table**
   - Place square on table. Mount dial gauge on spindle.
   - Rotate spindle 180°, observe deviation.
   - Permissible: 0.05 mm over 200 mm.
2. **Test for spindle runout**
   - Insert test bar in taper. Dial gauge near arbor.
   - Rotate spindle; max runout ≤ 0.02 mm.
3. **Test for column verticality**
   - Keep level on column guideways. Measure tilt.

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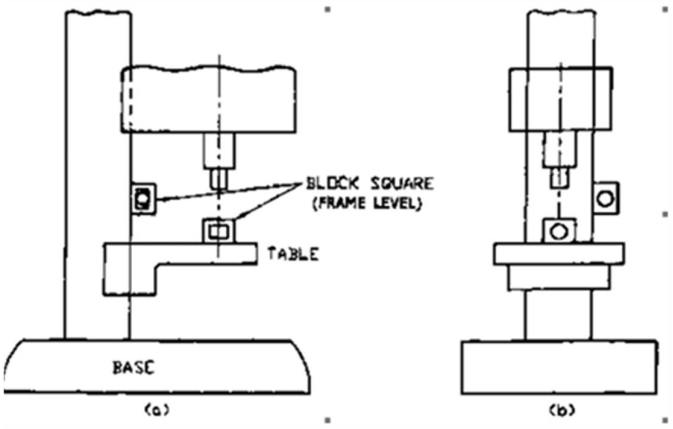


Fig.3.20 Perpendicularity of drill head guide with table

Real-world: After heavy use, realignment ensures accurate drilling.

Q.4 – Explain radial drilling machine with neat sketch. (7 marks)
Appeared in: S24(7), W25(4), W24(7) → Highest: 7 marks
Ans:

Construction:

- Base (heavy cast iron)
- Column (vertical cylindrical)
- Radial arm (can move up/down & rotate)
- Drilling head (motor, gearbox, spindle) moves horizontally on arm.

Working:

- Workpiece clamped on base.
- Arm adjusted to reach exact hole location.
- Drill head fed manually or automatically.

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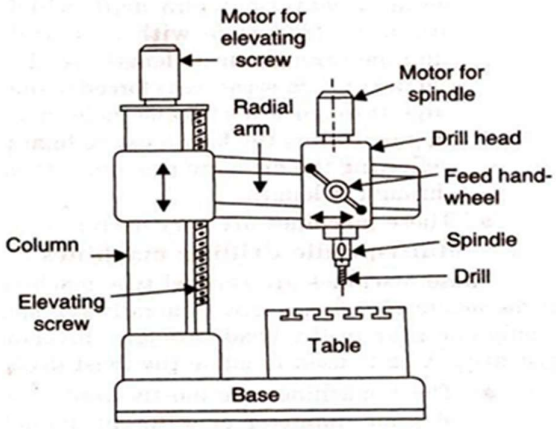


Fig.3.4 Radial Drilling Machine

Advantages:

- Can drill holes at any point within arm radius.
- Saves time on large parts (e.g., engine blocks).

Limitations:

- High cost, requires heavy floor.

Q.5 – List common operations on drilling machine and explain any three with sketches. (3 marks)

Appeared in: W25(3)

Ans:

Operations: Drilling, Reaming, Boring, Counterboring, Countersinking, Tapping, Spot facing.

Explain three:

1. **Drilling** – making round hole with twist drill.
2. **Reaming** – removes small stock to finish size (H7 tolerance).
3. **Countersinking** – conical recess for screw head (82° or 90°).

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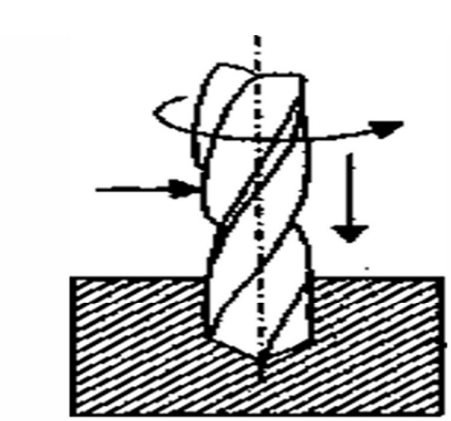


Fig.3.1 Drilling

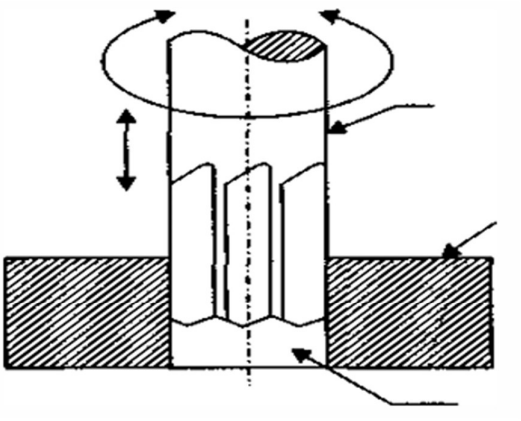


Fig.3.9 Reaming

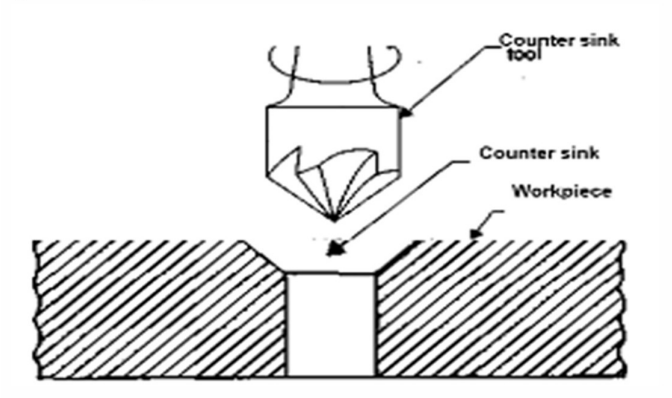
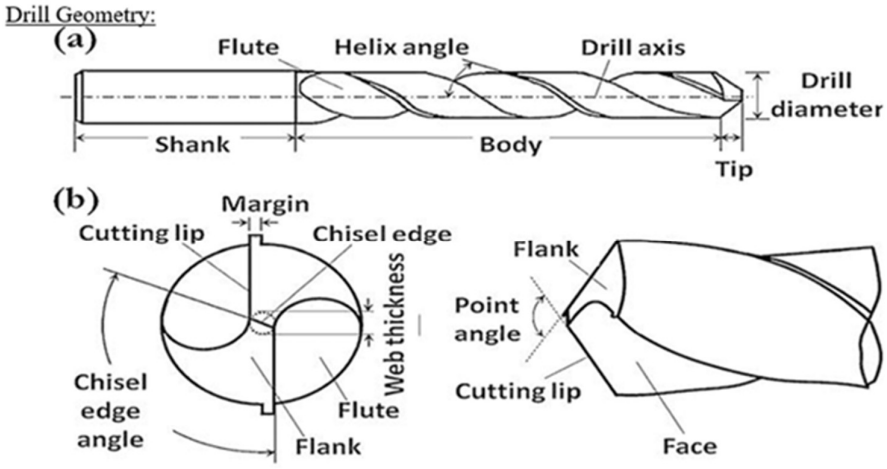


Fig.3.12 Counter Sinking

Q.6 – Illustrate nomenclature of drill bit with neat sketch. (7 marks)
Appeared in: W25(7), W24(7 OR)
Ans:
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Nomenclature table:

Part	Function

Part	Function
Point angle	Determines hole shape
Chisel edge	Extrudes material at centre
Lip relief angle	Prevents rubbing
Flute	Chip removal path
Margin	Guides drill & burnishes hole

Real-world application: 118° point for steel, 90° for brass.

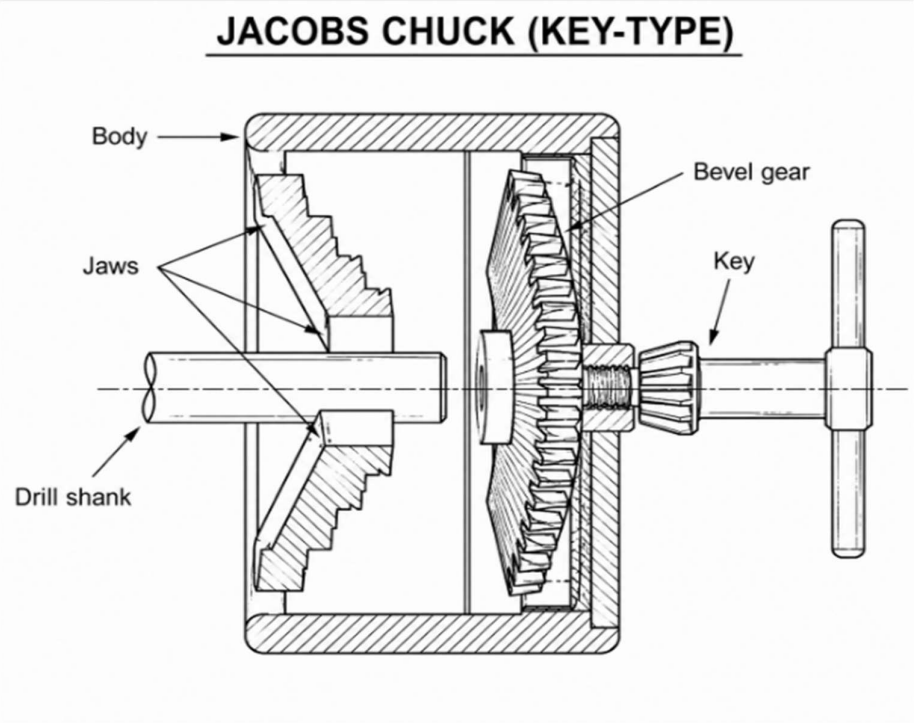
Q.7 – Differentiate between drilling and boring operations. (3 marks)
Appeared in: W24(3), W23(3)
Ans:

Drilling	Boring
Creates new hole from solid	Enlarges existing hole
Uses twist drill	Uses single-point boring bar
Lower accuracy (IT10-IT12)	Higher accuracy (IT6-IT8)
Can't correct hole position	Can correct hole axis
Faster process	Slower, requires setup

Q.8 – What are different tool holding devices of drilling machine? Describe one with sketch. (4 marks)
Appeared in: S23(4), W24(4), W25(4 OR)
Ans:
Tool holding devices:
- Jacobs chuck (key type)
- Morse taper sleeve
- Quick-change chuck
- Collet chuck

Describe Jacobs chuck:
- Three hardened jaws move simultaneously by rotating a toothed ring (key)
- Range: 0–13 mm diameter
- Used for straight shank drills

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Q.9 – Give any four field applications/operations of drilling machine. (3 marks)
Appeared in: W25(3), W24(3), W23(3)
Ans:

1. Drilling holes in structural steel (I-beams, channels)
2. PCB drilling (tiny holes, high speed)
3. Oil hole drilling in engine blocks
4. Woodworking – dowel holes & boring

Q.10 – Classify drills. Explain nomenclature of twist drill with neat sketch. (7 marks)
Appeared in: W23(7 OR)
Ans:
Classification of drills:

- By material: HSS, Carbide tipped, Coated (TiN)
- By shank: Straight, Morse taper
- By flutes: 2-flute (standard), 3-flute, 4-flute
- By purpose: Centre drill, Step drill, Subland drill, Spade drill

Nomenclature of twist drill – same as Above given

Q.11 – Differentiate between counter boring and counter sinking operations. (4 marks)
Appeared in: W22(4 OR)
Ans:

Feature	Counter boring	Countersinking
Shape produced	Cylindrical flat-bottom recess	Conical tapered recess
Tool	Pilot-guided counterbore	82° or 90° countersink

Feature	Counter boring	Countersinking
Purpose	Hide bolt head (socket head cap screw)	Hide countersunk screw (flat head)
Depth	Controlled by stop	Controlled by feed

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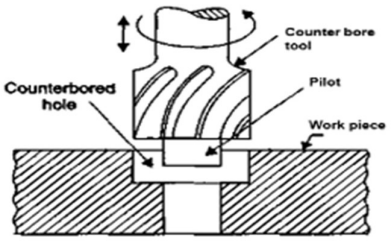


Fig.3.11 Counter Boring

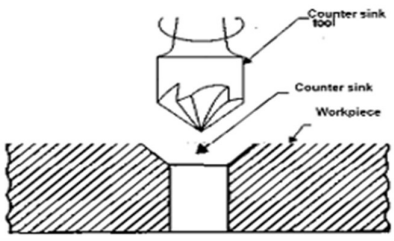


Fig.3.12 Counter Sinking

Q.12 – Describe a tapping attachment in drill machine. (7 marks OR)
Appeared in: S23(7 OR)
Ans:
Tapping attachment:

- A device fitted between drill spindle and tap.
- Provides torque limiting and reverse rotation.

Construction:

- Body connects to spindle.
- Inside: friction clutch (or ball clutches) and a reversing gear system.
- Tap holder at bottom.

Working:

- When tap contacts hole, clutch slips if torque exceeds limit (prevents breakage).
- At bottom, spindle reverses automatically (or operator reverses).
- Tap withdraws.

Real-world application: Mass production tapping (e.g., engine block threads) reduces broken taps by 90%.
Advantages:

- Protects tap
- Quick reversal without stopping spindle
- Suitable for blind holes

Limitations: High initial cost.

Q.13 – Is it possible to correct an out-of-round hole with a reamer? If yes, specify type. (3 marks)
Appeared in: S23(3 OR)
Ans:
No, a standard reamer cannot correct an out-of-round hole – it follows existing hole shape.
To correct, use a **chucking reamer with uneven flute spacing** (4 or 6 flutes unequal pitch). It will produce a round hole by cutting intermittently.
Alternatively, use a **rose reamer** for enlarging with minimal guiding.

Q.14 – Numerical problem: Tap of outside diameter 10 mm, pitch 1.5 mm, depth of thread d=0.61p, what is diameter of nearest drill? (4 marks)

Appeared in: S23(4 OR)
Ans:
Given:

- Tap OD (D) = 10 mm
- Pitch (p) = 1.5 mm
- Thread depth (h) = 0.61 × p = 0.61 × 1.5 = 0.915 mm

To find: Drill diameter for tapping (core diameter)
Formula (for metric threads):
Drill diameter = D – (2 × h) [because thread depth on each side]
Solution:
Drill diameter = 10 – (2 × 0.915)
= 10 – 1.83
= **8.17 mm**
Nearest standard drill size (metric): 8.2 mm (or 8.1 mm if available)
Final answer: 8.2 mm
