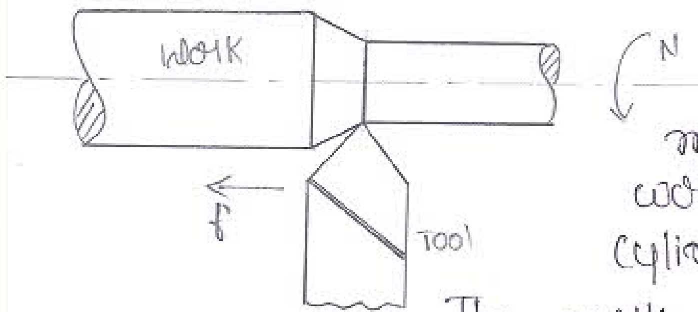
# Machine Tools & Operations
## II IA - Internal Assessment Test
## Solution.

(1) With neat sketches Explain any three operations performed on a lathe machine.

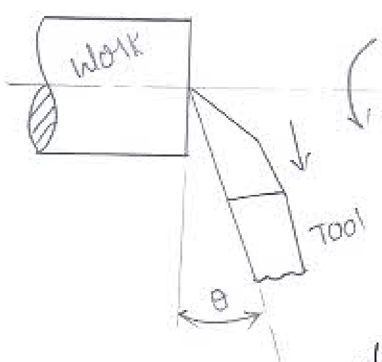
Cylindrical Turning.




It is also Referred to as straight turning. Excess material is Removed from the work piece to produce exact cylindrical surface.

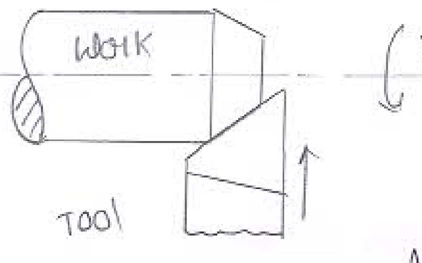
The work piece is made to Rotate about the lathe axis. The tool is pressed against work piece and moved parallel to the lathe axis. The work piece should be centered accurately in the chuck or between centers

Facing




It is an operation involving Removal of the material from the ends of the work. A flat end surface square with the axis is produced. The tool is slightly at an angle θ = 2-5° the work piece is Rotated and the desired depth of cut is given

chamfering




It is the operation of bevelling the Ends of the work piece. A form tool as shown is used for this. The work piece is Rotated and the tapered tool is fed against the End of the workpiece. A bevel portion is obtained.

(2) Estimate the machining time Required to machine 5mm thick layer from a workpiece of 200mm width x 400 length x 50mm thick, MS Material. The available stroke Rates are 10, 20, 40 & 80 strokes/min. The feed is 0.28 mm per cycle. The depth of cut is given as 1mm during each cutting cycle. consider the cutting speed as 30m/min. Also find MRR.

Sol Given data.

$b = 200mm$

$L_{job} = 400mm$

$V = 30 m/min$

$f = 0.28 mm/cycle.$

Machining time $T = \frac{b}{N_s \times f}$

Number of strokes

$$V = \frac{N_s \times L(1+m)}{1000}$$

$$30 = \frac{N_s \times 400(1+0.667)}{1000}$$

$$N_s = 40$$

$$T = \frac{200}{45 \times 0.28} = 17.875 \text{ min}$$

Material Removal Rate $= f \times d \times N_s \times L(1+m)$

$= 0.28 \times 1 \times 40 \times 400(1.667)$

$MRR = 7468 \ mm^3/min$

(3) With neat sketches explain broaching and shaping operations.

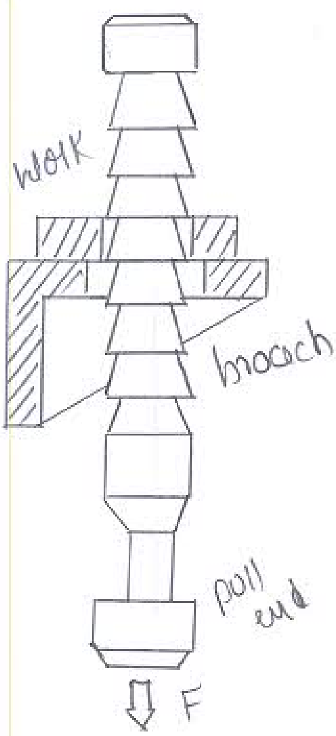
Broaching operations:

(i) pull broaching :- This method is used mainly for internal broaching. The broach is held at the pull end using a special device and is pulled through the work. The work is being held stationary.

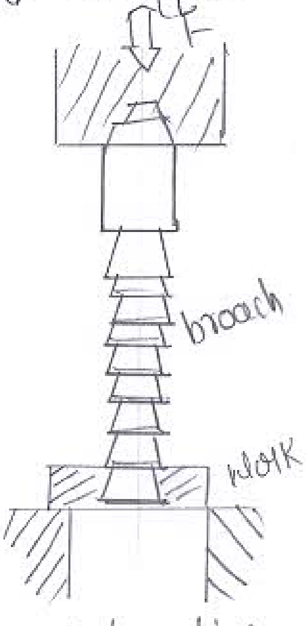
(ii) push broaching: The work is held stationary as before and the broach is pushed through the work.

(iii) Surface broaching: A Relative motion is established between the broach and the workpiece. Any one of them could be held stationary. Many irregular shapes can be broached by this method.

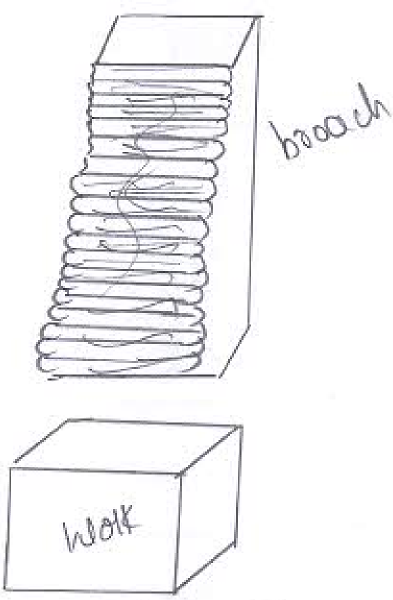
(iv) Continuous broaching. : Here the broach is held stationary and the work is moved continuously. The path of movement may be straight or circular.



(i) pull broaching



(ii) push broaching



(iii) Surface broaching

## Shaping operations

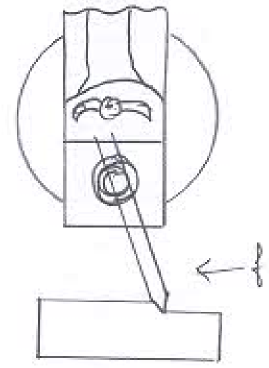
(i) Machining horizantal Surface : The tool is set in the tool holder the depth of cut is Adjusted by turning the handle w.r.t dial micrometer. The cross feed screw is engaged and the machine is operated.

(ii) Machining vertical surface : Here the Apron is tilted such that there is no interference of the tool holder & the work piece. The stroke length of the tool is Adjusted.

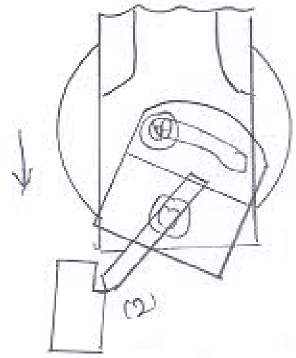
(iii) Machining Angular Surface :- Here the tool head of the shaper is tilted as well as Apron. The desired Angle is set by Adjusting the tool head w.r.t the Angular micrometer provided on the Ram.

(iv) Cutting External Key way : The location of the key way is marked and the tool is Adjusted w.r.t stroke length. Keeping the width of the tool equal to the key way the tool is Accelerated

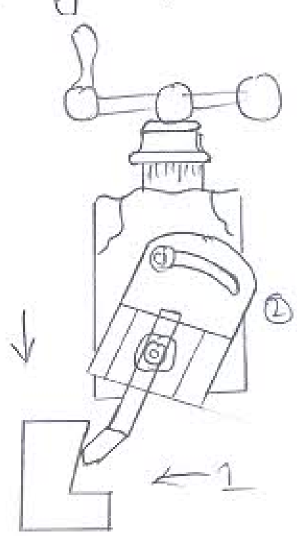
(v) Cutting internal Key way : A tool bit with the key way width is brazed on to a long bar and fixed to the tool post.



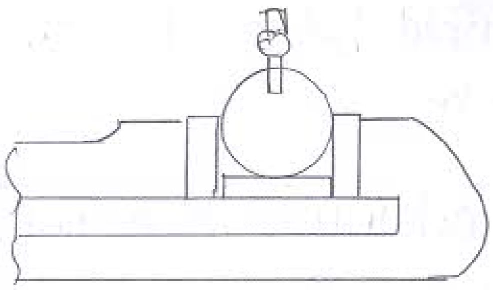
Machining Horizantal Surface



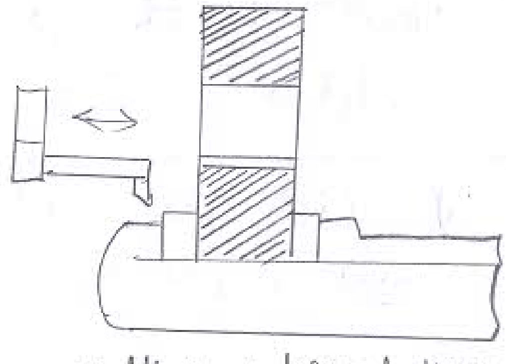
Machining vertical Surface



Machining Angular Surface



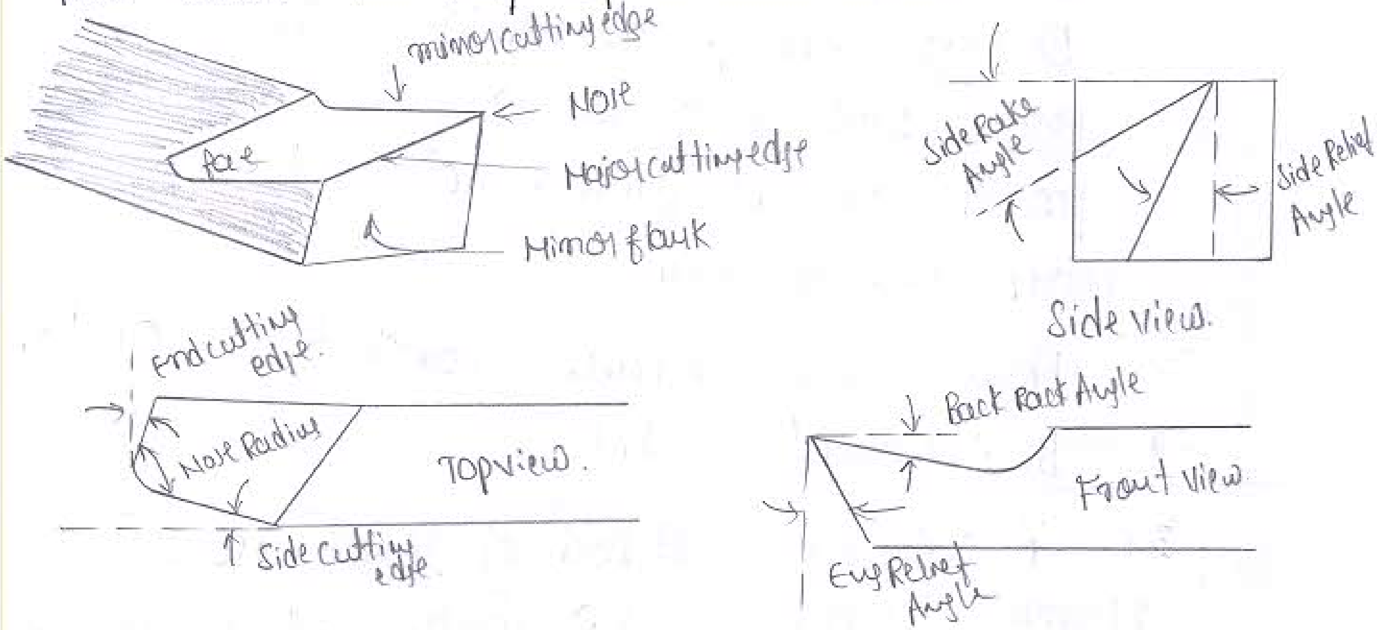
cutting External Keyway



cutting internal keyway

(4)

(A) Describe the nomenclature of a single point cutting tool with the help of a neat sketch




The feature of the tool is described Here under.

Shank: It is a Rectangular strong portion of the tool and forms the rear end of it.

Face: It is the front upper portion of the tool where the chip slides

point: It is the front portion of the tool.

Flank: It is the front portion of the tool that faces the work piece

Base: It is the bottom portion of the shank of the tool on which the tool can be onto the tool post.

Nose: It is the junction formed between the Side cutting edge and end cutting edges.

(B) List the ideal characteristics of a cutting tool material.

Machining is a deformation process. the tool must provide maximum Resistance to Alteration in its geometry. To achive this the tool material should.

⇒ Be harder than the work. (30-50% harder)
⇒ Retain high strength and hardness at higher temp.
⇒ Be tough enough to withstand shocks
⇒ Resist wear for a longer time even at high temp
⇒ provide low co-efficient of friction between the work and the tool.
⇒ Have High thermal conductivity and sp. heat.
⇒ Be chemical stable

(5) A cylindrical MS Rod of length 150 mm and diameter 11 mm, is Reduced to a diameter of 10 mm by turning on a lathe. The Spindle Rotates at 350 rpm and the tool is travelling at an axial speed of 250 mm/min calculate (i) the cutting Speed at maximum diameter and minimum diameter
(ii) Material Removal Rate
(iii) Machine time
(iv) The power Required. If the unit power is estimated to be 4 W.sec/mm³

Sol
∴ Given data

$L = 150mm$

$d_1 = 11mm$

$d_2 = 10mm$

$N = 350rpm$

$f = 250 mm/min$

⇒ Material Removal Rate

$MRR = \pi \times D_1 \times t \times N \times f$

$= \pi \times 11 \times 1 \times 350 \times 250$

$MRR = 3023782.924 \ mm^3/min$

⇒ Cutting Speed at $D = 11mm$

$V = \frac{\pi D N}{1000} = \frac{\pi \times 11 \times 350}{1000} = 12.095 \ m/min$

Cutting Speed at $D = 10mm$

$V = \frac{\pi \times 10 \times 350}{1000} = 10.99 \ m/min$

⇒ Machining time

$T = L/N \times f = \frac{150}{350 \times 250} = 0.00175 \ min$

$T = 0.00175 \ min$

(6) calculate the machining time to mill a grove 5mm deep in a component. The component is 300mm long. 100mm wide and 60mm high. The cutter diameter is 90mm and has 20 teeth with a feed rate of 0.08mm per tooth. Take the cutting speed of 25m/min. Allow 5mm clearance on either side

Sol Given data

$L_{job} = 300mm = 0.3m$

thickness $= 60mm = 0.06m$

$d_c = 90mm$

$z = 20$ tooth

$b = 100mm$

$t = 5mm$

$f_t = 0.08$ mm/tooth.

Maching time (T) $= L / b \times f_m$ $\qquad C_1 = C_2 = 5mm$

$L = L_{app} + C_1 + L_{job} + C_2 + L_{overtravel}$

$L_{app} = \sqrt{(D/2)^2 - (D/2 - t)^2}$

$= \sqrt{(45)^2 - (45-5)^2}$

$L_{app} = 20.615$ mm

$L = 20.615 + 5 + 300 + 5 + 20.615$

$L = 351.23$ mm

$f_m = f_t \times z \times N$

$= 0.08 \times 20 \times 89$

$f_m = 142.14$

where $V = \frac{\pi D N}{1000}$

$N = 88.4 rpm$

Machining time (T) $= \frac{~~20615~~ 350}{100 \times 142.14} = 0.00145$ min

$T = 0.00145$ min

$T = \frac{L}{f_m \times N}$.