1. Cutting Speed :- The distance travelled by the cutting tool along the work-piece in one minute is called cutting speed.

* It is expressed as m/min.

Mathematically,

$$\text{Cutting speed} = \frac{\pi DN}{100} \text{ m/min.}$$

where, D = diameter of job (cm)

N = speed (rpm)

⇒ Cutting speed depends upon following factors :-

i) Machinability of Material :-

Machinability is the ease with which material component is machined.

* Hard materials require lower cutting speed than soft and ductile materials.

ii) Material of Cutting Tool :- Cutting speed depends upon material of the cutting also. e.g. high speed steel tools cut at higher rate than carbon steel for same material component.

iii) Use of cutting fluid :- By using good cutting fluid, cutting speed may be increased.

iv) Feed and depth of cut :- If feed and depth of cut is more, less cutting speed is required and vice-versa.

2. Feed :- The distance travelled by the tool along the work piece or by the work-piece to the tool in each revolution is called feed.

* It is generally expressed in mm per revolution.

⇒ Feed depends upon :-
i) depth of cut ii) cutting speed and iii) power of the machine.

3. Depth of cut :- The amount by which a tool is inserted into the work piece during one cut is called depth of cut.

⇒ In other words, it is the thickness of metal removed in one cut.

* It is expressed in mm.

Lathe operation :-

We will discuss estimation of machining time on following lathe operations.

1. Turning
2. Drilling
3. Boring
4. Tapping.
5. Threading

Turning :- It is the process of reducing the external diameter of work piece by applying cut or a number of cuts.

Let D = diameter of workpiece (cm)

N = Revolution of workpiece /min.

F = Feed / revolution.

then,

Cutting speed, $$S = \frac{\pi D N}{100} \text{ m/min}$$

Now, Feed/min = Feed/rev. × rpm.

and, Time taken to turn $\frac{L \text{ metre length}}{}$

$$T = \frac{L}{\text{Feed/min}} = \frac{L}{\text{Feed/rev.} \times \text{rpm}}$$

or $$T = \frac{L}{F \times N} \text{ min.}$$

Numerical Problems

1. Find the time taken to turn a brass component of 5 cm diameter and 8 cm long. if the cutting speed is 45 m/min. and feed is 0.5 mm/rev. Assume single cut.

Solution: — Given,

$D = 5$ cm, $L = 8$ cm.

$S = 45$ m/min. $F = 0.5$ mm/rev. $= 0.05$ cm/rev.

Let N = Number of revolutions per min.

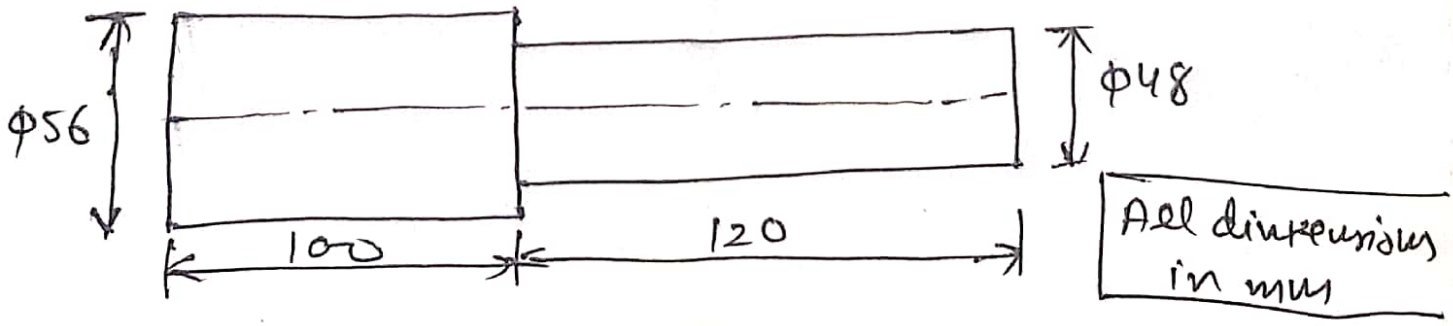
Cutting speed, $S = \frac{\pi D N}{100}$

$45 = \frac{\pi \times 5 \times N}{100}$ or $\boxed{N = 286 \text{ rpm}}$

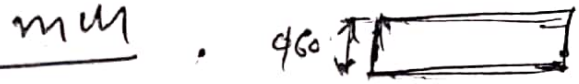
$\therefore$ Machining Time, $T = \frac{L}{F \times N}$

$= \frac{8}{0.05 \times 286} = \boxed{0.56 \text{ min}}$ Ans

2. Calculate time required to turn a 60mm diameter rod to as shown in figure. Take cutting speed as 20m/min, feed as 1.2 mm/rev. All cuts are 2mm deep.



Soln:- Given $L_1 = 220$ mm, $L_2 = 100$ mm, $L_3 = 120$ mm. $D = 60$ mm.



$S = 20$ m/min, $F = 1.2$ mm/rev.

* In first step diameter of rod will be reduced from 60 mm to 56 mm for a length of 220 mm by turning.

∵ Depth of cut = 2 mm. So one cut is required.

Cutting Speed, $S = \frac{\pi D N_1}{100} = \frac{\pi \times 6 \times N_1}{100}$

or $N_1 = \frac{100 \times S}{\pi \times 6} = \frac{100 \times 20}{\pi \times 6} =$ **106 rpm**

Time for turning, $T_1 = \frac{L_1}{F \times N_1} = \frac{220}{1.2 \times 106}$

or **$T_1 = 1.73$ minutes**

In Second step, the diameter of rod will be reduced from 56 mm to 48 mm for a length 120 mm.

∵ depth of cut = 2 mm

So 2 cuts will be required.

1st Cut:- (56 to 52) mm

$S = \frac{\pi D N_2}{100}$

$20 = \frac{\pi \times 5.6 \times N_2}{100}$

or **$N_2 = 114$ rpm**

Time for turning.

$T_2 = \frac{L_2}{F \times N_2} = \frac{120}{1.2 \times 114} =$ **0.73 min.**

2nd cut:- (52 to 48) mm

$S = \frac{\pi D N_3}{100}$

$20 = \frac{\pi \times 5.2 \times N_3}{100}$

$N_3 = 122$ rpm

Time for turning.

$T_3 = \frac{L_3}{F \times N_3} = \frac{120}{1.2 \times 122} =$ **0.82 min.**

Total turning time

$T = T_1 + T_2 + T_3 =$

$= 1.73 + 0.73 + 0.82 =$ **3.28 min**