MMT (Q1) P-1

Q1. A)

Restrictions in getting higher MRR.

Process parameters

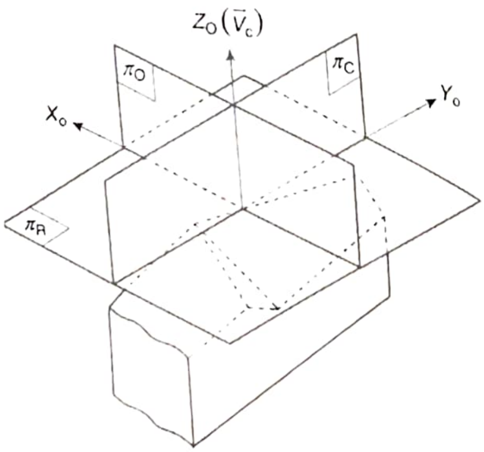
- → Cutting velocity
- → ~~Surface roughness~~
- → higher feed
- → Depth of cut

Geometrical parameters of tool

- → principal cutting edge angle
- → Inclination angle
- → Clearance angle

Q1. B) $\phi = 90^\circ$ & $\phi_s = 0$

Q1. C)



π_R = Ref. Plane

π_C = Cutting plane

π_O = orthogonal plane

Q.1) D)

$\lambda, \gamma_o, \alpha_o, \alpha_o', \phi_1, \phi, r$

$-10^\circ, 10^\circ, 8^\circ, 6^\circ, 20^\circ, 60^\circ, 1\text{ mm}$

$$\phi_\gamma = \tan^{-1}\left(\frac{\tan\gamma_x}{\tan\gamma_y}\right) \quad \text{For ASA}$$

Setting angle Rake plane- $\phi_\gamma = \phi - \tan^{-1}\left(\frac{\tan\lambda}{\tan\gamma_o}\right)$ for ORS

$$= \phi - \tan^{-1}\left(\frac{\tan(-10^\circ)}{\tan(10)}\right) \qquad \left\{ \begin{array}{l} \lambda = -10^\circ \\ \gamma_o = 10^\circ \\ \phi = 60^\circ \end{array} \right.$$

$$= 60 - \tan^{-1}\left(\frac{-0.176}{0.176}\right)$$

$$= 60 - (-45) = 105^\circ$$

Setting angle of principal flank.

$$\phi_\alpha = \phi - \tan^{-1}\left(\frac{\tan\lambda}{\cot\alpha_o}\right)$$

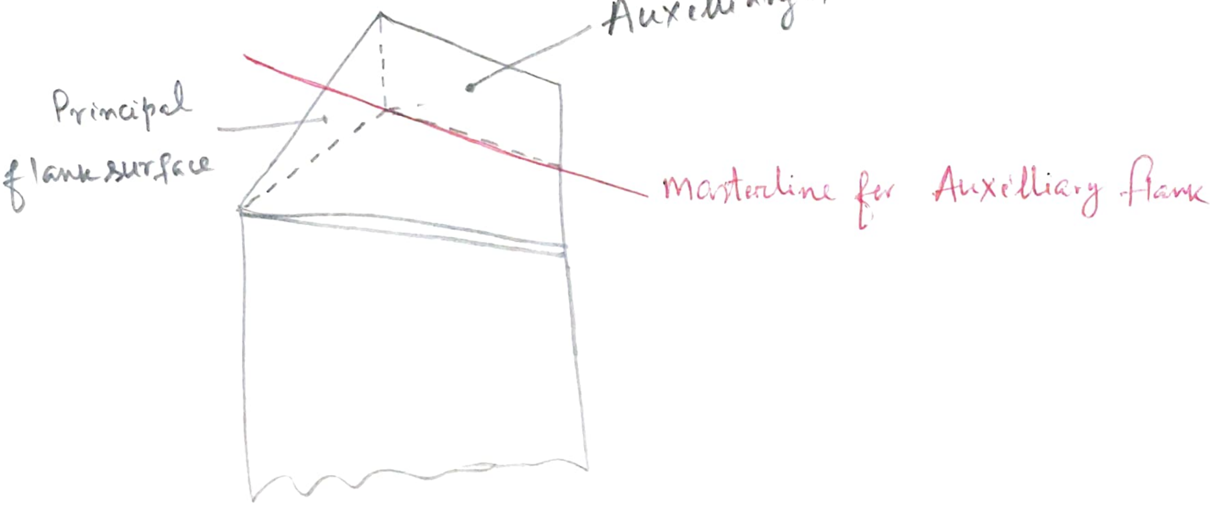
$$= \phi - \tan^{-1}\left(\frac{\tan(-10)}{\cot 8^\circ}\right)$$

$$= 60 - \tan^{-1}(-0.0248)$$

$$= \cancel{13.4}^\circ = 61.42^\circ$$

MMT Q2

Q2) A)

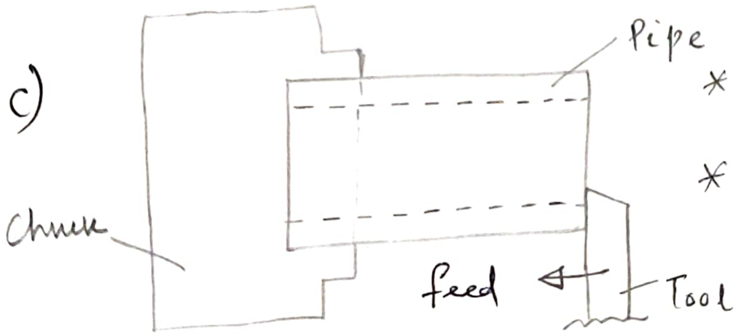


Q2) B) Geometrical conditions

(i) $\phi = 90^\circ, \lambda = 0$

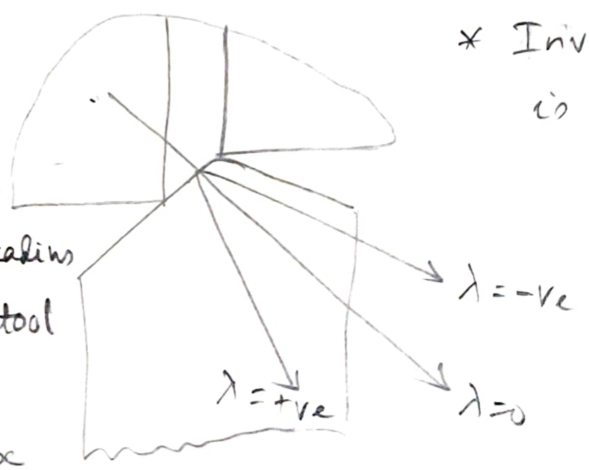
(ii) $\phi = 90^\circ, \gamma_n = 0$

Q2) C)



* Length reduction of hollow pipe
* Thickness of pipe < length of principal cutting edge.
* Involvement of nose is avoided.

Q2) D)



* Involvement of nose radius
* Presence of λ in the tool
* $\lambda = 0$ is possible but nose radius Cannot be Zero. There are reason behind.

Question 3 MMT Given: $a_1 = 0.5$, $a_2 = 1.125$ P-3

3 A) $\zeta = \frac{a_2}{a_1} = 2.25$

(i) $\tan\beta_0 = \frac{\cos\gamma_0}{\zeta - \sin\gamma_0} = \frac{\cos 10^\circ}{2.25 - \sin 10^\circ} = \frac{\cos 10^\circ}{2.08} = 0.473$

$\beta = 25.31^\circ$

(ii) Shear strain

$\varepsilon_s = \cot\beta_0 + \tan(\beta_0 - \gamma_0)$

$= \cot 25.31^\circ + \tan(25.31 - 10)$

$= 2.127 + 0.273 = 2.4$

3 B) (iii) Cutting force $= P_Z = 1559\,N$, $P_{xy} = 1271\,N$

$P_S = P_Z \cos\beta_0 - P_{xy} \sin\beta_0$

$= 1559 \cos 25.4 - 1271 \sin 15.4 = 863\,N$

$A_S = \frac{0.5 \times 0.3}{\sin 25.4} = 3.497\ mm^2$

Shear stress $= \tau_s = \frac{P_S}{A_S} = \frac{863}{3.497} = 247\ MPa$

3C) ~~(iv)~~ a) $\gamma_0 = 10^\circ$, $\beta_0 = 25.31^\circ$,

$2\beta_0 + \eta - \gamma_0 = \pi/2$ (for brittle mat.)

$\Rightarrow \cancel{\eta} = \cancel{45^\circ - (25.31 - 10)/2}$

$\cancel{45^\circ + 10^\circ - 25.31 = 29.31}$

$2 \times 25.4 + \eta - 10^\circ = 90^\circ$

$\eta = 49.2^\circ$

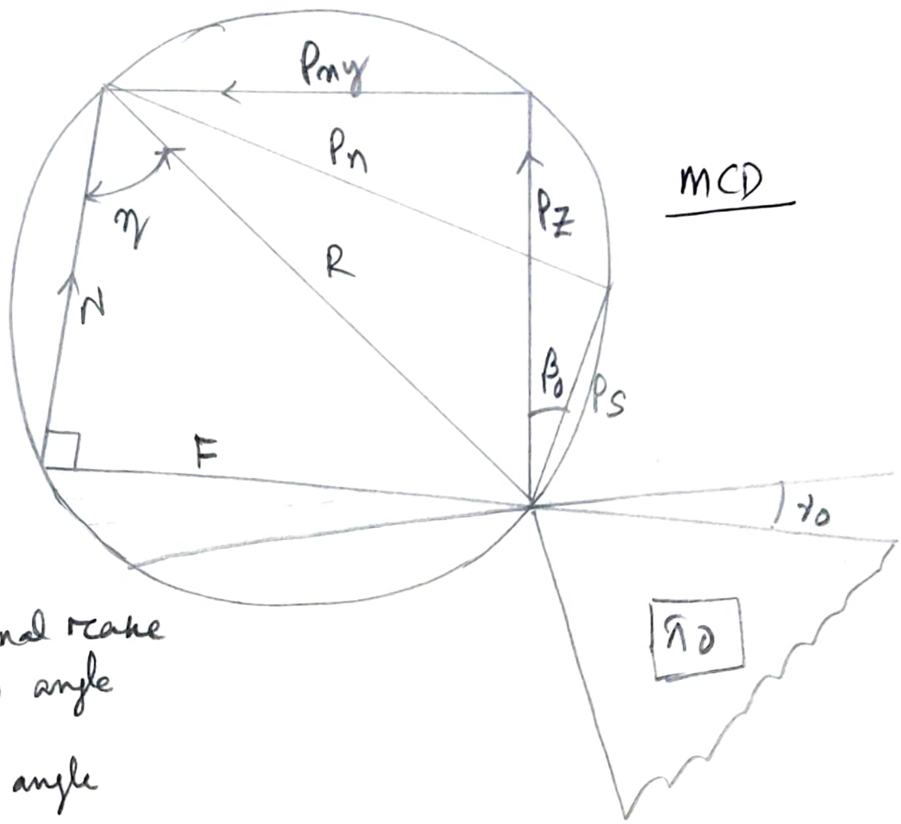
b) $\mu = \tan\eta$

$= 1.16$

[illegible]

Q3(A) [illegible] 10°,

Q3(D)



γ_0 = orthogonal rake

η = friction angle

β_0 = Shear angle

P_Z = main cutting force component

P_{xy} : Thrust force

P_S = Shear force,

F = Friction force

N = Normal reaction.

MMT Q4 P-5

Q4) A) In grinding, in addition to material removal action energy is consumed for rubbing and ploughing action. The rubbing and ploughing action are absent in the machining operation. So, Grinding always consume more energy for same amount of material removal as compared to machining operation.

Q.4) B) Total depth to be removed = 50 μm

$K = 0.5$

(i) Incremental feed.

S-1 $a_1 = 10\,\mu m, K = 0.5$

R_1 = Real depth = $10 \times \frac{1}{2} = 5\,\mu m$

Residue = $10 - 5 = 5\,\mu m$

S2 $a_2 = 5 + 10 = 15\,\mu m$

Real depth (R_2) = $15 \times \frac{1}{2} = 7.5\,\mu m$

Residue = $7.5\,\mu m$

S3 $a_3 = 10 + 7.5 = 17.5\,\mu m$

Real depth = $R_3 = 17.5 \times \frac{1}{2} = 8.75$

Residue = $8.75\,\mu m$

S4 $a_4 = 10 + 8.75 = 18.75$

$R_4 = 18.75 \times \frac{1}{2} = 9.375$

Residue = $9.375\,\mu m$.

S5 $a_5 = 9.375 + 10 = 19.375$

$R_5 = a_5 \times \frac{1}{2} = 9.687\,\mu m$.

Residue = $9.687\,\mu m$

S6 $a_6 = 9.687$

$R_6 = 9.687 \times \frac{1}{2} = 4.343\,\mu m$

Residue = $4.343\,\mu m < 5\,\mu m$

So, Total increment feed pass = 6

P-6

4) B) ii Single feed mode grinding

$a = 50\,\mu m$, $k = 0.5$

S1 $a_1 = 50$, $k = 0.5$

$R_1 = 50 \times 1/2 = 25\,\mu m$

S_2 $a_2 = 25$, $k = 0.5$

$R_2 = 25 \times \frac{1}{2} = 12.5\,\mu m$

S_3 $a_3 = 12.5\,\mu m$, $k = 0.5$

$R_3 = 12.5 \times 1/2 = 6.25\,\mu m$

S_4 $a_3 = 6.25\,\mu m$

$R_3 = 6.25 \times \frac{1}{2} = 3.125\,\mu m$

$< 5\,\mu m$

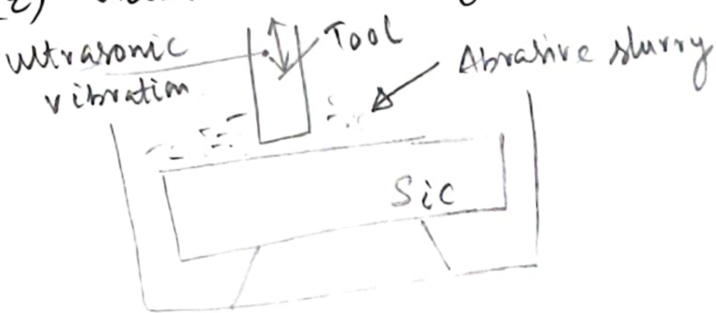
So, Total no of passes required = 4

4) c) qualitative values of maching parameters which responsible for.
Rise in temp: 1) Depth of cut ↑ 2) Cutting velocity ↑ (3) Rake angle (↑ −ve)
(4) coolant supply ↓ (5) Feed ↑
(6) Built up edge ↑ etc.

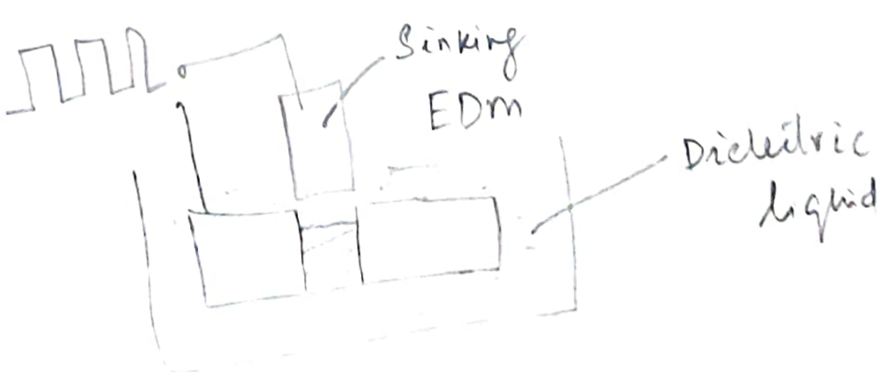
~~MMT Q5~~

MMT Q5

Q 5) A) (i) Ultrasonic machining process



(ii)



5) B) Machining time

$$T_c = \frac{L_c}{S_m} \text{ min.}$$

Now, $L_c = L_w + A + O + \frac{D_c}{2} = 200 + 20 + 20 + 35 = 275 \text{ mm}$ $\cancel{105}$

$$S_m = S_o Z_c N = 0.1 \times 6 \times N$$

where, $N = \frac{1000 V_c}{\pi D_c} = \frac{1000 \times 44}{\pi \times 70} = 200 \text{ rpm}$

So, $S_m = 0.2 \times 6 \times 200 = 240 \text{ mm/min.}$

$$T_c = \frac{L_c}{S_m} = \cancel{200}\ \frac{275}{240} = 1.1458 \text{ min.}$$

Q 5) C) 1) Sinking EDM 2) Reaming operation.

3) Ultrasonic machining 4) Abrasive water jet cutting

5) CNC gas/plasma/Laser ~~cut~~ cutter 6) Electrochemical machining

7) Electrochemical deburring / Polishing using emery paper

8) Boring operation 9) Cylindrical grinding

10) Lath / specialized lathe.