

FIRST MID TERM TEST – 2017-18

Class	:	B.TECH. 2ND YEAR	Semester	:	IV
Branch	:	MECHANICAL ENGINEERING			Time : 1 HOUR
Subject	:	MMT			Max. Marks: 20

Q.1 Explain the geometry of single point cutting tool with neat sketch?

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Q.2 Taylor's tool life equation for M/C c-40 steel with a 18:4:1 H.S.S. cutting tool at a feed of 0.2mm/min and a depth of cut of 2mm is given by $VT^n = C$, where n & C are constant. The following V and T observation have been noted.

V1 m/min 25 35

V2 m/min 90 20 Calculate:

(i) n & C (ii) hence recommended the cutting speed for a desired tool life of 60 min.?

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Q.3 Define Following: any five

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(i) HSS (ii) Machinability (iii) BUE (iv) Tool Life or Wear (v) orthogonal cutting (vi) Abrasion (vii) Diffusion

Q.4 The following data from the orthogonal cutting test is available rake angle 10° , chip thickness ratio 0.33, uncut chip thickness 0.51 mm, width of cut 3mm, and yield shear stress of work material 285 N/mm^2 , mean friction coefficient on tool force 0.65

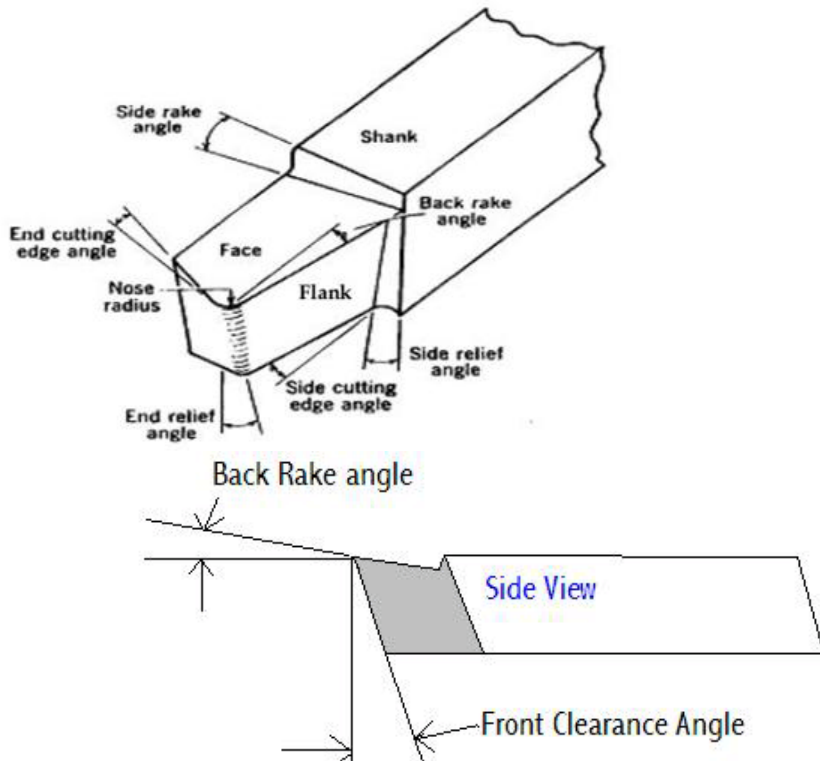
Determine:

(i) Cutting force F_c (ii) Radial Force (iii) Normal force N (iv) Shear force on the tool F_s

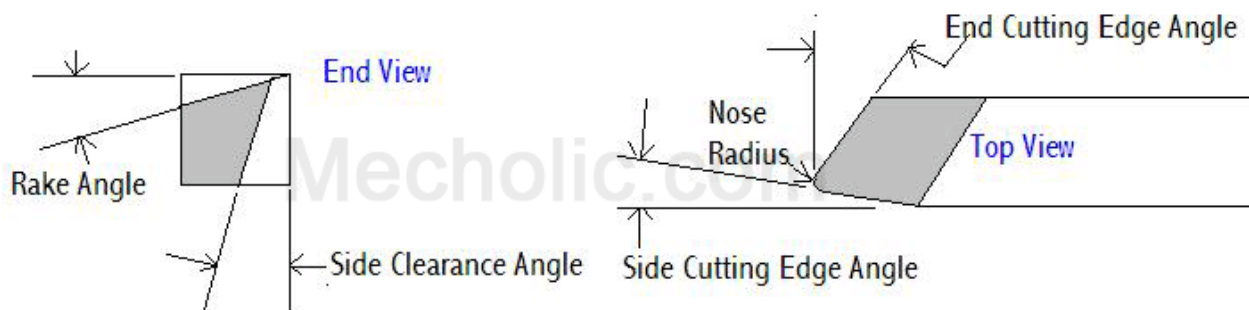
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Solutions

Ans.1



Credit: Wikimedia



Rake: The rake is the slope of the top away from the cutting edge. The larger the rake angle, the larger the shear angle, and thereby the cutting force and power reduce. Large rake gives good surface finish.

Back rake angle: Back rake indicates that the plane which forms the face or top of a tool has been ground back at an angle sloping from the nose.

Side rake angle: Side rake indicates that the plane that form the face or top of a tool has been ground back at an angle sloping from the side cutting edge.

Nose: The nose of a tool is the conjunction of the side- and end- cutting edges. A nose radius increases the tool life and improves surface finish.

Flank: The flank of a cutting tool is that surface which face the workpiece.

Shank: The shank is that portion of the tool bit which is not ground to form cutting edges and is rectangular in cross-section.

Face: The face of the cutting-tool is that surface against which the chip slides forward.

End relief or clearance angle: Indicates that the nose or end of a tool has been ground back at an angle sloping down from the end cutting edge.

Side relief or clearance: Indicates that the plane that forms the flank or side of a tool has been ground back at an angle sloping from the side cutting edge.

End cutting edge angle: Indicates that the plane which forms the end of a tool has been ground back at an angle sloping from the nose to the side of the shank.

Side cutting edge angle: Indicates that the plane which forms the flank or side for a tool has been ground back at an angle to the side of the shank. Chips are removed by this cutting edge.

Ans.2

Ans.2) Given +

$$V_1 = 25$$

$$V_2 = 90$$

$$T_1 = 35$$

$$T_2 = 20$$

we know that +

$$VT^n = C$$

$$25 \times 35^n = C \quad \text{--- ①}$$

$$90 \times 20^n = C \quad \text{--- ②}$$

equating eq. ① & ②

$$25 \times 35^n = 90 \times 20^n$$

$$\left(\frac{35}{20}\right)^n = \frac{90}{25}$$

taking log both sides +

$$n \ln\left(\frac{35}{20}\right) = \ln\left(\frac{90}{25}\right)$$

$$n = \frac{\ln\left(\frac{90}{25}\right)}{\ln\left(\frac{35}{20}\right)} \quad n = 2.28$$

$$\boxed{n = 2.28}$$

$$(25)(35)^{2.28} = C$$

$$\boxed{C = 82873.39}$$

(ii) $VT^n = C \quad V(60)^{2.28} = 82873.39$

$$\boxed{V = 7.315 \text{ m/min}} \quad \text{Ans}$$

Ans.3

- i) These steels are used for cutting metals at a much higher cutting speed than ordinary carbon tool steels. The high speed steels have the valuable property of retaining their hardness even when heated to red heat.

- ii) Machinability can be tentatively defined as ‘ability of being machined’ and more reasonably as ‘ease of machining’
- iii) In machining ductile material with long chip – tool contact length, The weld material starts forming as an embryo at the most favorable location and thus gradually grows. With the growth of the BUE, the force also gradually increased due to wedging action of the tool tip along with the BUE formed on it.
- iv) The tool life is the duration of actual cutting time after which the tool is no longer usable. Tool wear describes the gradual failure of cutting tools due to regular operation
- v) Cutting edge of the tool is perpendicular to the direction of cutting velocity. The cutting edge is wider than the workpiece width and extends beyond the workpiece on either side. The cutting forces act along two directions only.
- vi) • If a hard particle cuts or grooves one of the rubbing surfaces then abrasive wear will occur. • Coating the cutting edge or surface treatment for high hardness is a method for reducing abrasive wear.
- vii) • Solid state diffusion occurs when atoms in a metallic crystal move from a region of high atomic concentration to one of low concentration. • Temperature exponentially increases the rate of diffusion.

Ans.4

Ans 4 Given ÷

$$\alpha = 10^\circ, \quad r = 0.35, \quad t = 0.51 \text{ mm}$$

$$\mu = 0.65, \quad T_s = 285 \text{ N/mm}^2, \quad b = 3 \text{ mm}$$

(i) Cutting Force (F_c) = $R \cos(\beta - \alpha)$

$$\beta = \tan^{-1}(\mu) = \tan^{-1}(0.65) = 33.02^\circ$$

we know that ÷

$$F_s = \frac{T_s \cdot b \cdot t}{\sin \phi}$$

$$\tan \phi = \frac{r \cos \alpha}{1 - r \sin \alpha} = \frac{0.35 \cdot \cos 10^\circ}{1 - 0.35 \sin 10^\circ} = 0.3669$$

$$\phi = 20.15^\circ$$

$$F_s = \frac{285 \times 3 \times 0.51}{\sin(20.15^\circ)}$$

$$F_s = 1265.8 \text{ N} \quad \text{Ans (iv).}$$

we know that ÷

$$F_s = R \cos(\phi + \beta - \alpha)$$

$$1265.8 = R \cos(20.15^\circ + 33.02^\circ - 10^\circ)$$

$$R = 1735 \text{ N}$$

$$F_c = R \cos(\beta - \alpha) \\ = 1735 \cos(33.02^\circ - 10^\circ)$$

$$F_c = 1546.83 \approx 1547 \text{ N} \quad \text{Ans (i)}$$

(ii) Radial Force ÷

Radial force is not use in orthogonal cutting
it's use in turning so Radial force zero. Ans (ii)

(iii) Normal Force (N) on tool ÷

$$N = R \cdot \cos \beta$$

$$N = 1735 \cdot \cos 33.02^\circ$$

$$N = 1453.8 \approx 1455 \text{ N} \quad \text{Ans (iii)}$$

(iv)

$$F_s = 1265.8 \text{ N} \quad \text{Ans (iv).}$$