Adda247

WELCOME

TO Adda247

"There is nothing impossible to they who will try."

ISRO | BHEL | DRDO & OTHER PSUs

PRODUCTION

METAL CUTTING

MOST EXPECTED QUESTIONS

PART-3

Live@ 11:30Am

Gaurav sir

YouTube Classes Schedule

ENGINEERS

MECHANICAL ENGINEERING

EXAM TARGET	SUBJECT	TIME	FACULTY
ALL PSUs	ENGINEERING MATHS	10:00 AM	ANANT SIR
ALL PSUs	PRODUCTION	11:30 PM	GAURAV SIR
ALL PSUs	THERMODYNAMICS	3:00 PM	KANISTH SIR
GATE 2024-25	HMT	4:30 PM	YOGESH SIR
GATE 2024-25	SOM	9:00 PM	MUKESH SIR

FREE APP CLASS SCHEDULE

MECHANICAL ENGINEERING

GATE

HMT	MONDAY Live @11AM	YOGESH SIR
PRODUCTION	TUESDAY Live @11AM	GAURAV SIR
SOM	WEDNESDAY Live @8PM	MUKESH SIR
THERMODYNAMICS	THURSDAY Live @11AM	KANISTH SIR
ENGINEERING MATHEMATICS	FRIDAY Live @11AM	ANANT SIR

The heat generated in metal cutting can conveniently be determined by

(a) Installing thermocouple on the job
(b) Installing thermocouple on the tool
(c) Calorimetric set-up → Heat
(d) Using radiation pyrometer → Temp

(a), (b) → Temp

A straight turning operation is carried out using a single point cutting tool on an AISI 1020 steel rod. The feed is 0.2 mm/rev and the depth of cut is 0.5 mm. The tool has a side cutting edge angle of 60°. The uncut chip thickness (in mm) is 0.1mm

Given Data:→ Turning

* $f = 0.2$ mm/rev
* doc = 0.5 mm
* $C_s = 60^\circ$
* $t = ?$

Solution:→

* $t = f \cdot \sin\lambda$
* $\lambda = 90^\circ - C_s$
* $\lambda = 90^\circ - 60^\circ$
* $\lambda = 30^\circ$
* $t = 0.2 \times \sin 30$
* $t = 0.1$ mm

Given Data: → orthogonal Turning

$(\lambda = 90^\circ)$

* $N = 200\,rpm$
* $f = 0.25\,mm/rev = t$
* $doc = 0.4\,mm$
* $\alpha = 10^\circ$
* $\phi = 27.75^\circ$

① $t_c = ?$

* $t = f \cdot \sin\lambda = f$
* $t = 0.25\,mm/rev$

A cylinder is turned on a lathe with orthogonal machining principle. Spindle rotates at 200 rpm. The axial feed rate is 0.25 mm per revolution. Depth of cut is 0.4 mm. The rake angle is 10°. In the analysis it is found that the shear angle is 27.75°

Q The thickness of the produced chip is

(a) 0.511 mm ✓ (b) 0.528 mm
(c) 0.818 mm (d) 0.846 mm

Q **In the above problem, the coefficient of friction at the chip tool interface obtained using Earnest and Merchant theory is**

(a) 0.18 (b) 0.36
(c) 0.71 (d) 0.98 ✓

$\mu = ?$

* $\mu = \tan\beta = \tan 44.5$
* $\mu = 0.98$

Solution:→

$* \ r = \frac{t}{t_c}$

$* \ 0.4888 = \frac{0.25}{t_c}$

$* \ t_c = 0.52138 \text{ mm}$

$* \ \tan\phi = \frac{r\cos\alpha}{1 - r\sin\alpha}$

$* \ \tan 27.75 = \frac{r \cdot \cos 10}{1 - r \cdot \sin 10}$

$* \ r = 0.4888$

A/c to Merchant Theory

⇓

$* \ \phi = 45^\circ + \frac{\alpha}{2} - \frac{\beta}{2}$

$* \ 27.75 = 45 + \frac{10}{2} - \frac{\beta}{2}$

$* \ \beta = 44.5$

For cutting of brass with single-point cutting tool on a lathe, tool should have

(a) Negative rake angle

(b) Positive rake angle

(c) Zero rake angle

(d) Zero side relief angle

* Brass ⇓ Machining ⇓ Zero Rake Angle

Single point thread cutting tool should ideally have:

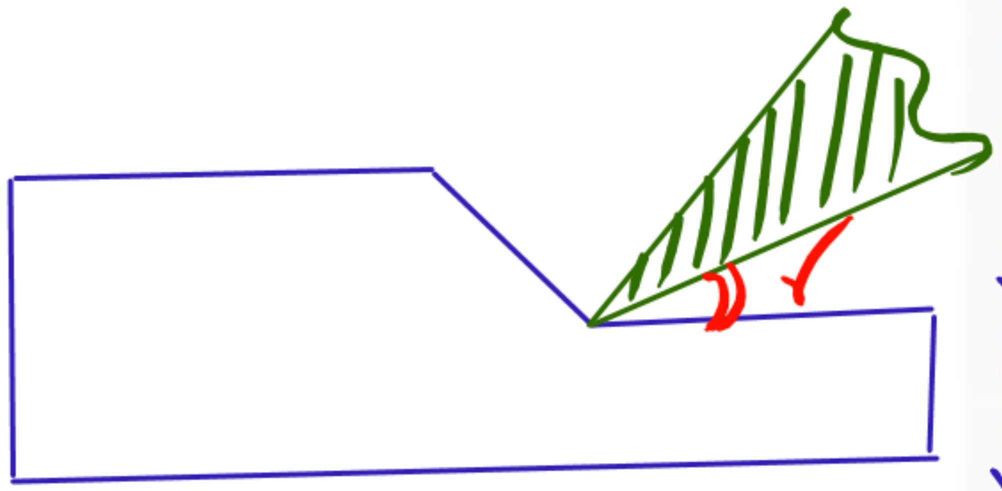
a) Zero rake ✓

b) Positive rake

c) Negative rake

d) Normal rake

Thread cutting
⇓
Lathe m/c
⇓
Lead screw
⇓
zero Rake Angle
⇓
Thread cutting is slowest operation



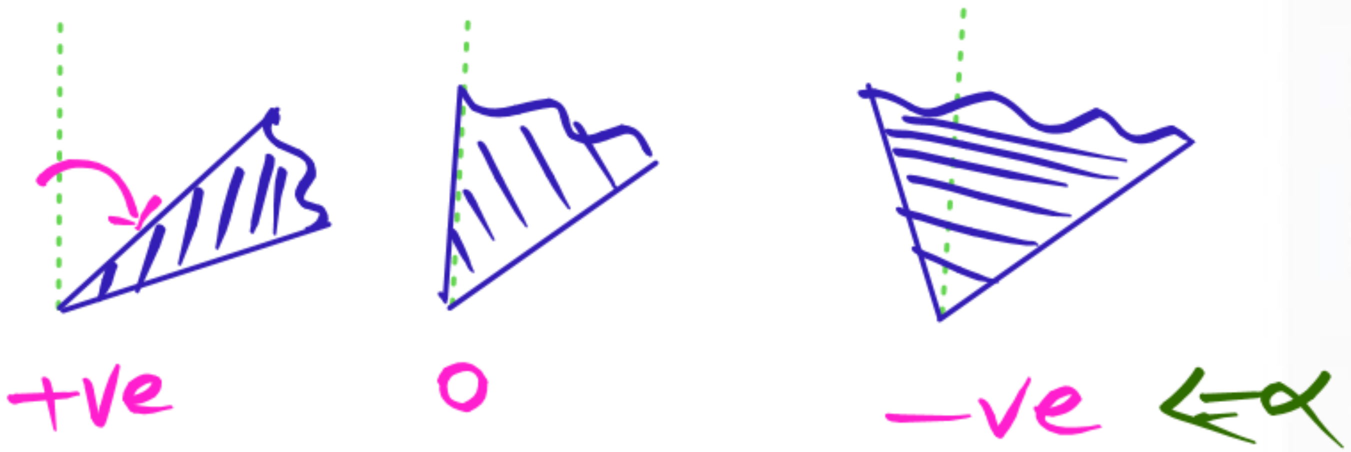
Consider the following statements with respect to the relief angle of cutting tool:

1. This affects the direction of chip flow
2. This reduces excessive friction between the tool and work piece
3. This affects tool life
4. This allows better access of coolant to the tool work piece interface

Which of the statements given above are correct?

(a) 1 and 2 (b) 2 and 3

(c) 2 and 4 (d) 3 and 4



Brittle materials are machined with tools having zero or negative rake angle because it

(a) results in lower cutting force

(b) improves surface finish

(c) provides adequate strength to cutting tool ✓

(d) results in more accurate dimensions

Brittle Material
⇓
High strength OR Hard

$F_c \perp F$

$\Downarrow$

$\alpha = 0$

$\times$ $F_c = 1500N = N$

In orthogonal turning of a bar of 100 mm diameter with a feed of 0.25 mm/rev, depth of cut of 4 mm and cutting velocity of 90 m/min, it is observed that the main (tangential)cutting force is perpendicular to friction force acting at the chip-tool interface. The main (tangential) cutting force is 1500 N.

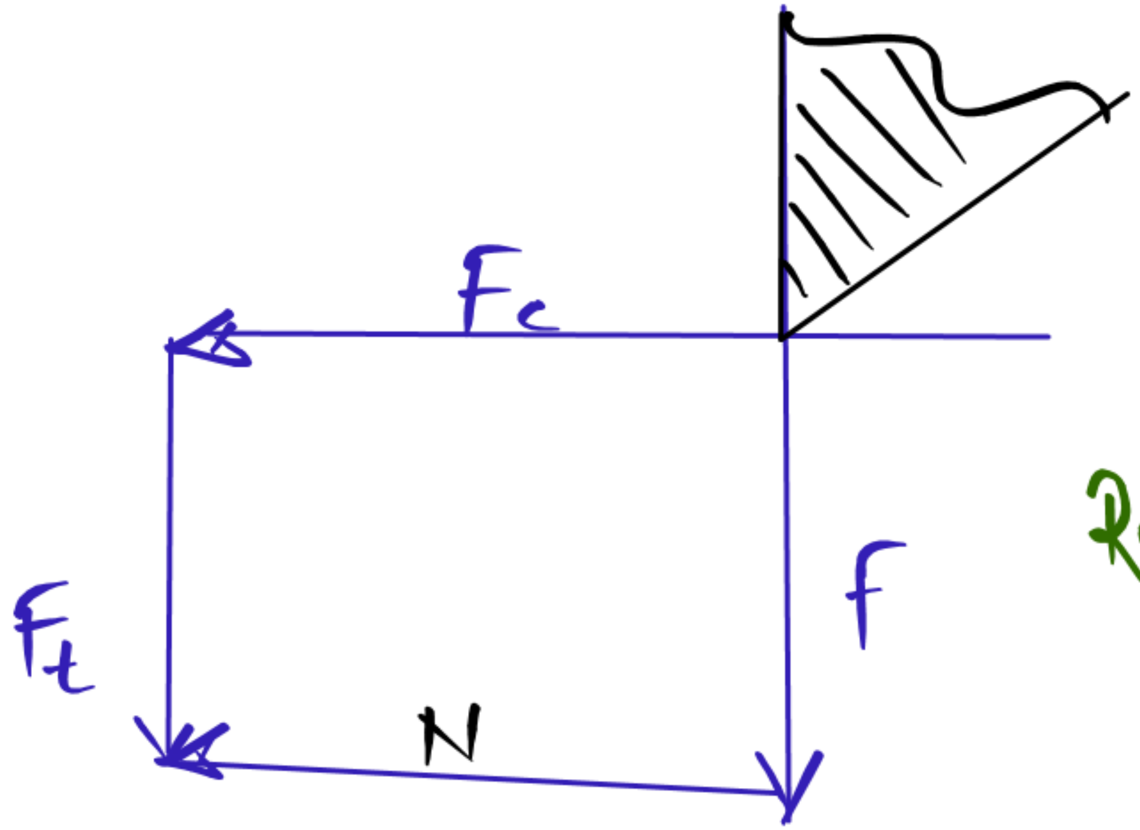
Q. The orthogonal rake angle of the cutting tool in degree is

(a) zero (b) 3.58 (c) 5 (d) 7.16

Q. The normal force acting at the chip-tool interface in N is

(a) 1000 (b) 1500 (c) 2000 (d) 2500

$\alpha = 0$



Rectangle

⇓

* $F_c = N$
* $F_t = F$

* $F_c \perp F$ OR $F \perp V$ → $\alpha = 0$

Fc > f > Ft

Consider the following forces acting on a finish turning tool:

1. Feed force
2. Thrust force
3. Cutting force.

The correct sequence of the decreasing order of the magnitudes of these forces is

(a) 1, 2, 3 (b) 2, 3, 1

(c) 3, 1, 2 (d) 3, 2, 1

The radial force in single-point tool during turning operation varies between

(a) 0.2 to 0.4 times the main cutting force ✓

(b) 0.4 to 0.6 times the main cutting force

(c) 0.6 to 0.8 times the main cutting force

(d) 0.5 to 0.6 times the main cutting force

$F_r = F_y \rightarrow$ Radial Force

An orthogonal machining operation is being carried out under the following conditions :

depth of cut = 0.1 mm,

chip thickness = 0.2 mm,

width of cut = 5 mm,

rake angle = 10°

The force components along and normal to the direction of cutting velocity are 500 N and 200 N respectively. Determine

(i) The coefficient of friction between the tool and chip.

(ii) Ultimate shear stress of the workpiece material.

Given Data :→ orthogonal Turning

* $t_c = 0.32$ mm
* $f = 0.2$ mm/rev $= t$
* cutting Ratio = ?

In an orthogonal turning process, the chip thickness = 0.32 mm, feed = 0.2 mm/rev. Then the cutting ratio will be

(a) 2.6
(b) 3.2
(c) 1.6 ✓
(d) 1.8

Solution :→ $(\lambda = 90°)$

* $t = f \sin\lambda = f \sin 90 = f$
* $r = \frac{t}{t_c} = \frac{0.2}{0.32} = 0.625$

* $h = \frac{1}{r} = \frac{1}{0.625} = 1.6$

Which one of the following statements is correct about an oblique cutting? → 3-D

orthogonal ← (a) Direction of chip flow velocity is normal to the cutting edge of the tool

orthogonal → (b) Only two components of cutting forces act on the tool

✓ (c) Cutting edge of the tool is inclined at an acute angle to the direction of tool feed

orthogonal → (d) Cutting edge clears the width of the workpiece

In orthogonal cutting test, the cutting force = 900N, the thrust force = 600N and chip shear angle is 30°. Then the chip shear force is

(a) 1079.4 N
(b) 969.6 N
(c) 479.4 N
(d) 69.6 N

Given Data:→ Facing

* D = 72mm ⇒ r = 36mm
* N = 80 rpm
* f = 0.3 mm/rev
* t_m = ?

The time taken to face a workpiece of 72mm diameter, if the spindle speed is 80 rpm and cross-feed is 0.3 mm/rev, is

(a) 1.5 minutes
(b) 3.0 minutes
(c) 5.4 minutes
(d) 8.5 minutes

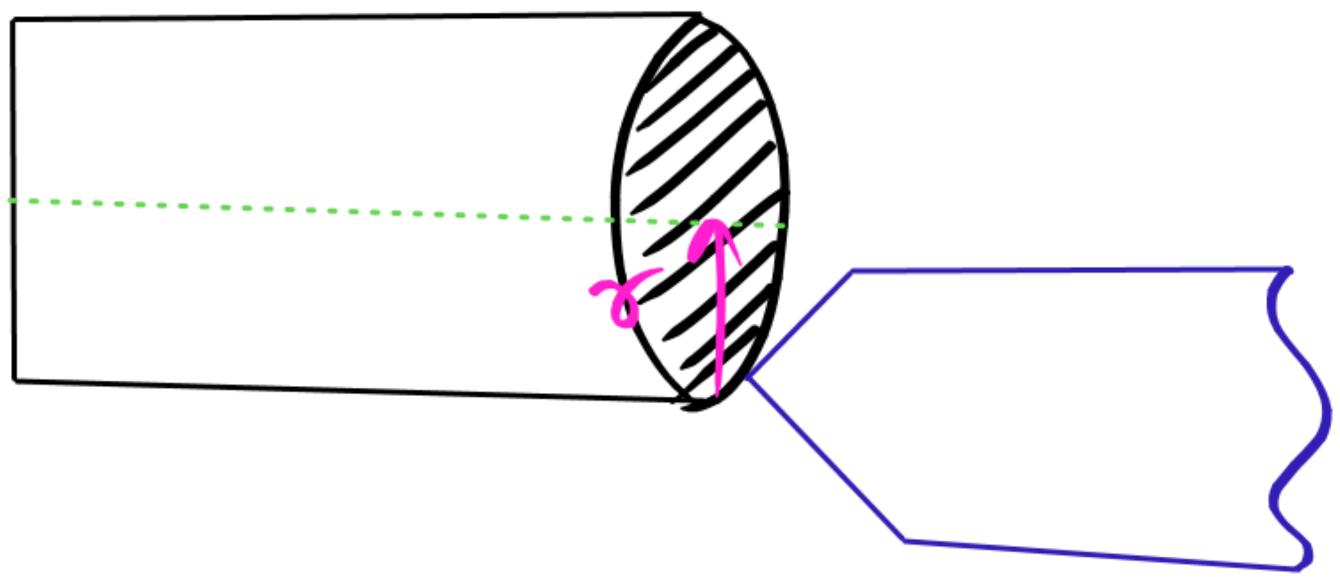
Solution:→ $t_m = \frac{r}{f \cdot N}$

* $t_m = \frac{36}{0.3 \times 80} = 1.5$ min

Facing

⇓

$$t_m = \frac{D/2}{f \times N} = \frac{r}{f \times N}$$



$$* \quad t_m = \frac{r}{f \times N} \longrightarrow \text{min}$$

- r ← mm
- f ↑ mm/rev
- N ↑ rev/min

A 150 mm long, 12 mm diameter 304 stainless steel rod is being reduced in diameter to 11.5 mm by turning on a lathe. The spindle rotates at N = 400 rpm and the tool is travelling at an axial speed of 200 mm/min. The time taken for cutting is given by

(a) 30 s (b) 36 s
(c) 1 minute (d) 45 s

Given data:→

* $L = 150\ mm$
* $D_1 = 12\ mm$
* $D_2 = 11.5\ mm$
* $N = 400\ rpm$
* $V_f = 200\ mm/min$
* $t_m = ?$

Solution:→ * $t_m = \frac{L}{f \cdot N} = \frac{150}{V_f} = \frac{150 \leftarrow mm}{200 \leftarrow mm/min}$

$= \frac{150 \times 60}{200} = 45\ sec$

H.S.S → 30m/min

W : Cr : V

18 : 4 : 1

* Steel + W → Hot Hardness ↑

* Steel + Cr → Corossive Resistance ↑

* Steel + V → Wear Resistance ↑

Consider the following cutting tool materials used for metal-cutting operation at high speed:

1. Tungsten carbide → 90 m/min
2. Cemented titanium carbide → 180 m/min
3. High-speed steel → 30 m/min
4. Ceramic → 600 m/min

The correct sequence in increasing order of the range of cutting speeds for optimum use of these materials is

(a) 3, 1, 4, 2 (b) 1, 3, 2, 4

(c) 3, 1, 2, 4 ✓ (d) 1, 3, 4, 2

Consider the following statements:

The tool life is increased by

1. built-up edge formation ✓
2. increasing cutting velocity ✗
3. increasing back rake angle up to a certain value ✓

$\uparrow V \, T^{n} \downarrow = C$

Which of these statements are correct?

(a) 1 and 3 ✓

(b) 1 and 2

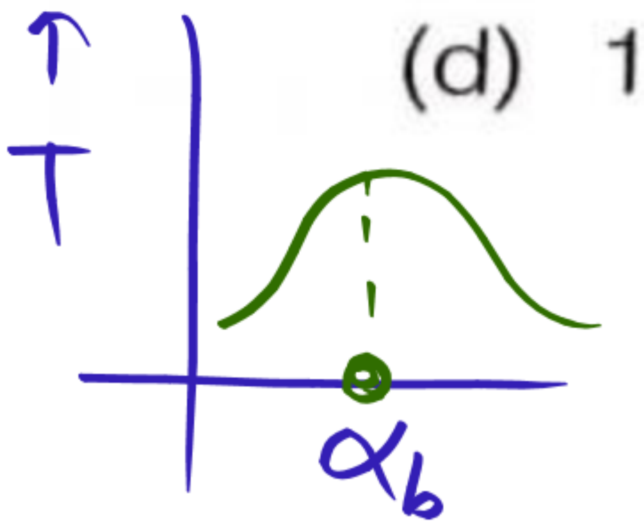
(c) 2 and 3

(d) 1, 2 and 3

$\alpha_b \uparrow$

* strength ↓
* Force/power ↓
* Tool wear ↓
* Tool life

* $(\alpha_b)_{Max} = 45^{0}$



In idealized chip formation, built up edge will break off and remove some of the cutting tool materials, thereby reducing tool life. Which of the following steps prevent built up edge ?

1. Increasing cutting speed
2. Increasing feed rate
3. Increasing ambient work-piece temperature
4. Decreasing rake angle
5. Reducing friction

Select the correct answer using the code given below :

(a) 1, 2 and 3 (b) 2, 3 and 4
(c) 1, 3 and 5 (d) 2, 4 and 5

In an orthogonal cutting operation, the length of the cut is 76 mm, length of the chip measured is 61 mm and depth of cut is 0.2 mm. What is the thickness of the chip?

(a) 0.01 mm (b) 0.8 mm

(c) 0.2 mm (d) 0.25 mm ✓

Given Data :→ orthogonal m/c

* $l = 76\,mm$
* $l_c = 61\,mm$
* $doc = 0.2\,mm = t$
* $t_c = ?$

Solution :→

* $\frac{t}{t_c} = \frac{l_c}{l}$
* $\frac{0.2}{t_c} = \frac{61}{76}$
* $t_c = 0.25\,mm$

* $r = \frac{t}{t_c} = \frac{l_c}{l} = \frac{V_c}{V} = \frac{\sin\phi}{\cos(\phi-\alpha)}$

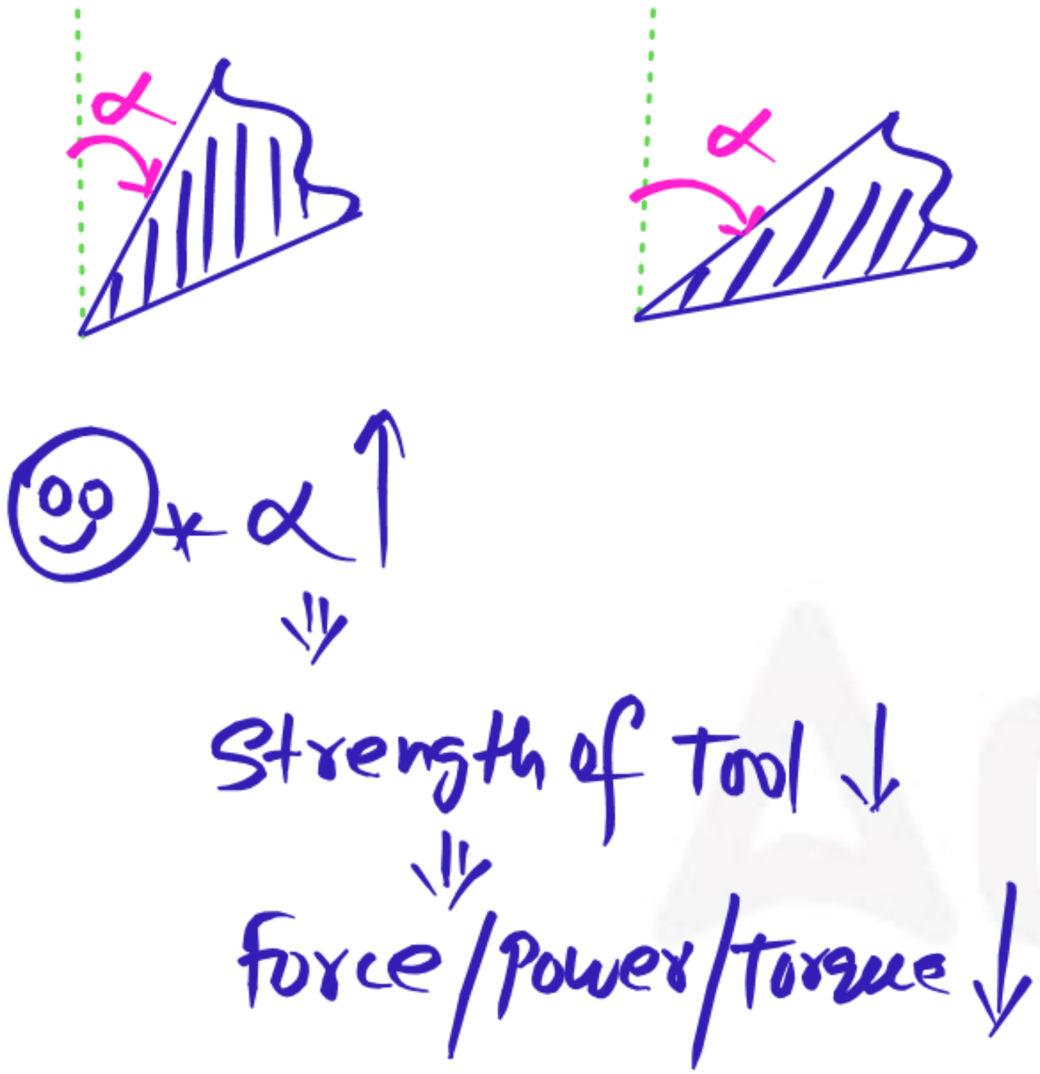
Consider the following statements with respect to tool life:

1. The presence of built up edge on the tool face during cutting sometimes decreases the tool life and sometimes increases it.
2. For constant set of cutting conditions an optimum rake angle exists giving a maximum tool life.
3. Tool life is defined as the cutting time required for failure of the tool.

Which of the above statements is/are correct?

(a) 1 only (b) 1 and 2

(c) 2 and 3 (d) 3 only



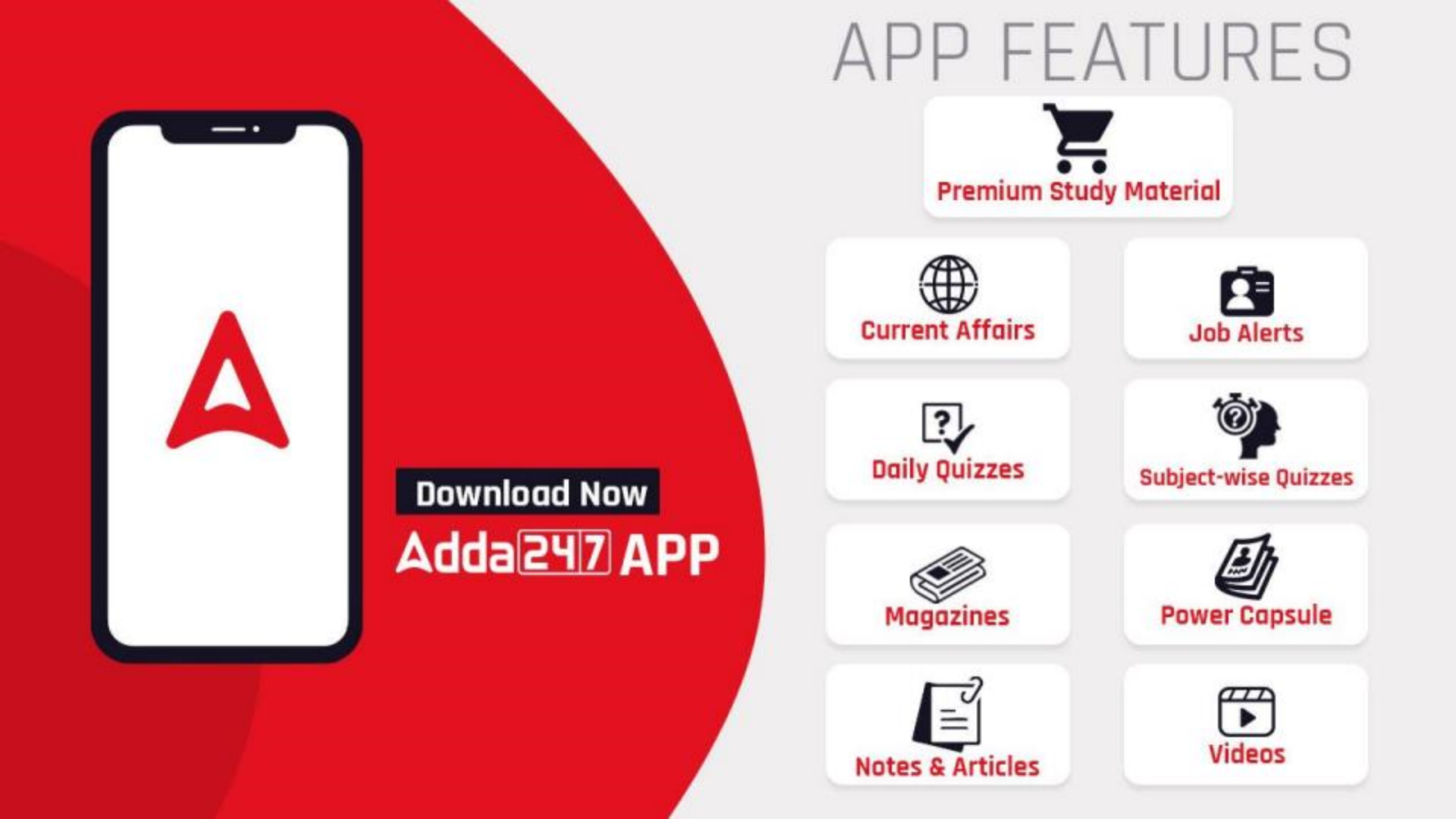
Consider the following statements:

1. A large rake angle means lower strength of the cutting edge.
2. Cutting torque decreases with rake angle.

Which of the statements given above is/are correct?

(a) Only 1 (b) Only 2

(c) Both 1 and 2 (d) Neither 1 nor 2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