For Proctor's Remarks

Q1: Why is the depth of cut usually much larger in rough machining compared to finishing? (3 Marks)

3

depth of cut is larger ~~than~~ in rough maching > finishing

because of the ~~forces~~ plastic deformation & shear strains ↑↑ is much higher than finishing proce

& because of the compressive force that will compress the material due to → depth of cut in rough Maching be larger than ~~rough~~ finishing

because also of the high cutting forces & power & speeds & rough maching conduct so much heat. ~~the that~~

Q2: Explain the effect of temperature rise during machining. (3 Marks) (3 Marks)

- produce hot chips
- reduse the tool life
- ~~reduse the~~ poor → surface finish & integrity
- ~~wear~~ uneven diminsion
- ~~Wear~~ crater wear

3

Q3: Describe how excellence in metal-cutting practices can impact the national economy. (3 Marks) (ABET SO4)

1- increase the work force & reduce un employment

2- Increase productivity, technology & innovation

3- environment sustanability & reduce waste & encourage recycling

4- increase gross product.

3

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Q4: What are the basic components of traditional machine tools, and what are their main functions? (4Marks)

1- Bed / structure / frame
It's hold the cutting tool, material workpiece & other various moving parts in the Machine, It should be minimum diflection & high moment of inertia.

2- power unit → electrical motor (gear Box)

3- transimition system → transmit the power from the power unit to other moving parts like spindle.

4- spindle → It may hold the material workpiece → like turning or hold the cutting tool → like drilling & milling

5- work table → If the spindle hold the work piece material It will hold the cutting tool & vice versa

6- tail stock → hold the workpiece

7- head stock → left end of the machine that hold various moving parts like ~~like spindle~~ & power unit.

2

Q5) Rate the following materials according to their machinability index (2.5)

Martensitic stainless steel, ferritic stainless steel, Polymer matrix composite, Aluminum, Magnesium

- Martensitic stainless steel: not easy to machine It's abrasive
- ferritic stainless steel: easy and good Machinability
- Polymer matrix composite: very hard & not easy to work with, not good machinability
- Aluminum: very easy & very good
- Magnesium: very easy & good & give good dimensional accuracy

2

Q6) Briefly illustrate the difference between the manufacturing process of carbide and ceramic inserts (2.5)

Carbide is consist of tengsten, titanum & tiltalum mixed together as Fine poweders & add to them cobalt then ~~they~~ into high temprature to do (sinteriug) then the cobalt will be good ~~as~~ abrasive cutting edge.

Ceramics → also we do sintering process For Alumide & boron nitride ~~they used~~ as an inserts & they are portable (we can change them)
& always the ceramics inserts is much hard & effective than carbides inserts. because of hot hardness is larger ...

2.5

3-5

Q7) Tool life tests on lathe provided the following data: 1) at cutting speed 800 ft/min the tool life was 52.5 minute, 2) at cutting speed 600 ft/min the tool life was 185 min. What is the expected tool life at a cutting speed of 900 ft/min. (5 Marks)

1- $V_1 = 800$ ft/min, $T_1 = 52.5$ min

2- $V_2 = 600$ ft/min, $T_2 = 185$ min

$V_1 T_1^n = V_2 T_2^n$

$(800)(52.5)^n = 600(185)^n$

1989.42
1993.4

$\frac{52.5^n}{185^n} = \frac{600}{800}$

$\left(\frac{52.5}{185}\right)^n = \frac{600}{800}$

$n = 0.228 \approx 0.23$

$800(52.5)^{0.23} = T_3(900)^{0.23} \rightarrow T_3 = 416.15$ min

Q8) An orthogonal turning process performed on a material that has 130 MPa shear strength with 10° rake angle tool, 4mm width of the cut, 1 mm depth of the cut, the chip thickness was 1.2 mm and the coefficient of friction on the rake face was 1.7. Calculate a) the required cutting forces, b) the percentage of power dissipated in friction if the cutting velocity is 120 m/min. (10 Marks)

$\tau_s = 130$ MPa

$\alpha = 10°$

$w = 4$ mm

$t_1 = t_o = 1$ mm

$t_2 = t_c = 1.2$ mm

$\mu = 1.7$

$\tau_s = 130 = \frac{F_s}{w t_o} \sin\phi$

→

a) required cutting forces F_t, F_c

$$\tau_s = \frac{F_s}{w \cdot t_o} \sin\phi$$

$$\phi = \tan^{-1}\left(\frac{r\cos\alpha}{1 - r\sin\alpha}\right) = \tan^{-1}\left(\frac{0.83\cos(10)}{1-0.83\sin(10)}\right) = 43.68°$$

$$r = \frac{t_o}{t_c} = \frac{1}{1.2} = 0.83$$

$F_s = ?$

$$130 = \frac{F_s}{4 \times 1}\sin(43.68) \rightarrow F_s = 752.9\,N$$

$$\beta = \tan^{-1}(\mu) = \tan^{-1}(1.7) = 59.53°$$

$$752.9 = R\cos(43.68 + 59.53 - 10) \rightarrow R = -13445.66\,N$$
$$= 13445.66\,N$$

$$F_c = R\cos(\beta - \alpha) = -8726.9\,N \quad = -8726.9\,N \quad = 8726.9\,N$$

$$F_t = R\sin(\beta - \alpha) = -10228.73\,N \quad = 10228.73\,N$$

$R = \sqrt{F_t^2 + F_c^2} \rightarrow$ so I put them +ve

b) power dissipated in friction

$V_{cutting} = 120\ m/min$

10

$$P = F V_c$$

$P_{Tot.} = F_c V$
$= 1047228$

$$\frac{V}{\sin(90 - \phi + \alpha)} = \frac{V_c}{\sin\phi}$$

$$\frac{120}{\sin(90 - 43.68 + 10)} = \frac{V_c}{\sin(43.68)} \rightarrow V_c = 99.59\ m/min$$

$$F = R\sin\beta$$
$$= 13445.66\sin(59.53) = 11588.74\,N$$

$$P = 11588.74 \times 99.59$$
$$P = 1154123\ N/mm$$

$$\frac{1154123}{1047228} = 1.1\%$$

$$\frac{F V_c}{F_c V} = \frac{F_r}{F_c} = 1.1\%$$