

TA 202A: Introduction to Manufacturing Processes 2017-18: I Sem
Mid Sem exam

Write your name, section and roll number very clearly on the answer book.

Answer all questions to the point and furnish figures wherever required.

Answer the question and its sub-division continuously in ascending order only.

Start a new question in a fresh page.

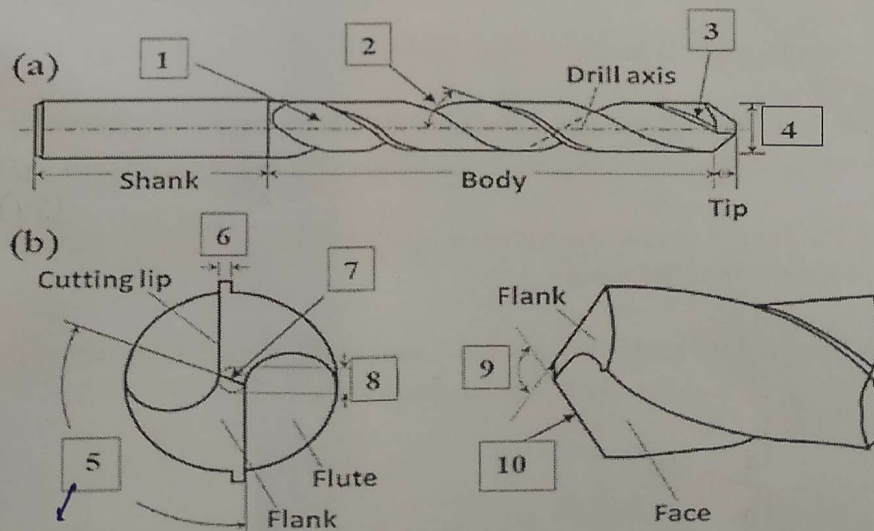
Date : 23/09/17

Duration : 120 minutes

Marks: 60

Question:1 [12 Marks]

- (a) Cutting tools are provided with large positive rake angle mainly for..... [1]
- (b) Crater wear always starts at some distance from the tool tip because at that point..... [1]
- (c) BUE is formed while machining at speeds and feeds. [1]
- (d) The following data relate to an orthogonal turning process:
 Back rake angle: 15° (α)
 Width of cut: 2mm (t_1)
 Chip thickness: 0.4 mm (t_2)
 Feed rate: 0.2 mm/rev
 Calculate the shear angle in the process. [2]
- (e) Keeping the above data, if the cutting force F_c and the thrust force F_T are 900N and 810N respectively, calculate the mean shear strength of the work piece in MPa. [2]
- (f) Fill in the drill nomenclature [5]



Question:2 [12 Marks]

- (a) In a typical metal cutting operation using a cutting tool of positive rake angle of 10° it was observed that the shear angle was 20° . The friction angle is [1]
- (b) Thrust force in drilling can be reduced by the point angle and by the helix angle of the drill. [1]
- (c) Amount of energy consumption for unit volume of material removal is maximum in operation. [1]
- (d) Draw and explain briefly the relationship between feed force and MRR in USM process. [2]
- (e) Calculate the minimum shear strain in orthogonal turning with a cutting tool of Zero rake angle Tool. [2]
- (f) In an EDM operation using RC generator, Open voltage is 250 V, Resistance is $10\ \Omega$ and Capacitance is $3\ \mu\text{F}$. Under the maximum power condition, calculate:
(i) Discharge voltage, [1]
(ii) Charging time [3]
(iii) Energy of individual discharge [1]

Question:3 [12 Marks]

- (a) Majorly negative rake angle is used in tools. [1]
- (b) When depth of cut increases the specific cutting energy [1]
- (c) Grinding wheel is said to be glazed if [1]
- (d) In a machining operation, doubling the cutting speed reduces the tool life to $1/8^{\text{th}}$ of the original value. Evaluate the exponent "n" in Taylor's tool life equation $VT^n = C$ [2]
 $(2V)(T/8)^n = VT^n$
- (e) A milling cutter having 8 teeth is rotating at 100 RPM. The work piece feed is set at 40 mm/min. Find the feed per tooth. [2]
- (f) During AJM process, mass ratio used is 0.8. Calculate mixing ratio, if the ratio of density of abrasives and density of carrier gas is equal to 20. [5]

$$\frac{\rho_a}{\rho_g} = 20$$
$$\rho_a = 20\rho_g$$

Question:4 [12 Marks]

- (a) In ultrasonic machining process the material removal rate will be higher for material with toughness. [1]
- (b) Mechanism of material removal in EDM process is due to and [1]
- (c) In AJM process if "Q" is the flow rate of abrasives "d" is the diameter of the abrasives MRR is proportional to [1]
- (d) Establish the relationship between grit depth of cut to force in grinding process and briefly explain the relationship [2]
- (e) Grinding wheel specification **AA-48-L-7-V**. What does 48, L, 7 and V represent? [2]
- (f) Three holes are to be drilled in series with varying diameters all starting from the top of a plate of 10 mm thickness. The details of the holes are as follows:
 (a) A through hole has to be drilled straight with diameter 6 mm
 (b) A blind hole up to 5 mm has to be drilled straight with diameter 10 mm.
 (c) A through angled hole (15°) has to be drilled with 12 mm diameter drill.
 Calculate the overall drilling time for the entire component. When Drill spindle speed is 500 RPM, feed is 0.2mm/rev for all three cases. [5]

$$\frac{500 \times 0.2 \times 0.1}{1000 \times 2} = 0.005 \text{ min}$$

Rev 10
10°

Question:5 [12 Marks]

- (a) Keeping all other parameters unchanged, the tool wear in EDM would be less if the tool material has [1]
- (b) Better surface finish is obtained with a large rake angle tool because [1]
- (c) Grinding ratio is defined as... [1]
- (d) During orthogonal machining of M.S specimen with cutting tool of Zero rake angle the following data is obtained.
 Uncut chip thickness = 0.25 mm
 Chip thickness = 0.75 mm
 Width of cut = 2.5 mm
 Cutting force = 950 N
 Thrust force = 475 N
 Evaluate the Shear force [2]

(e) Draw and explain the relationship between surface roughness and cutting speed. [2]

(f) In an orthogonal cutting test, the following data were made

Cutting force = 1200 N

Thrust force = 500 N

Rake angle = 0°

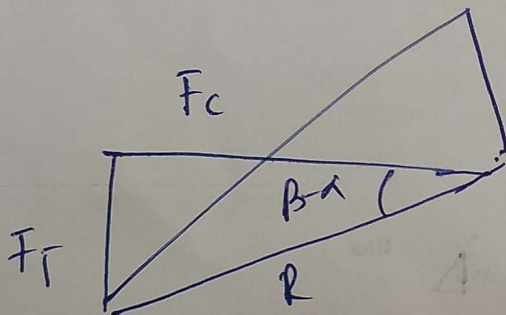
Depth of cut = 0.8 mm

Chip thickness = 1.5 mm

Cutting speed = 1 m/sec

Find the chip speed along the rake face of the tool.

[5]



$$\frac{F_c}{R} = \cos(\beta - \alpha) = \cos\left(\frac{\pi}{2} - 2\phi\right) = \sin 2\phi$$

$$\frac{V_s}{V_c} = \frac{\cos \alpha}{\cos(\phi - \alpha)} = \frac{1}{\cos \phi}$$

find ϕ and hence V_s .