

## Unit 3 - Week 1

### Course outline

How does an NPTEL online course work?

#### week 0

#### Week 1

Lecture 1: Non-traditional abrasive machining: Ultrasonic, Abrasive jet and abrasive water jet machining

Lecture 2: Ultrasonic Machining

Lecture 3: Ultrasonic Machining (Contd.)

Lecture 4: Ultrasonic Machining: Free Impacts and Problem Solving

Lecture 5: Ultrasonic Machining- Problems & MCQs

Week 1 Lecture Material

Quiz : Assignment 1

Week 1 Feedback Form

#### Week 2

#### Week 3

#### Week 4

Detailed Assignment Solution

Download Videos

Text Transcript

Live Interactive Session

## Assignment 1

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

Due on 2020-02-12, 23:59 IST.

For USM MRR, use the expression :

$$MRR \propto \frac{C^{0.25} \times A^{0.25} \times F^{0.75} \times a_0^{0.75}}{H_w^{0.75} \times (1 + \gamma)^{0.75}} \times d_g \times f \times \mu^{0.75}$$

1) An order is received by the owner of a USM machine facility, to supply glass badges with the map of India debossed in square shaped glass samples, 4 mm thick. The debossed map is to have an area of 650 square mm and depth of 1 mm. Given, ratio of hardness of work piece material to that of Titanium = Ratio of their respective flow stress values =5, Ratio of hardness of work piece material to that of Steel = ratio of their respective flow rates = 7. The time required to machine one pc with steel tool is 10 seconds.  
The time required to machine one pc with Titanium tool is nearest to (in seconds) :

1 point

- a. 6.5  
b. 5  
c. 8  
d. Not within 0.25 s of any of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
c.

2) In the previous problem, if the area of the map is changed to 325 square mm, the debossing speed (using steel tool) would be nearest to (in mm/s)

1 point

- a. 0.16  
b. 0.21  
c. 0.38  
d. Not within 0.05 mm/s of any of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
a.

3) In a tender for supplying USM machines, it is required that the quoted machines should achieve a drilling speed of 2 mm/min in sodalime glass (work material) at a running cost not exceeding Rs 6000/hr. A USM company has a machine which achieves a drilling speed of 3 mm/min in sodalime glass at an abrasive concentration of 50% v/v of abrasive: water. Slurry flow rate is fixed at 5 lpm. If the running cost is solely the cost of abrasives in slurry, the concentration of abrasives to be used in the slurry (to satisfy the tender specifications) is nearest to

1 point

Sl. No.	Type of data	value
1	Flowrate of slurry	5 lpm (abrasive + water) - fixed
2	Cost of abrasive	Rs 50/kg
3	Density of abrasive	4000 kg/m <sup>3</sup>
4	Water density	1000 kg/m <sup>3</sup>

- a. 0.3 % v/v of abrasive : water  
b. 0.0987 v/v of abrasive : water  
c. 0.115 v/v of abrasive : water  
d. None of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
b.

4) An outgoing student group is contemplating a startup for debossing numbers on glass surfaces by using USM as a debossing tool. They are thinking of two options – one is to go for a single tool with indexable rectangular shape



This will be used to deboss all numbers by using above tool in sequence and the other is to get dedicated tools for each number separately, like this for 8



If only machining time is considered, the debossing time with tool 1 and that with tool 2 for the number 8, will be (for the same depth)

- a. debossing time with tool 1 > that with tool 2  
b. debossing time with tool 1 < that with tool 2  
c. debossing time with tool 1 = that with tool 2  
d. None of these

1 point

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
b.

5) There is a USM machine in which the horn is having the cross sectional area decreasing exponentially with its length, from the transducer end to the tool end. The main reason for doing this is to

1 point

- a. Reduce the weight of the horn  
b. Make it possible for the horn to be introduced inside holes and recesses  
c. Increase the amplitude of vibration from transducer end to the tool end  
d. None of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
c.

6) The principal material removal mechanism in case of USM of brittle work piece material is

1 point

- a. Ploughing  
b. Micro cutting  
c. Impact erosion  
d. None of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
c.

7) The frequency in USM is nearest to

1 point

- a. 100 Hz  
b. 20 Hz  
c. 20 kHz  
d. Not near any of these within 2 Hz

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
c.

8) USM is ideal for the drilling of

1 point

- a. Glass  
b. Gold  
c. Aluminum  
d. None of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
a.

9) If roughness of part surface, obtained through USM is to be reduced,

1 point

- a. Liquid slurry flow rate should be increased  
b. Average size of abrasive particles should be reduced  
c. Frequency of vibration should be reduced  
d. None of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
b.

10) One of the abrasives used in case of USM is

1 point

- a. Gold powder  
b. Graphite powder  
c. Sic powder  
d. None of these

- a.  
 b.  
 c.  
 d.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
c.