



Name :
Roll No. :
Invigilator's Signature :

CS/M.Tech /(PE)/SEM-1/PEM-103/2012-13

2012

THEORY OF MACHINING AND GRINDING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

Answer any *one* question

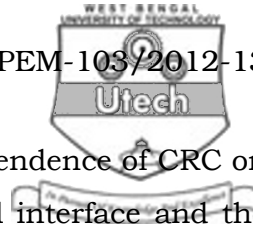
1. a) Explain why study of tool geometry is important for obtaining good machinability. 3
b) A tool signature is given by :
 $0^\circ - (-) 7^\circ - 6^\circ - 6^\circ - 15^\circ - 90^\circ - 0.4 \text{ mm}.$
From this tool signature, evaluate the tool setting angles in ASA system for grinding rake face and principal flank surface. Derive the relationships used. 3 + 8
2. a) Define a normal plane. How is it different from an orthogonal plane ? State the advantage of using NRS of tool signature system. 1 + 2 + 2
b) A HSS milling cutter has its flank surface with Archimedian spiral. After reaching its tool life, how this cutter can be made reusable ? Discuss the method briefly. 5
c) "In a standard twist drill, rake and clearance angles vary along the cutting edge from its centre towards the periphery". Justify the statement. 4



GROUP – B

Answer any *two* of the following.

3. a) Discuss briefly the mechanism of chip formation in machining.
- b) Under what machining conditions a ductile material like Aluminium will give discontinuous chips ?
- c) Compare tungsten carbide and ceramic as cutting tool materials.
- d) Why diamond tool is not generally recommended for machining of ferrous materials ? What do you mean by high performance cutting tool ? 6 + 2 + 3 + 3
4. a) Derive Ernst and Merchant's solution. Explain the cause of necessary modifications in MCD.
- b) What is the purpose of using chip breakers ?
- c) Sketch a diagram to show the variation of rake angle and clearance angle along the cutting edge of a twist drill.
- d) During machining with a carbide tool, the wear land size l_w (mm) was found to be related to the cutting speed V (m/min) and tool life T (min) by the following relationship :
- $$l_w = 56.5 \times 10^{-8} V^{2.4} T^{0.6}$$
- Assuming $l_w^* = 1.5$ mm as the criterion for tool failure, obtain the tool life equation and evaluate the cutting speed for a tool life of 30 min. 6 + 2 + 3 + 3



5. a) Derive an expression to show the dependence of CRC on the frictional aspects at the chip tool interface and the orthogonal rake angle.
- b) Effectiveness of a cutting fluid is a function of the flow rate and direction of flow. Justify the statement.
- c) State the significance of restricted contact machining.
- d) During orthogonal machining with an HSS tool, the rake angle was 5° , the underformed chip thickness was 0.25 mm and the width of cut was 4 mm. Taking the shear strength of the work material to be 350 N/mm^2 and the co-efficient of friction between the chip and the tool to be 0.5, estimate the cutting force and thrust force components.

5 + 3 + 2 + 4

GROUP – C

Answer any *two* of the following.

6. a) Describe briefly the different methods of application of grinding fluid under different situations. 6
- b) How can surface finish and surface integrity of the product be improved in grinding ? 3
- c) The wheel is given an infeed of $25 \mu\text{m}$ in horizontal surface grinding. The stiffness factor is $K = 0.3$. After 10 spark-out passes without further in feed, what is the size error due to system deflection ? 2
- d) Describe different factors for selecting grinding wheel for any work. 3



7. a) What is meant by grindability and how can it be assessed and improved ? 4
- b) Why does grinding wheel need balancing, truing and dressing before use ? 2
- c) Derive the maximum uncut grit depth of cut (h_m) assuming the abrasive to be square pyramid with apex angle of 120° . 8
8. a) Write short notes on the following :
- i) Creep feed grinding
- ii) High-efficiency deep grinding (HEDG) 4
- b) What are the possible causes and effects of vibration in grinding ? 3
- c) What is self-excited vibration ? Explain van der Pal's model of vibration for machining. 4
- d) What is high speed machining ? Explain its advantages and disadvantages. 3
9. a) Derive Gilbert's model for economic tool life. 7
- b) Derive the formula $lc = (a \cdot ds)^{\frac{1}{2}}$ for surface grinding, where lc = arc length of contact, a = infeed and ds = grinding wheel diameter. 3
- c) Write short notes on the following :
- i) G-ratio
- ii) Grinding Temperature. 4
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