

Name :

Roll No. :

Invigilator's Signature :

**CS/M.Tech(PE)/SEM-1/PEM-102/2009-10
2009**

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.*

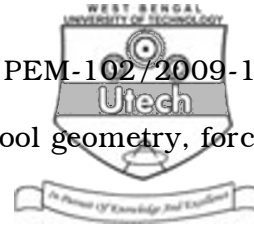
Answer five question taking at least *two* questions
from each group.

GROUP – A

1. A tool signature is given by
– 6°, – 6°, 6°, 6°, 6°, 15°, 75°, 0·8° mm (ORS)
 - a) Find out the angles to set for grinding the rake surface and flank surface of the cutting tool in ORS corresponding to the above tool signature. 2
 - b) State why this ORS system is not recommended by ISO. 2
 - c) With reasons, state the ISO system to overcome the above problem and find out the angle setting to grind the rake face and flank surface. 2 + 3
 - d) Derive the angles to set in a 2-D system for grinding the rake surface of the tool signature. 5



2. a) For a typical twist drill, show how do a rake angle and a clearance angle change along the cutting edge ? 5
- b) Describe the role of the chisel edge in a drill. How can this be modified ? 4 + 5
3. a) Discuss the method (any one) of drill grinding. 5
- b) State the ways to sharpen horizontal axis milling cutters. Give schematic diagrams. 6
- c) What is chip load ? How does it affect machining ? 3
4. a) Discuss briefly about determination of shear angle experimentally through microstructure observation. 5
- b) What are meant by restricted machining and controlled contact machining ? State their usefulness. 6
- c) Write a short note on built-up edge (BUE). 3
5. a) How is orthogonal machining is different from oblique machining ? 4
- b) State the applications of + ve and - ve rake angles with reasons. 5
- c) Why is high tool temperature not desired during machining ? How can it be controlled ? 5
6. a) With sketches, describe briefly the embedded thermocouple-based temperature measurement technique. 7
- b) State the desirable characteristics of a tool force dynamometer. 4
- c) State the use of calibration curve in temperature as well as force measurement ? 3



7. a) For a cutting tool with the following tool geometry, force components experienced are

$$P_x = 120 \text{ N, and } P_z = 200 \text{ N.}$$

Tool signature : $0^\circ - 6^\circ - 6^\circ - 6^\circ - 15^\circ - 90^\circ - 0.50 \text{ mm.}$

Machining is performed on MS job with 0.1 mm/rev feed and 60 m/min cutting velocity. Chip thickness measured is 0.35 mm in turning.

Find out

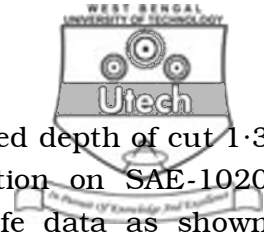
- i) shear angle
- ii) shear strain
- iii) coefficient of friction
- iv) shear force compount.

Derive the formula used for shear strain and shear force. 4 + 5

- b) How can P_x and P_z be measured using a strain gauge or a piezoelectric dynamometer ? 5

GROUP – B

8. a) Compare between ceramic and tungsten carbide tools. 3
- b) State the standards developed by ISO for grouping of carbide tools. 2
- c) Write a short note on Cubic Boron Nitride (CBN) tool material. 3
- d) Discuss the mechanisms of tool wear. With sketch, explain geometry and major features of wear of turning tools. 6
9. a) Is diamond tool suitable for turning high carbon steel ? Justify your answer. 2
- b) Compare between creep-feed grinding and high efficiency deep grinding. 3



- c) The tool life test conducted with a fixed depth of cut 1.3 mm and a feed of 0.3 mm/revolution on SAE-1020 steel, presented a scatter in tool life data as shown below :

Cutting speed m/minute	100	150	200	220	250
Tool life, minute	7	5	4	3	2

Find the Taylor tool life equation from the above tool life data. 6

- d) Describe about general properties of high speed machining. 3
10. a) Write short notes of the following : 3 × 2 = 6
- i) Grinding ratio (G)
 - ii) Dressing lead (S_d)
 - iii) Dressing overlap ratio (U_d).
- b) Describe about different grinding fluid delivery methods. 3
- c) Evaluate tool life for minimum cost on the basis of Gilbert's model. 5
11. a) Write short note on "Electrolytic in-process dressing (ELID)". 4
- b) Describe about different source of vibration during machining. 3
- c) Derive the formula $l_c = (a.d_s)^{1/2}$ for straight surface grinding, where l_c = Arc length of contact, a = depth of cut, d_s = grinding wheel diameter. 3
- d) Explain about self-excited vibration using stick-slip phenomenon. 4