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 resharpen 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 restrited maching and controlled cantact maching ? 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 N, and P_z = 200 N.

Tool signature : 0° – 6° – 6° – 6° – 15° – 90° – 0·50 mm.

Machining is performed on MS job with 0·1 mm/rev feed and 60 m/min cutting velocity. Chip thickeness measured is 0·35 mm in turining.

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 : $3 \infty 2 = 6$

i) Grinding ratio (G)

ii) Dressing lead (S_d)

iii) Dressing overlap ratio (U_d).

b) Describe about different grinding fluid delevery 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 strainght 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