Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/ME(NEW)/SEM-6/ME-602/2013

2013

MACHINING PRINCIPLES AND MACHINE TOOLS

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

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) The angle between orthogonal plane and normal plane of a single point turing tool (SPTT) is

      a) γ_o b) ϕ

      c) λ d) γ_n .

   ii) A cutting tool can never have its

      a) rake angle – positive

      b) rake angle – negative

      c) clearance angle – positive

      d) clearance angle – negative.

iii) Rake angle of a standard twist drill

a) is constant

b) varies from a positive value at the periphery to a negative value around its centre

c) is zero

d) has positive value around its centre and changes uniformly to a negative value at the drill periphery.

iv) Machining of cast iron yields

a) powdered, needle-like chips

b) long continuous chips

c) fractured chips

d) open coiled chips.

v) Chip reduction coefficient is

a) always less than 1·0

b) equal to or less than 1·0

c) more than 1·0

d) none of these.

vi) In machining, merchants circle diagram deals with

a) machining forces b) tool life

c) cutting temperature d) surface finish.

vii) Life of any cutting tool depends on

a) tool material

b) tool geometry

c) application of cutting fluid

d) all of these.

viii) In orthogonal cutting system, chip flows

a) in line with direction of tool travel

b) perpendicular to the direction of tool travel

c) perpendicular to shear plane

d) perpendicular to cutting plane.

ix) The composition of commonly used HSS is

a) 18 W 4 Cr 1V b) 12 Mo 1W 4 Cr 1V

c) 6 Mo 6W 4 Cr 1V d) none of these.

x) Tool life is most affected by

a) cutting speed b) tool geometry

c) feed d) cutting fluid.

xi) Both cutting motion and feed motion are imparted to the cutting tools in

a) lathe b) milling machine

c) drilling machine d) shaping machine.

xii) The size of the grinding wheel is generally specified by

a) diameter of the wheel

b) diameter of the spindle hole

c) face width of the wheel

d) all of these.

xiii) Dividing head is one of the most important attachments used with

a) drilling machine b) milling machine

c) sawing machine d) grinding machine.

xiv) Machine tool chatter is a vibration that

a) is self induced in course of cutting process

b) is generated due to exciting force coming from outside element

c) both of these

d) none of these.

xv) Maximum degrees of freedom in a machine tool is obtained in

a) a CNC lathe b) a CNC milling machine

c) a machining centre d) none of these.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Draw a single point turning tool (SPTT) and show on it tool signature parameters in ORS.

3. With a schematic diagram, discuss about the quick return mechanism in shaping. Why is it employed ? 4 + 1

4. a) Why are speeds of a machine tool arranged in GP ? 2

b) State the use of ray diagram showing an example of it. 3

5. a) State the main reasons of tool failure. 2

b) To ensure high tool life, state the desired properties a cutting tool should have to machine a workpiece. 3

6. a) What are the types of automation ? Discuss about their application areas. $2\frac{1}{2}$

b) State the advantages of CNC machine tools over conventional machine tools. $2\frac{1}{2}$

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Derive the relations between rake angles in the ORS system and ASA system in tool geometry of a single point cutting tool. And hence find the side rake and back rake angle of a single point turning tool with a tool geometry in ORS system is 10-0-5-8-20-90-0(mm).

5 + 3

b) State the purpose of conversion of tool angles from one system of reference to another ? 2

c) Define normal rake angle, inclination angle, back rake, orthogonal clearance and auxiliary orthogonal clearance angle. 5

8. a) Why does chip become thicker after machining ? 3

b) How does large positive rake angle help the tool in reducing the magnitude of cutting forces ? 3

c) If during turning a mild steel rod by a HSS turning tool of geometry : 0°, 0°, 10°, 10°, 20°, 90°, 0 (mm) the thickness of the chip becomes 0.5 mm, then what will be the value of shear angle during chip formation ? Given feed value of 0.2 mm/rev. Derive the relationship used. 2 + 4

d) Write a short note on built-up edge (BUE). 3

9. a) Distinguish between orthogonal & oblique cutting. 2

b) In an orthogonal cutting of steel, the following values are obtained as :

Vertical or main cutting force = 1500 N

Horizonal cutting force = 1000N

Back rake angle of tool = 10°

Cutting ratio 0.35 = (1/chip reduction coefficient)

Find the coefficient of friction at the chip tool interface using merchant circle diagram. Derive the equations used. 6

c) State the sources of heat generation in machining. How can maching temperature be controlled ? 3 + 4

10. a) During straight turning of a 24mm diameter steel bar at 300 rpm with an HSS tool, a tool life of 9 min was obtained. When the same bar was turned at 250 rpm, the tool life increased to 48.5 min. What will be the tool life at a speed of 280 rpm ? 5

b) How is a grinding wheel specified ? 3

c) Write a note on machinability. How can it be judged for a particular tool-work combination ? 4

d) State different tool wear mechanisms. 3

11. a) Differentiate between up milling and down milling. 4

b) Name what are the various operations that can be performed in a centre Lathe. 5

c) Estimate the time that will be required to reduce the diameter of a rod for 200 mm to 160 mm over a length of 145 mm in a Lathe, where spindle speed is 200 rpm, tool feed 0.5 mm/rev, depth of cut 5 mm per pass & tool approach 5 mm. 6

12. a) Find out the differences between a shaping machine and a planing machine. 4

b) What are the main differeces between a capstan lathe and a turret lathe ? 3

c) Write a note on various power drives in a CNC lathe mentioning their applicability. 3

d) Write short note on any two of the following : $2 \times 2\frac{1}{2}$

i) Recirculating bolt and nut

ii) FMS and its salient features

iii) Machining centre — its flexibility and advantages

iv) Hydraulic control of table feed.