Total Pages—5

Yogesh 17.12.2015

(Set-Q_1)

B.Tech-5th(PE)

Theory of Metal Cutting

Full Marks : 70

Time : 3 hours

Answer **Q. No. 1** which is compulsory and any **five** of the remaining seven questions

The figures in the right-hand margin indicate marks

1. Answer in brief the following : 2 × 10

   (a) State the two models those explain chip formation mechanism.

   (b) State two important conditions of formation of discontinuous chip in machining of ductile materials.

   (c) Mention the two angles those represent the orientation of rake face in ORS system.

   (d) Define chip reduction coefficient. State the approximate range of its value.

(e) The tool signature of a single point cutting tool (SPCT) is given by 8-14-6-6-8-15-$\frac{3''}{64}$ (ASA). What are the values of back rake and side rake angles ?

(f) What are the percentage of Cr and W present in 18-4-1 HSS ?

(g) Lee and Shaffer shear angle relationship. State its important application.

(h) State the relationship between mechanical properties of materials and machinability.

(i) Which of the three following variables are more responsible for surface finish (any *two*) : (1) speed (2) feed or (3) depth of cut in machining.

(j) State any two methods adopted to take care the effect of vibration in machine tools.

2. (a) State and explain the two systems of nomenclature of cutting tools, the ORS and ASA with neat sketches. How do you specify a single point cutting tool in these two systems ? 6

(b) A cutting tool is specified in ASA system with a back rake angle 8°, side rake angle 10° and side cutting edge angle 15°. Calculate the inclination angle λ and the orthogonal rake angle γ_0. 4

3. (a) What are the different types of chips produced in machining ? State their favourable conditions of their occurrence, advantages and disadvantages. 6

(b) State the types of chips produced in milling process. How does the shape of such chips vary for upmilling and down milling processes ? State the expression for uncut chip area for milling by plain milling cutters. 4

4. Derive an expression for Merchant's shear angle relationship from Merchant's circle diagram with a neat sketch. State the assumptions made for the Merchant's analysis. 10

5. Following data were collected from an orthogonal machining test of steel :

Cutting speed	18 m/min
Rake angle	20°
Clearance angle	10°
Width of cut	3·2 mm
Undeformed chip thickness	0·06 mm
Deformed chip thickness	0·25 mm
Cutting force in cutting velocity direction	800 N
Normal force in a direction normal to cutting velocity	500 N

Draw the circle diagram of forces and evaluate :

sheare angle, shears train, friction coefficient against chip flow; friction force on the rake face. 10

6. (a) What are the functions of cutting fluid in machining ? State the advantages and disadvantages of different types of cutting fluids. 6

(b) What are the techniques of application of cutting fluids ? Explain with neat sketches. 4

7. (a) State and explain the factors on which tool wear and tool life depend. 6

(b) Establish the simple tool life equation with magnitudes of constants from the following data (Taylor's tool life equation). A tool life of 100 min is obtained from a cutting tool at a speed of 25 m/min and 10 min at cutting speed of 33·3 m/min. What is the cutting speed for 60 min tool life ? 4

8. Write short notes on any *three* of the following including '(*i*)' which is compulsory : 4 + 3 + 3 + 3

(*i*) Geometry of twist drill and variation of rake angle along the cutting edge

(*ii*) Modified Taylor's tool life equation

(*iii*) Force-Measurement by Turning tool dynamometer

(*iv*) Chip-tool interface temperature.

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