MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : ME-602

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) A cutting tool can never have its

a) rake angle positive

b) rake angle negative

c) clearance angle positive

d) clearance angle negative.

ii) In machining Merchant's circle diagram deals with

a) tool geometry

b) mechanism of chip formation

c) mechanics of machining

d) tool life.

iii) Taylor's tool life equation is expressed by

a) $TV^n = C$ b) $VT^n = C$

c) $(VT)^n = C$ d) $VT = C$.

iv) The angle between orthogonal plane and normal plane of a single point turning tool is

a) γ_o b) ϕ

c) λ d) γ_n.

v) 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.

vi) Tool life is most affected by

a) cutting speed b) tool geometry

c) feed d) cutting fluid.

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

a) lathe
b) milling machine
c) drilling machine
d) shaping machine.

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

a) diameter of the wheel
b) diameter of the spindle
c) face width of the wheel
d) all of these.

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

a) drilling machine
b) milling machine
c) sawing machine
d) grinding machine.

x) Machining of cast iron yields

a) powdered, needle like chip
b) long continuous chip
c) fractured chips
d) open coil chips.

xi) Chip reduction coefficient is

a) always less then 1.0

b) equal to or less than 1.0

c) more than 1.0

d) none of these.

xii) Normal rake and orthogonal rake of a turning tool will be same when its

a) $\varphi = 0°$ b) $\lambda = 0°$

c) $\varphi_1 = 0°$ d) $\varphi_1 = 90°$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

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

3. (a) Why are speeds of a machine tool arranged in GP ?

(b) State the use of ray diagram showing an example of it. 2 + 3

4. Write a note on various power drives in a CNC lathe mentioning their applicability. 3 + 2

5. a) With a schematic diagram, discuss about the quick return mechanism in shaping.

b) Why is it employed? 4 + 1

6. a) What are the differences between shaping machine and planning machine?

b) State the advantages of CNC machine tools over conventional machine tools. 2 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What are the different types of kinematic structure in machine tools?

b) Explain a "C" type kinematic structure with neat sketch. 5 + 10

8. a) What do you mean by tool life ? State the main reasons of tool failure.

b) The following equation for tool life is given for a turning operation :

$VT^{0.13} f^{0.77} d^{0.37} = C.$

A 60 minute tool life was obtained while cutting at V = 30 m/min, f = 0.3 mm/rev. & d = 2.5 mm. Determine the change in tool life if the cutting speed, feed & depth of cut are increased by 20% individually & also taken together. 5 + 10

9. In an orthogonal cutting, the following data are available : uncut chip thickness = 0.127 mm, width of cut = 6.35 mm, cutting speed = 2 m/s, rake angle = 10°, cutting force = 567 N, thrust force = 227 N, chip thickness = 0.228 mm. Calculate

a) The frictional force and normal force.

b) Mean frictional angle and kinematic co-efficient of friction.

c) Cutting ratio, shear plane angle.

d) The shear force and normal force at shear plane.

e) Direction and magnitude of resultant force. 5 × 3

10. a) Explain Generatrix and Directrix with neat sketch for the following operations (any *two*) :

i) Gear Hobbing; ii) Thread milling; iii) Turning. 4 + 4

b) Why is Broaching called progressive cutting ? Explain Broaching with neat sketch. 2 + 3

c) What are the major components of a Planning Machine ? 2

11. a) What is speed gear box (SGB) ?

b) What is 'Ray diagram' ?

c) Design 3 feasible open type 'speed flow diagram' and gear layout for a 12 speed gearbox (in 3 stages). 3 + 2 + 4 + 6

2. a) Describe briefly the basic working principle of numerical control of machine tools. State the functions of DPU (data processing unit) and CLU (control loop unit) of numerical control system of machine tools. 7

b) Draw schematically the kinematic diagram of a conventional milling machine. 7 + 8