



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : ME-602

MACHINING PRINCIPLES & 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 the following :

10 × 1 = 10

i) American Standard Association (ASA) system of designation of cutting tool geometry is actually

- a) tool in hand system
- b) machine reference system
- c) tool reference system
- d) work reference system.

- ii) The value of shear angle, β_0 depends upon
 - a) tool rake angle
 - b) friction at chip-tool interface
 - c) built-up-edge formation
 - d) all of these.
- iii) Relief angle on HSS tool usually vary from
 - a) 3° to 10°
 - b) 11° to 15°
 - c) 16° to 20°
 - d) 22° to 27° .
- iv) The maximum amount of heat that is generated at the cutting zone during machining goes to the
 - a) Cutting tool
 - b) Workpiece
 - c) Chip
 - d) none of these.
- v) Taylor's tool life equation is expressed as
 - a) $V^n T = C$
 - b) $VT^n = C$
 - c) $(VT)^n = C$
 - d) $VT = C$.
- vi) The most flexible machining system is
 - a) CNC milling machine
 - b) Machining centre
 - c) FMS
 - d) CIM.

- vii) Numerically controlled machine tools are
- non-automatic
 - semi-automatic
 - fixed type automatic
 - flexibly automatic.
- viii) Among the manufacturing processes, machining is a
- Forming process
 - Removal process
 - Joining process
 - Regenerative process.
- ix) In a 48 A 100-H-8-S-BE grinding wheel the type of bond used is
- Vitrified
 - Silicate
 - Resinoid
 - Rubber.
- x) In machining Merchant's Circle diagram deals with
- tool geometry
 - mechanism of chip formation
 - mechanism of machining
 - tool life.

GROUP - B

(Short Answer Type Questions)

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

- Prove that $\tan \beta_0 = \cos \gamma_0 / \xi - \sin \gamma_0$, where β_0 = shear angle, γ_0 = rake angle and ξ = chip reduction coefficient.
- During machining of C-20 steel (carbon 0.2%) with a triple carbide cutting tool of 0-10-6-6-8-75-1 (mm) ORS configuration shape with a feed of 0.2 mm/min and depth of cut of 2 mm at a cutting speed of 140 m/min a chip thickness of 0.36 mm has been obtained. Calculate the (a) chip reduction coefficient, (b) shear angle.
- With a schematic diagram, discuss about the quick return mechanism in shaping.
- Differentiate Up milling and Down milling with suitable skewness. What is Machinability index? $4 + 1$
- a) Show the tool-work motions and the Generatrix and Directrix in external thread cutting in centre lathe.
b) In which conventional machine tools flat surface can be produced? $3 + 2$

- 7 a) State the main reasons of tool failure.
b) To ensure high tool life, state the desired properties a cutting tool should have to machine a workpiece.

2 + 3

GROUP - C

(Long Answer Type Questions)

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

8. a) Considering the Merchant's theory of metal cutting prove that, $2\beta + \eta - \gamma_0 = \frac{\pi}{2}$, where β = shear angle, η = friction angle and γ_0 = orthogonal rake angle.
b) Derive the following expression in orthogonal cutting $\xi = e^{\mu(\frac{\pi}{2} - \gamma_0)}$, where ξ is the chip reduction coefficient, μ is the coefficient of friction and γ_0 is the rake angle.
9. a) Prove that in turning material removal rate (MRR) can be approximated by the expression $MRR = 1000 V_c S_0 t$ mm³/min where V_c is cutting speed in m/min, S_0 is the feed in mm/rev and t is the depth of cut in mm and hence prove that for a

http://www.makaut.com

given length (L) of the job requiring multiple pass (n_p), machining time can be calculated as

$$T_{m/c} = \frac{L}{S_0 \times N} \times n_p, \text{ where } N \text{ is the rpm.}$$

- b) In shaping, prove that average cutting velocity V can be expressed as $V = \frac{NL(1+q)}{1000}$ m/min, where N = number of complete strokes per minute, L = length of stroke in mm and q = ratio of time taken in return stroke to that of forward stroke.
- c) Calculate the time required to mill a slot of 350 mm × 30 mm in a mild steel workpiece of 350 mm length with a side and face milling cutter of 120 mm diameter, 30 mm wide and having 20 teeth. The depth of cut is 6 mm, the feed per tooth is 0.1 mm and cutting speed is 34 m/min. Assume overtravel distance of 5 mm.
10. a) What are advantages of CNC over conventional machine tools?
b) Write a short note on drives of CNC machine tools.
c) Write a short note on FMS.

CS/B.Tech/ME/EVEN/SEM-6/ME-602/2016-17

- d) What is function of MCU ?
- e) Distinguish between NC and CNC.

3 + 3 + 3 + 3 + 3

11. a) Mention the difference between Planer & Shaper.
b) Discuss about Loading & Glazing of a grinding wheel.
c) Explain Honing and Lapping processes.
d) Write down the types of abrasives in a grinding wheel.
e) Show the main parts of the twist drill drawing the neat sketch.
12. a) Describe a 3-2-1 locating principle in a jig or fixture.
b) Calculate the suitable gear trains for cutting thread using lead of the thread to be cut 30 mm on a lathe with a lead screw having 6.25 mm pitch.
c) Distinguish between mass production and batch production.

3 + (2 + 2) + 3 + 2 + 3

5 + 5 + 5

<http://www.makaut.com>