# MACHINING & MACHINE TOOLS
## (MECH 3104)

**Time Allotted : 3 hrs**            **Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and*
*<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

# Group – A
## (Multiple Choice Type Questions)

1. Choose the correct alternative for the following:          **10 × 1 = 10**

   (i)    The tool angle which causes oblique cutting is
       (a) rake angle                 (b) clearance angle
       (c) inclination angle          (d) principal cutting edge angle.

   (ii)   Cutting tools are essentially provided with clearance angle
       (a)  for ease of chip flow
       (b)  to reduce cutting forces
       (c)  to avoid rubbing with the finished surface
       (d)  to reduce friction at the chip tool interface.

   (iii)  In machining, Built-up-edge develops at the chip tool interface mainly due to
       (a) abrasion      (b) adhesion      (c) diffusion      (d) cohesion.

   (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) chip breaker.

   (v)   The machining chips will be discontinuous type and of irregular size and shape, if the work material being machine is
       (a) mild steel              (b) wrought iron
       (c) stainless steel         (d) grey cast iron.

   (vi)  Material separation in the form of chip in machining ductile metals is caused mainly by
       (a) tensile stress           (b) compressive stress
       (c) shear stress             (d)  combination of all the above stresses.

   (vii)  Machinability rating (MR) is expressed by
       (a) tool life at given cutting velocity    (b) cutting velocity for a given tool life
       (c) material removal rate           (d) all of the above.

(viii) Both cutting motion and feed motion are imparted to the cutting tool in
(a) lathe
(b) drilling
(c) milling machine
(d) shaping machine.

(ix) The spindle speeds of machine tools are provided preferably in
(a) AP series
(b) GP series
(c) LP series
(d) HP series.

(x) In machine tools, a kinematic chain comprises
(a) a number of mechanisms
(b) all the power sources
(c) a power source and a mechanism
(d) a number of mechanisms and the tool/work motion.

# Group – B

2. (a) State the advantages of rake angle being positive for machining ductile metals. Explain geometry of single point cutting tool in Orthogonal Rake System with neat sketches.

(b) Name the factors that contribute to poor surface finish in machining? A single point turning tool is specified in ORS system as $0^0$, $10^0$, $8^0$, $6^0$, $15^0$, $60^0$, 0 (mm), find the back rake ($\gamma_y$) and side rake ($\gamma_x$) of the tool.

**(2 + 4) + (2 + 4) = 12**

3. (a) A mild steel rod is turned at feed of 0.20 mm/rev by tool of geometry: $0^0$, $10^0$, $8^0$, $7^0$, $15^0$, $60^0$, 0 (mm) and chip thickness becomes 0.50 mm, then determine the expected values of chip reduction co-efficient, thickness of chip before cut, shear angle and average cutting strain.

(b) What are the causes and effects of formation of Built-up-edge (BUE) during machining of ductile materials? State the factors which are responsible for producing continuous chip formation during machining.

**6 + (4+2) = 12**

# Group – C

4. (a) During turning a mild steel bar of diameter 160 mm at speed 560 rpm, feed 0.32 mm/rev and depth of cut 4.00 mm by a ceramic insert of geometry $0^0$, $-10^0$, $6^0$, $6^0$, $15^0$, $75^0$, 0 (mm). The following data were obtained: $P_Z$ = 1000 N, $P_X$ = 800 N and chip thickness = 1mm. Determine with help of MCD the possible values of F, N, $\gamma$, Ps, Pn and cutting power consumption. (Symbols are as per convention)

(b) Define Machinability of a work material. Discuss on the factors on which machinability of a material depends.

**6 + (2 + 4) = 12**

5. (a) State the sources and effects of heat generation in machining. What are the essential properties of cutting fluids. Name 3 (three) cutting fluids and their specific uses.

(b) What are the important characteristics of cutting tool? The following data were obtained while turning a mild steel rod on a lathe: cutting speed = 30 m/min, feed = 0.25 mm/rev., depth of cut = 2.0 mm, tool life = 90 minutes. The following tool life equation is given by the equation $V T^{0.12} f^{0.7} t^{0.3} = C$. If turning speed is increased by 25%, what will be the effect on tool life?

**(3 + 3) + (2 + 4) = 12**

# Group – D

6. (a) Briefly explain with the help of suitable diagrams, the principle of production of flat surfaces and cylindrical surfaces during facing and turning operation respectively in lathe with the help of Generatrix and Directrix.

(b) Explain kinematic structure to transmit power from motor to spindle of a centre lathe to rotate it in variable speed with suitable diagram.

**6 + 6 = 12**

7. (a) What are the major differences between capstan and turret lathe. Write down the name of the operations that can be done on a Lathe.

(b) Explain the mechanism behind quick return ratio in Shaper.

**(3 + 3) + 6 = 12**

# Group – E

8. (a) Name different bonds used in the manufacturing of grinding wheels. Write down the standard marking system for conventional abrasive wheel.

(b) A cylindrical job of 80 mm diameter and 200 mm length has to be turned up to 60 mm diameter with a carbide tool at a cutting speed of 100 m/min and feed of 0.2 mm/revolution in a centre lathe. Depth of each pass is 2 mm. Estimate the machining time required for turning the job with an approach and over travel of 2mm each.

**(4 + 2) + 6 = 12**

9. (a) What is NC system. Explain the feedback system of CNC with suitable sketch.

(b) How are the lowest spindle speed and the highest spindle speed (rpm) decided during designing the speed gear box of centre lathe? State why geometric progression (GP) is preferred to arithmetic progression (AP) for layout of spindle speeds in machine tools.

**(3 + 3) + (3 + 3) = 12**

| Department & Section | Submission link: |
|---|---|
| ME A | https://classroom.google.com/c/MTIzMDAxODgwNzQx/a/Mjc0NzM5 NjY1MTk5/details |
| ME B | https://classroom.google.com/c/MjcxMTE1ODY0NzA0 /a/MjcxMTE4MDQxNjQz/details |