

- (b) A drilling machine having nine spindle speeds in GP (geometric progression) is to be designed for drilling holes of diameter in between 6 mm and 30 mm at cutting velocity in between 20 m/min and 50 m/min. Determine the values of all those nine spindle speeds.
(2 + 4) + 6 = 12

9. (a) Determine the actual machining time that will be required to remove, by shaping a layer of 2 mm thickness from a cast iron plate of length 100 mm and width 60 mm at cutting velocity of 40 m/min and feed of 0.2 mm/stroke. Assume approach and overrun along width = 2 mm and along length = 5 mm, quick return ratio of the shaping machine is 2/3.
- (b) How are numerical control machine tools different from mechanical control of conventional machine tools? Distinguish between Numerical Controlled (NC) machine tools and Computer Numerical Controlled (CNC) machine tools.

6 + (3 + 3) = 12

**MACHINING PRINCIPLE & MACHINE TOOLS
(MECH 3202)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

***Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one 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**
- The angle of inclination of the top surface of the turning tool from the plane perpendicular to the velocity vector is called tool's
 (a) rake angle (b) clearance angle
 (c) cutting edge angle (d) inclination angle.
 - Back rake of turning tool is measured on its
 (a) machine longitudinal plane (b) orthogonal plane
 (c) machine transverse plane (d) cutting plane.
 - Both cutting motion and feed motion are imparted to the cutting tool in
 (a) lathe (b) drilling machine
 (c) milling machine (d) shaping machine.
 - Chip in turning has a thickness
 (a) greater than uncut chip thickness
 (b) less than uncut chip thickness
 (c) equal to uncut chip thickness
 (d) any of these.
 - Power required for turning operation is given by
 (a) $P_s \times V_c + F \times V_c$ (b) $P_z \times V_c + F \times V_f$
 (c) $P_n \times V_f + N \times V_c$ (d) $P_x \times V_f + N \times V_c$.
 - Turning can be done at a cutting velocity of 150 m/min with a
 (a) high carbon steel tool (b) high speed steel tool
 (c) carbide tool (d) all of these.

- (vii) The spindle speeds of machine tools are provided preferably in
 (a) AP (arithmetic progression) series
 (b) GP (geometric progression) series
 (c) LP (logarithmic progression) series
 (d) HP (harmonic progression) series.
- (viii) Machine tool helps manufacturing products by
 (a) joining process (b) metal forming process
 (c) removal process (d) regenerative process.
- (ix) Capstan lathes are
 (a) non automatic (b) semi automatic
 (c) automatic (d) any of these.
- (x) Use of CNC machine tools is not justified for
 (a) piece production (b) batch production
 (c) small lot production (d) mass production.

Group - B

2. (a) Define machining. Explain the significance of rake and clearance angles in cutting tools.
 (b) Represent the geometry of a single point turning tool in ASA system. Give necessary sketches.
 (c) Differentiate between Orthogonal cutting and Oblique cutting.
(2 + 3) + 4 + 3 = 12
3. (a) A mild steel rod is turned at feed of 0.32 mm/rev by tool of geometry: 0°, 12°, 6°, 6°, 20°, 45°, 0 (mm) and chip thickness becomes 0.64 mm. Determine the expected values of chip reduction co-efficient, thickness of chip before cut, shear angle and average cutting strain.
 (b) What is meant by Built-up-edge formation in machining ductile metals? Discuss the factors responsible for production of various types of chip during machining.

6 + (3 + 3) = 12

Group - C

4. (a) Considering a free body diagram of the chip formed during turning show the forces acting on the chip and explain the formation of Merchant's circle diagram.

- (b) Theoretically estimate the tangential force (P_z) from machining parameters (feed, depth of cut) and material property (yield shear stress) using angle relationship in Merchant' circle diagram.
- (c) Describe a tool force dynamometer.
5 + 4 + 3 = 12
5. (a) Discuss on the sources of heat generation in machining giving a neat sketch of heat flow.
 (b) Show the flank tool wear growth of a turning tool against time of machining at a given cutting velocity. What is criterion of flank wear for determining tool life of a tool ?
 (c) Explain the advantages and disadvantages of using carbide tools over HSS tools.

4 + 4 + 4 = 12

Group - D

6. (a) Explain Generatrix and Directrix with neat sketch for the following operations: (i) turning and (ii) facing.
 (b) How are centre lathes specified? How are capstan lathes and turret lathes different from centre lathes?
 (c) What are the major components of a Planning machine?
6 + (2 + 2) + 2 = 12
7. (a) State the basic functions of the kinematic structure of machines tools. Explain compound kinematic structure using suitable block diagram.
 (b) Schematically show how power and motion are transmitted from the motor to the work piece in a centre lathe.

(3 + 4) + 5 = 12

Group - E

8. (a) What is meant by the term machinability of a material? How do materials and geometry of cutting tools influence the machinability characteristics of work materials?