

(3 Hours)**[Total Marks : 80]****N.B.** (1) Question no. 1 is **compulsory**.(2) Attempt any **three** questions out of remaining **five** questions.(3) **Illustrate** your answer with **necessary** sketch wherever **necessary**.(4) **Figures** to the **right** indicate full **marks**.(5) **Assume** suitable data wherever **necessary**.

1. **Attempt any FOUR of the following :** (20)
- Write in brief about Lee and Shaffer's theory.
 - Explain about the action of coolants.
 - Explain crater wear and flank wear.
 - Write in brief about micro hardness.
 - Explain about the Normal Rake System (NRS).
2. (a) In an orthogonal turning operation on a lathe, the following observations were obtained: Cutting force = 120 N, Feed rate = 0.2 mm/rev, Feed force = 30 N, Cutting thickness = 0.3 mm, Back rake angle = 15°, Cutting speed = 100 m/min, Workpiece diameter = 120 mm, Depth of cut = 0.4 mm. Calculate: (i) Chip thickness ratio (ii) Shear angle (iii) Friction angle (iv) Coefficient of friction (v) Shear stress. (10)
- (b) Explain about the sources of heat in metal cutting. (6)
- (c) Write in brief about the measurement of cutting temperature. (4)
3. (a) A carbide tipped tool of designation 0-10-5-5-8-90-1 mm (ORS) is used to turn a steel workpiece of 50 mm diameter with cutting speed of 240 m/min and feed of 0.25 mm/rev. If Cutting force = 180 N, Feed force = 100 N, Chip thickness = 0.32 mm. Calculate: (i) Shear angle, (ii) Shear force, (iii) Normal force acting on shear plane, (iv) Coefficient of friction, (v) Chip flow velocity. (10)
- (b) Explain Built Up Edge (BUE) formation and its influence on surface finish. (6)
- (c) Write short note on: Polycrystalline diamond (PCD). (4)
4. (a) Explain Taylor's tool life equation. (10)
- (b) Write short note on: Chip breakers. (6)
- (c) Explain the constructional features of tipped tools. (4)

5. (a) In a certain tool test, a single point cutting tool had a life of 10 minutes when operating at 240m/min. At what speed should the tool have to be operated in order to have a tool life of 3 hours? Taken $n = 0.2$ (10)
- (b) Explain about the tangential form tools. (6)
- (c) Calculate the total effective length and the number of teeth of a broach to be used for cutting a keyway 5 mm wide, 2.5 mm deep in a boss 45 mm long. Assume number of finishing teeth = 6 and rise per tooth = 0.0875 mm. (4)
6. (a) Find the total effective length of a broach to be used for cutting a square keyway of 5 mm side in a boss of 60 mm length. Assume number of finishing teeth = 5 and rise per tooth = 0.075 mm. Also find number of teeth of a broach and force required to pull the broach if $K = 4000$ N. (10)
- (b) Explain the constructional details of flat form tool. (6)
- (c) Write short note on: Drilling dynamometer (4)
