

All answers must be brief and to the point. Assume any relevant data wherever required. All parts of a question must be answered together.

1. Answer in brief the followings: 20

 - a. Sketch the machining of a Gear tooth by end milling cutter and mention clearly how the directrix and the generatrix have been formed and whether they are related with any motions. Is there any auxiliary motion given during such machining process? 4
 - b. With neat sketches show the normal rake and clearance angles of a single point cutting tool. Under which condition will the normal and orthogonal rake angles become the same? 4
 - c. What are the major causes of a Built up Edge formation during machining by a single point tool. Derive the following equation: $\tan \beta = \frac{\cos \gamma_o}{\zeta - \sin \gamma_o}$ 4
 - d. With neat sketch give an example of a pure orthogonal machining process. What is restricted cutting effect phenomenon? 4
 - e. Mention any two favourable and any two unfavourable effects of chip breaking. 4
2. During turning a ductile alloy by a tool of $\gamma_o = 10^\circ$, it was found $P_Z = 1000$ N, $P_X = 400$ N, $P_Y = 300$ N and $\zeta = 2.5$. Evaluate, using MCD (graphically), the values of F, N and μ as well as P_s and P_n for the above machining process. 7
3. A low carbon steel bar is being turned orthogonally with an uncoated carbide insert at a cutting speed of 80 m/min, feed of 0.2 mm/rev and depth of cut of 2 mm. The main (tangential) cutting force P_z and resultant thrust force P_y are 1000 N and 600 N respectively. Assume 90% conversion of the cutting energy into heat and the chip takes away 85% of the heat from the primary shear zone. Calculate the rise in temperature at the primary shear plane. The density, thermal conductivity and specific heat of the work material in SI unit are 7800, 50 and 500 respectively. The orthogonal rake angle is zero. 8
4. What are the different mechanisms of tool wear during machining operations and explain in details with an example the diffusion (macro) wear mechanism in machining. During turning a metallic rod at a given condition, the tool life was found to increase from 25 min to 50 min. when V_c was reduced from 100 m/min to 80 m/min. How much will be the life of that tool if machined at 90 m/min? $3+4+3=10$
5. What are the basic principles of measuring cutting forces from its effects? Mention any five drawbacks of strain gauged dynamometers over the piezoelectric ones. $5+5=10$
6. What type of temperature measurement technique can be used when both the work material and the tool material are non conductive in nature and explain in brief the method to be used? 5
7. What type of cutting fluid is preferred during high speed cutting process and why? Name any two solid lubricants which can be used during machining and mention any two benefits of the solid lubricants over the conventional cutting fluids. $3+2=5$
8. Which type of non conventional machining process will be preferred for machining of brittle materials and explain in brief the process used. What is taper cut and overcut in Electro-discharge machining process and how taper cut can be controlled? $3+2=5$