BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR

M.E. 1ST SEMESTER (MECHANICAL) FINAL EXAMINATIONS, 2011

Theory of Metal Cutting (ME-915)

Full Marks: 70 **Time: 3 hr**

Answer any FIVE questions
All questions carry equal marks.

1. Discuss about the formation and effects of continuous chip with built-up edge, also illustrate the preventive measures against its formation.

   During an oblique cutting process with a cutting tool of 8-14-6-6-8-15-(1/64)" ASA geometry, a chip thickness of 0.35 mm has been obtained while the uncut layer thickness was 0.2 mm. Calculate (i) true shear angle and (ii) lateral shear angle.
   Assume a modified Stabler rule for the angle of chip flow (τ),$\tau = 0.8\lambda$, where λ is the inclination angle

2. Discuss how restricted cutting affects chip deviation and formation of non-uniform chip.

   Given, Job material: Medium carbon steel, Feed: 0.12 mm/rev, Chip thickness: 0.46 mm, Cutting speed: 200 mm/min
   Calculate the following, assuming single shear plane, (i) Shear angle, (ii) Dynamic Cutting Strain, (iii) Inclination of the texture line from the direction perpendicular to interface.

3 Define chip reduction coefficient (ξ). What is it's significance in metal cutting? Show how ξ varies with rake angle.

   Derive the relation between shear angle and orthogonal rake angle.

   While drilling mild steel with a 12 mm HSS drill at a feed of 0.10 mm/rev and a cutting speed of 18 m/min, a mean chip thickness of 0.10 mm has been obtained. Calculate the mean shear angle, if the point angle is 118° and helix angle is 30°.

4. With the help of Merchant's circle diagram establish the relationship of frictional force system at the chip tool interface with respect to tangential component of cutting force and thrust force.

   Draw a neat diagram of force components acting on a drill bit during cutting. Also illustrate how the torque and thrust in drilling vary with the change in helix and point angles.

5. With reference to force system during turning, discuss with illustration about the "orthogonal system of the second kind". Give an example of pure orthogonal cutting.

   Draw a neat sketch, with proper lebelling, of wear features on a single point cutting tool. Specify the limits of wear for estimating tool life.

   What are the different wear mechanisms through which wear of cutting tool occurs.

6. Write short notes on (any three)
   (i) Single shear plane theory (ii) Failure of cutting tools (iii) Cutting fluids (iv) Down milling