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I SEM M. Tech. (MANUFACTURING ENGG & TECHNOLOGY) DEGREE END SEMESTER EXAMINATIONS NOVEMBER/DECEMBER 2015

SUBJECT: THEORY OF METAL CUTTING (MME 533)
REVISED CREDIT SYSTEM
(03/12/2015)

Time: 3 Hours Max. Marks: 50

Instructions to Candidates:
- Answer **ANY FIVE FULL** questions.
- Missing data, if any, may be assumed appropriately.

1. a) Discuss the features of Tool-point reference system for designating the geometry of cutting tools with an example. **[06]**

   b) When machining steel with HSS tools, the following equation was found to fit the tool life data fairly well **[04]**

   $$V T^{0.2} f^{0.85} d^{0.3} = 243.5$$

   Calculate the tool life T at a cutting speed V = 25m/min, feed f = 0.35 mm/rev and depth of cut d = 2.0 mm. Calculate the tool life, if the above parameters are increased by 20% individually.

2. a) Obtain Merchant's shear angle solution for optimized orthogonal machining stating the assumptions. **[04]**

   b) The following data were observed during orthogonal machining: **[06]**

   Normal rake angle = 20°
   Cutting speed = 100 m/min
   Uncut chip thickness = 0.125 mm
   Width of cut = 4 mm
   Chip thickness ratio = 0.45
   Cutting force = 1100 N
   Thrust force = 400 N
   Chip-tool contact length = 0.3 mm
   Exponent of normal stress distribution on rake = 0.4

   Estimate the following:

   i) Shear plane angle
   ii) Friction angle
   iii) Maximum normal stress on rake
   iv) Shearing and chip velocities

3. a) Discuss the force system on a turning tool in oblique machining and the conditions on which the process would become orthogonal. **[06]**

   b) Discuss the influence of the following on cutting tool life: **[04]**

      i) Tool geometry

      ii) Coating of tools

4. a) Discuss the following tool wear mechanisms in machining: **[06]**

      i) Diffusion

      ii) Abrasion

   b) Discuss the characteristics and applications of the following cutting tool materials:

      i) Cubic Boron Nitride (CBN)

      ii) High Speed Steel (HSS) **[04]**

5. a) Discuss the deformation mechanisms involved in chip formation, while machining the following: **[04]**

      i) Ductile material

      ii) Brittle material

   b) Discuss the mechanics of machining based on the models proposed by Okushima and Zorev. **[06]**

6. a) Discuss the mechanisms of formation of the following types of chip while machining: **[04]**

      i) Continuous Chip

      ii) Discontinuous Chip

   b) In an orthogonal machining of mild steel the following conditions were observed:

   Tool rake angle = 8˚, Cutting force = 890 N, Thrust force = 667 N, Cutting speed = 120 m/min, uncut chip thickness = 0.25 mm, width of cut = 2.5 mm, chip thickness ratio = 0.3, Chip-tool contact length = 0.75 mm, friction angle = 30˚, Specific heat = 502 J/kgK, Density of steel = 7200 kg/m^3. Determine the maximum temperature of the chip. **[06]**