# Paper ID [PE502]

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E. MAY 2008

## M.Tech. (Sem. - 1$^{st}$)
## METAL CUTTING (PE - 502)

Time : 03 Hours                                                  Maximum Marks : 100

**Instruction to Candidates:**

1)   Attempt any **Five** questions.

2)   **All** questions carry equal marks.

*Q1)* (a)   Discuss the 'Tool nomenclature' and the effect of different tool angles on machinability and the tool performance in any machining operation.

  (b)   Discuss the 'Merchant force diagram' and its importance in machining.

  (c)   Explain different types of chip formation during machining, along with the mechanisms involved.

*Q2)* (a)   Discuss in detail the force system in oblique cutting. How does it differ from orthogonal cutting?

  (b)   Describe the following in relation to orthogonal cutting :-

  (i)    Shear strain.

  (ii)   Rate of strain.

  (iii)  Total energy consumed per unit volume.

*Q3)* (a)   Discuss the fundamental factors that affect the tool forces and hence the tool wear and tool performance in any machining operation.

  (b)   Using the concept of dynamometry and theoretical considerations, explain how the following can be measured during metal cutting :-

  (i)    Force measurement.

  (ii)   Heat measurement.

  (iii)  Temperature measurement.

*Q4)* (a)   Describe any tool life equation. On what basis the tool life criterion is based?

(b) A HSS tool requires regrinding after 2 hours and 45 minutes when machining steel at a cutting speed of 35m/min. Calculate the tool life if the speed is increased to 70m/min.

(c) How does metallurgy of the work material and the cutting tool affect the machinability in any machining operation?

*Q5)* (a) Discuss what different types of wear can take place in cutting tool. Explain any three of them along with the mechanism involved.

(b) Taking the optimization variables as 'specific cost' and 'production rate', describe the procedural steps that are involved in optimizing any machining operation? Support your answer with a suitable example.

(c) How brittle fracture is analyzed in tools using the fracture mechanics approach?

*Q6)* (a) Discuss the mechanism of grinding in detail. Also describe the cutting action of the grit and the effect of grit force on wheel wear.

(b) How grinding wheels are tested?

(c) Mention the procedural steps required in simulating any grinding process. What advantages are associated with it?

*Q7)* (a) Taking a suitable example discuss how cutting tool wear can be mathematically modeled using different approaches? What benefits can be achieved from such modelling?

(b) Write a note on 'tool life testing' and the success rate and reliability of the methods used for the same.

(c) Discuss the following :
   (i) Wear-Land wear.
   (ii) Crater wear.

*Q8)* Write notes on the following :

(a) Measurement of wear of cutting tools in machining.

(b) Economics of metal machining and its importance.

(c) Mechanics of lapping.

(d) Force system in milling operation.

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