Karunya University
(Karunya Institute of Technology and Sciences)
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1965)

End Semester Examinations - 2015-16 Even Semester - May 2016

14ME3015 Theory of Metal Cutting

Set B

Time : 3 hrs
Total Marks: 100

1. a) Derive the relationship between the various velocities during metal cutting. (8)

   b) Explain Ernest -Merchant theory for shear plane angle in orthogonal cutting. State the assumptions made. (12)

OR

2. a) Discuss the different types of chip formed in metal cutting with neat sketch. (15)

   b) Derive the expression for shear plane angle. (5)

3. a) Explain with neat sketch the system of forces in milling process. (5)

   b) Explain the American Standard Association (ASA) system for designating cutting tool with neat sketch. (15)

OR

4. Explain the construction and working of a strain gauge dynamometer used for measuring cutting force. Also state the merits and demerits of this method.

5. a) What are the essential properties of tool material? (5)

   b) Compare various tool material based on their applications to metal cutting. (15)

OR

6. During orthogonal turning of steel, 10^{o} rake cemented carbide tool was used. The work material used had a shear yield strength of 200 N/mm^2, density 6000 kg/m^3 and specific heat of 500 J/ kg-^{o}C, chip tool contact length is 0.25 mm. Other data observed during experiment were as follows:

   Undeformed chip thickness = 0.1 mm

   Depth of cut = 2 mm

   Chip thickness ratio = 0.25

   Cutting speed = 1 m/s

   Coefficient of friction = 0.674

   Thermal conductivity of work material = 50 W/m- ^{o}C.

   Calculate the average tool chip interface temperature.

7. Explain the tool work thermocouple method of measuring cutting temperature in metal cutting. State its advantages and limitations.

OR

8. A steel component is to be rough machined using a feed of 0.2 mm/rev. The size of component is 100 mm diameter and 250 mm length. The cost data is as follows:

   Cost per cutting edge of throw-away carbine insert=Rs. 50

   Changing time per cutting edge= 1 min

   Total machining rate including operator cost = Rs 300/hr

The Taylor's tool life equation is $VT^{0.25}=650$, where V is in m/min and T is in minute.

Calculate: a) Optimum cutting speed for minimum cost, b) Optimum tool life, c) Production time and d) Production cost per component. Assume loading and unloading time is 2 min per component.

9. a) Explain in detail the various mechanisms of grinding tool wear with neat sketch. (15)

b) Explain the stages of metal removal in grinding process. (5)

Wishing you All the Best
