



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Industrial and Production Engineering

Semester End Examination; Dec. - 2015

Theory of Metal Cutting

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting at least ONE full question from each unit.

UNIT - I

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| 1 a. Sketch and explain mechanics of chip formation and also explain the concept of oblique cutting. | 10 |
| b. Explain the effect of cutting speed, feed and depth of cut on tool geometry with the help of suitable graphs. | 10 |
| 2 a. Sketch and explain the ISO nomenclature of a single point cutting tool. | 8 |
| b. Explain with the help of sketch, the ASA system of tool angle specifications. | 8 |
| c. Write a note on chip breaker. | 4 |

UNIT - II

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| 3 a. Derive the relationship among the various forces in the metal cutting process using merchants circle diagram. | 10 |
| b. Write the expression used for finding the shear plane angle and explain the notations used. | 4 |
| c. In orthogonal cutting of a material the feed force is 80 kg and cutting force is 150 kg. Calculate the following, | |
| i) Compression and shear force on shear plane. | 6 |
| ii) Coefficient of friction of the chip on the tool face. Take chip thickness ratio as 0.3 and rake angle as 8°. | |
| 4 a. List the various requirements of cutting tool dynamometers. | 6 |
| b. Classify the dynamometers giving examples for each. | 4 |
| c. With a neat sketch, explain the following types of dynamometers: | 10 |
| i) Lathe tool dynamometer ii) Milling dynamometer. | |

UNIT - III

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| 5 a. Explain with the help and neat sketch Flank wear and Crater wear with suitable example. | 10 |
| b. What is tool life? Explain the effect of cutting parameters on tool life. | 6 |
| c. The tool life for a high speed steel tool is expressed by the relation $VT^{1/7} = C_1$ and for tungsten carbide is expressed as $VT^{1/5} = C_2$. If at a speed of 24 meter per minute, tool life is 128 minutes, compare the life of the two tools at a speed of 30 m/min. | 4 |

6. a. Explain the various costs associated with machining operations. 8
- b. Derive an expression for optimum cutting speed for minimum cost in turning operation. 6
- c. Determine the cost of manufacturing a component using the following data,
- Initial cost of the machine = Rs. 10,000/-
- Depreciation rate of machine = Rs. 2000/Gear
- Labour rate = Rs. 3 per hour
- Operator and machine overloads = 100%
- Number of working days per year = 250 6
- Working hours per day = 8, machining time = 3 minutes
- Non – Productive time = 2 minutes.
- Tools Changing and resetting time = 0.6 per component
- Cost of regrinding the tool per component = 7 paise
- Tool depreciation per component = 6 paise.

UNIT - IV

- 7 a. Explain with neat sketch the heat source in metal cutting. 6
- b. What are the different types of cutting fluids? Explain. 10
- c. Write a note on selection of cutting fluids. 4
- 8 a. Mention the different properties and functions of cutting fluids. 8
- b. With a neat sketch explain the temperature distribution in metal cutting process. 6
- c. Briefly explain the different factors which effect heat generation. 6

UNIT - V

- 9 a. Explain clearly the characteristics of cutting tool materials. 8
- b. Discuss HSS and cemented carbides as tool materials. 12
10. Write a note on :
- i) Carbon tool Steels
- ii) Ceramics 20
- iii) CBN
- iv) Diamond
- v) UCON.

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