Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 12209

M.E./M.Tech. DEGREE EXAMINATIONS, JANUARY 2022.

First Semester

Manufacturing Engineering

MF 4103 — THEORY OF METAL CUTTING

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How chip formation occurs in metal cutting?

2. Compare orthogonal and oblique cutting.

3. Briefly explain the effect of rake angle during cutting.

4. What do you know about straight fluted drill and fluted drill?

5. Write a short note on Heat zones in cutting.

6. List out the essential characteristics of a cutting fluid.

7. Write a short note on any two modern tool materials.

8. What are the four important characteristics of materials used for cutting tools?

9. What is tool wear?

10. What are the factors affecting chatter?

PART B — (5 × 13 = 65 marks)

11. (a) Explain primary and secondary deformation during metal cutting. Explain and calculate the forces on a chip using Merchant circle diagram.

(13)

Or

(b) Discuss in detail the force system in oblique cutting. How does it differ from orthogonal cutting? Explain different types of-chip formation during machining, along with the mechanisms involved. (13)

12. (a) Discuss the Tool Nomenclature' and the effect of tool angles on machinability and the tool performance in any machining operation. (13)

Or

(b) Discuss the following design features of a milling cutter (13)

    (i) Size of cutter

    (ii) Tool angles

    (iii) Width of land

    (iv) Number of teeth.

13. (a) What are the variables affecting tool temperature? Explain the principle and working of a tool work thermocouple. (13)

Or

(b) Explain the properties of good cutting fluid. How are the cutting fluids classified? Explain. (13)

14. (a) Discuss the fundamental factors that affect the tool forces and hence the tool wear and tool performance in any machining operation. (13)

Or

(b) Describe any tool life equation. On what basis the tool life criterion is based? How does metallurgy of the work material and the cutting tool affect the machinability in any machining operation? (13)

15. (a) Discuss in detail the different types of tool failures. What are the different wear measurement techniques? Discuss in detail. (13)

Or

(b) Explain the mechanism of chatter in machining in detail. (13)

12209

PART C — (1 × 15 = 15 marks)

16. (a) During the machining of mild steel with 0° – 10° – 8° – 8° – 90° – 2 mm ORS shaped carbide tool, the following observations were made. Depth of cut = 2.0 mm; feed = 0.2 mm / rev; cutting speed = 150 m / mm; chip thickness = 0.4 mm; tangential force = 320 N; axial force 170 N. Calculate

    (i) Shear force and normal force on shear plane

    (ii) Friction force and normal force on rake face

    (iii) Kinetic coefficient of friction and

    (iv) Specific energy in cutting.   (15)

Or

(b) What are the effects of different factors on the cutting temperature in turning? What are the different materials and their properties that can be used for Cutting tools?   (15)

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3   12209