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Question Paper Code : 10876

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

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. What are the needs for rational approach to the problem of cutting materials?

2. Mention the significance of chip breakers in subtractive manufacturing.

3. Define side relief angle.

4. How do you calculate specific cutting pressure?

5. What is hot machining?

6. List any four properties required for cutting fluids.

7. Write Taylor's tool life equation and name the notations.

8. What is the significance of machinability index?

9. Vibrations affect surface roughness. Say true or false. Justify your answer.

10. Mention any two methods to reduce chatters during machining.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the types of chip formation in metal cutting.   (6)

       (ii) Derive the expression for shear angle in orthogonal cutting in terms of rake angle and chip thickness ratio.   (7)

Or

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(b) (i) Discuss the Ernst-merchant theory and lee and Shaffer's theory of metal cutting. (9)

(ii) Explain energy considerations in machining. (4)

12. (a) (i) With neat schematic explain the single point cutting tool with its salient features Also mention the significance general rules for rake angles in it. (8)

(ii) Describe the elements involved in twist drill with necessary diagrams. (5)

Or

(b) (i) With neat schematic explain the nomenclature of milling cutter. (7)

(ii) Compare conventional and climb milling. (6)

13. (a) (i) Explain the sources and causes of heat generation and development of temperature in machining. (7)

(ii) Enumerate the effect of various parameters on temperature during machining. (6)

Or

(b) (i) Compare the measurement of chip tool interface temperature using tool work thermocouple and embedded thermocouple techniques. (7)

(ii) Evaluate the properties and applications of straight and water miscible cutting fluids in metal cutting. (6)

14. (a) (i) Compare salient features of HSS and carbide cutting tool materials. (8)

(ii) Explain the ISO specification for inserts and tool holders. (5)

Or

(b) (i) Analyze the types of tool wear during metal cutting. (8)

(ii) Describe high efficiency machining range in economics of machining. (5)

15. (a) (i) Describe the procedure involved for measuring wear in pin on disc. (8)

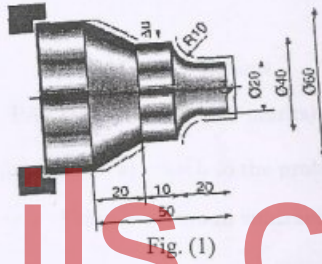(ii) Discuss the various reasons for failure of cutting tools. (5)

Or

(b) What is chatter in machining? Explain the types and mechanism of chatter during machining and the factors affecting chatters during machining. (13)

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PART C — (1 × 15 = 15 marks)

16. (a) The following observations were made during an orthogonal cutting operation, depth of cut = 0.3 mm, chip thickness = 0.6 mm, rake angle = 20°, cutting velocity = 102 m/min , cutting force = 300 N , feed force = 120 N, Determine shear angle, shear strain, velocity of chip along the tool force and work done in shear.

Or

(b) Select suitable turning inserts and tool holders for CNC applications for the component shown in Figure 1. The material of the work piece is medium carbon steel. The specific cutting resistance of the material is 3000 N/mm². Specify the tool shank dimension geometry and ISO designation of tool holder pertaining to the component. The cutting speed is 300 m/min and E= 2.1×10^5 N/mm². (15)

Fig. (1)

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