

Code: 20ME3502

**III B.Tech - I Semester – Regular Examinations - DECEMBER 2022**

**METAL CUTTING AND MACHINE TOOLS  
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.

2. All parts of Question must be answered in one place.

BL – Blooms Level

CO – Course Outcome

|               |    |  | BL | CO  | Max. Marks |
|---------------|----|--|----|-----|------------|
| <b>UNIT-I</b> |    |  |    |     |            |
| 1             | a) | Discuss the importance of shear plane angle in metal cutting performance. What factors influence its value?  | L2 | CO1 | 7 M        |
|               | b) | A 100 mm bar is turned by means of a tool with a rake angle of 15° orthogonally. Depth of cut is 5 mm while the feed rate is 0.25 mm/rev. The chip length was measured as 85 mm where as uncut chip length was 202 mm. Determine the shear plane angle and chip thickness. | L3 | CO1 | 7 M        |
| <b>OR</b>     |    |  |    |     |            |
| 2             | a) | What is meant by built-up-edge (BUE)? Explain the reasons for formation and growth of a BUE.   | L2 | CO1 | 6 M        |
|               | b) | The following data was obtained from an orthogonal cutting test.   | L3 | CO1 | 8 M        |

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|--|--|--|--|--|--|
|  |  | <p>Rake angle = <math>20^\circ</math>, Depth of cut = 6 mm,<br/> Feed rate = 0.25 mm/rev,<br/> Cutting speed = 0.6 m/s,<br/> Chip length before cutting = 29.4 mm,<br/> Vertical cutting force = 1050 N,<br/> Horizontal cutting force = 630 N,<br/> Chip length after cutting = 12.9 mm,<br/> Using Merchant's analysis, calculate<br/> (i) magnitude of resultant force,<br/> (ii) shear plane angle,<br/> (iii) friction force and friction angle, and<br/> (iv) various energies consumed.</p> |  |  |  |
|--|--|--|--|--|--|

**UNIT-II**

|   |    |   |    |     |     |
|---|----|---|----|-----|-----|
| 3 | a) | Enumerate the desirable characteristics of cutting tool materials with respect to high speed steel tools.   | L2 | CO2 | 7 M |
|   | b) | Explain the effect of cutting process parameters (rotational speed, feed rate and depth of cut) on cutting tool wear in single point cutting tools? | L2 | CO2 | 7 M |

**OR**

|   |    |  |    |     |     |
|---|----|--|----|-----|-----|
| 4 | a) | Explain the selection criteria of cutting fluids for the applications of turning and milling and suggest the type of cutting fluid used.                           | L2 | CO2 | 7 M |
|   | b) | The tool life of a high speed steel (HSS) tool and carbide tool have the same tool life of 60 minutes at a cutting speed of 75 m/min. The exponent of tool life in | L3 | CO2 | 7 M |

|                 |    |   |    |     |     |
|-----------------|----|---|----|-----|-----|
|                 |    | Taylor's equation (n) is 0.15 for HSS while it is 0.20 for carbide. Compare the life of the two tools at a speed of 90 m/min.   |    |     |     |
| <b>UNIT-III</b> |    |   |    |     |     |
| 5               | a) | Explain the method used for the generation of threads in lathe.   | L2 | CO3 | 8 M |
|                 | b) | Distinguish between capsten and turret lathes.  | L3 | CO3 | 6 M |
| <b>OR</b>       |    |   |    |     |     |
| 6               | a) | Explain the following principal parts of a mechanical shaper.<br>(i) Ram<br>(ii) Tool post<br>(iii) Quick return motion   | L2 | CO3 | 8 M |
|                 | b) | A part measuring 250 mm × 100 mm × 40 mm is to be machined using a hydraulic shaper along its wide face (250 mm × 100 mm). Calculate the machining time taking approach as well as over travel as 20 mm each. Take cutting speed as 5 m/min, and a machining allowance on either side of plate width is 3 mm and feed is 1 mm/stroke. | L3 | CO3 | 6 M |
| <b>UNIT-IV</b>  |    |   |    |     |     |
| 7               | a) | Briefly discuss about the following types of boring machines:<br>(i) Planer type boring machine.<br>(ii) Multiple head type boring machine.   | L2 | CO4 | 7 M |

|               |    |  |    |     |     |
|---------------|----|--|----|-----|-----|
|               | b) | Using a neat sketch discuss in detail about radial drilling machine and list out the various operations performed.   | L2 | CO4 | 7 M |
| <b>OR</b>     |    |  |    |     |     |
| 8             | a) | Describe the application and relative merits of various types of milling cutters that are used in milling.   | L2 | CO4 | 7 M |
|               | b) | Calculate the indexing requirement for 127 divisions on a milling machine equipped with a differential indexing head. The index plates available are<br>Plate no. 1: 15, 16, 17, 18, 19, 20 holes<br>Plate no. 2: 21, 23, 27, 29, 31, 33 holes<br>Plate no. 3: 37, 39, 41, 43, 47, 49 holes<br>The change gear set available is<br>24, 28, 32, 40, 44, 48, 56, 64, 72, 86, 100 | L3 | CO4 | 7 M |
| <b>UNIT-V</b> |    |  |    |     |     |
| 9             | a) | Describe grinding wheel structure with the help of a neat sketch and state different bonding and abrasive materials used in it.  | L2 | CO5 | 7 M |
|               | b) | Explain the honing parameters to be considered for good honing practice.   | L2 | CO5 | 7 M |
| <b>OR</b>     |    |  |    |     |     |
| 10            | a) | Discuss in detail about centerless grinding process and list out various methods of grinding.  | L2 | CO5 | 7 M |
|               | b) | Using a neat sketch discuss in detail about machine lapping process and list out the advantages .  | L2 | CO5 | 7 M |