



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

**FOURTH YEAR FOURTH SEMESTER EXAMINATION FOR BACHELOR
OF TECHNOLOGY IN MECHANICAL ENGINEERING**

EMT 415 – TOOL ROOM PROCESSES

DURATION: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer question one and any other two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a. State five assumptions of merchant theory (5marks)
- b. A mild steel bar of 90mm diameter is reduced to 85mm by a H.S.S cutting tool during an orthogonal cutting operation. If one steam long of the chip is 85.5mm, and the tool rake angle is 15° , find:
 - i. Cutting ratio
 - ii. Shear angle ϕ (6marks)
- c. Define the following terms:
 - i. Orthogonal cutting
 - ii. Oblique cutting
 - iii. Tool lift (3marks)
- d. With the aid of a neat sketch illustrate the elements of a single point cutting tool. (7marks)
- e. List five essential properties of good fluid. (5marks)
- f. With the aid of a sketch, illustrate the principle of forced chip. (4marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

- a. In an orthogonal cutting operation with a tool rake of 12° . The following information was recorded.
 - i. Chip thickness 0.4
 - ii. Horizontal component $F_c = 1550\text{N}$
 - iii. Vertical component $F_t = 2100\text{N}$

From merchant theory calculate,

- i. Shear plane angle (ϕ)
 - ii. Frictional force (F)
 - iii. Normal force (N)
 - iv. Coefficient of Friction μ at chip tool interface. (10marks)
- b. State five importance of chip breaking during (5marks)

QUESTION THREE (20 MARKS)

- a. State five types of cutting fluids. (5marks)
- b. List five types of cutting tools. (5marks)
- c. Outline four basic purpose of cutting fluids. (4marks)
- d. Explain six important considerations while designing for jigs and fixtures. (6marks)

QUESTION FOUR (20 MARKS)

- a. State and explain five fundamental principles of jig and fixture designs. (10marks)
- b. With the aid of neat labelled sketch illustrate the elements of a jig. (10marks)