



MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

EMM 223: WORKSHOP PROCESSES & PRACTICE II

DATE: 17/4/2023

TIME: 11:00 – 1:00 PM

INSTRUCTIONS

- i) This examination contains **FIVE** questions.
- ii) You are required to answer **THREE** questions only
- iii) **Section A** (Question **ONE**) is compulsory
- iv) Attempt **ONE** question from **Section B** and **ONE** question from **Section C**
- v) Questions **ONE** carries **30 marks** and the **others** carry **20 marks** each.

QUESTION ONE (30 MARKS)

- a) Describe **TWO** types of milling processes using neat sketches (4 marks)
- b) List **FOUR** broad classifications of milling machines (2 marks)
- c) Using neat sketches describe the following milling operations. (4 marks)
 - i) T-slot milling.
 - ii) Form milling.
- d) Highlight **SIX** advantages of grinding process over other cutting processes. (6 marks)
- e) Enumerate **FOUR** characteristics of a grinding wheel. (2 marks)

- f) A hole of 30 mm diameter and 75 mm depth is to be drilled. The suggested feed is 1.3 mm per rev. and the cutting speed is 62 m/min. Assuming tool approach and tool over travel as 6 mm, calculate; (6 marks)
- i) Spindle rpm.
 - ii) Feed speed.
 - iii) Cutting time.
 - iv) Material removal rate.
- g) Calculate the time required to machine the top surface of slab 450 mm (wide) by 3500 mm (long) on a planer, using the following data. Cutting speed = 19.2 m/min; Return speed = 76.5 m/min; Machining allowance = 10 mm; Tool approach angle = 45°; Cross feed of tool = 3 mm/full stroke; Side over travel of tool = 3 mm; Table over travel on both side = 300 mm. (6 marks)

QUESTION TWO (20 MARKS)

- a) Using a neat sketch describe any **FOUR** main parts of a horizontal milling machine. (8 marks)
- b) Given the following sets of index plates shown below for milling operation, obtain the indexing for 137 divisions. (6 marks)
- i) Plate No. 1: 15, 16, 17, 18, 19, 20 holes.
 - ii) Plate No. 2: 21, 23, 27, 29, 31, 33 holes.
 - iii) Plate No. 3: 37, 39, 41, 43, 47, 49 holes.

- c) Calculate the cutting time for cutting 150 mm long keyway using HSS end mill of 20 mm diameter having four cutting teeth. The depth of keyway is 4.2 mm. Feed per tooth is 0.1 mm and cutting speed is 38 m/min. assume the approach and over travel distance as half of the diameter of the cutter and a depth of 4.2 mm can be cut in one pass. (4 marks)

QUESTION THREE (20 MARKS)

- a) Using a neat sketch illustrate the working principle of a centre lathe. (6 marks)
- b) A work piece of 300 mm diameter and 600 mm length is to be turned down to 282 mm for the entire length. The suggested feed is 1.2 mm/revolution and the cutting speed is 162 m/min. The maximum allowable depth of cut is 4.5 mm. (6 marks)
- i) Spindle rpm
 - ii) Feed speed.
 - iii) Material removal rate.
 - iv) Cutting time.
- c) A two-start external square thread of 10 mm pitch and outside diameter of 62 mm is to be cut on a centre lathe which has a 6 mm pitch lead screw. (8 marks)
- i) Depth of thread to give 0.12 mm clearance.
 - ii) Lead of thread.
 - iii) Core diameter.
 - iv) Helix angle of thread.
 - v) Gear ratio between the headstock spindle and lathe lead screw.

QUESTION FOUR (20 MARKS)

- a) Illustrate **THREE** types of flames of oxygen and acetylene mixture as applied in gas welding. (6 marks)
- b) State **FOUR** applications of gas welding. (4 marks)
- c) Explain the working principle of TIG welding process using a neat sketch. (6 marks)
- d) Highlight **FOUR** advantages of MIG welding process. (4 marks)

QUESTION FIVE (20 MARKS)

- a) Describe the working principle of a plain cylindrical grinder using a neat sketch. (8 marks)
- b) Enumerate **SIX** special features of grinding process. (6 marks)
- c) List and explain **TWO** artificial abrasive materials used in grinding and polishing operations (6 marks)