



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMM 216: WORKSHOP PROCESSES & PRACTICE III

DATE: 16/12/2020

TIME: 8.30-10.30 AM

INSTRUCTIONS

- i) This examination contains **FIVE** questions.
- ii) You are required to answer **THREE** questions only
- iii) Question **ONE** is compulsory
- iv) Attempt any other **TWO** questions.
- v) Questions **ONE** carries **30 marks** and the **others** carry **20 marks** each.

QUESTION ONE (30 MARKS)

- a) Using neat sketches describe the following milling operations. (4 marks)
 - i) Gang milling.
 - ii) Dove-tail milling.
- 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) Enumerate **FOUR** special features of grinding process (4 marks)
- d) List **SIX** parameters considered in size specification of a grinding machine (6 marks)
- e) Explain the working principle of MIG welding process using a neat sketch. (6 marks)
- f) Enumerate **FOUR** advantages of spot welding process. (4 marks)

QUESTION TWO (20 MARKS)

- a) Using a neat sketch describe any **FOUR** main parts of a vertical milling machine. (8 marks)
- b) Calculate the time required to mill a slot of 350 mm x 30 mm in a workpiece of 350 mm length with a side and face milling cutter of 120 mm diameter, 30 mm wide and having 20 teeth. The depth of cut is 6 mm, the feed per tooth is 0.1 mm and cutting speed is 34 m/min. Assume overtravel distance of 5 mm. (6 marks)
- c) List and explain **THREE** common work holding devices used on milling machines, giving one application in each case. (6 marks)

QUESTION THREE (20 MARKS)

- a) Describe the working principle of a plain cylindrical grinder using a neat sketch. (8 marks)
- b) A specimen is being grinded on surface grinder with grinding wheel speed of 1,500 m/min and workpiece speed 30 m/min, grinding wheel diameter 200 mm, grinding depth of cut of 0.02 mm. Take transverse feed of workpiece = 4 mm/pass and specific cutting energy = 2,000 N/mm². Assume that pitch of grits at periphery of grinding wheel is (p_g) 10 mm, and factor for negative rake angle of abrasive grains as 5. Determine the mean chip thickness, mean grinding power and feed power in above operation. (6 marks)
- c) List and explain **TWO** artificial abrasive materials used in grinding and polishing operations (6 marks)

QUESTION FOUR (20 MARKS)

- a) A pair of bevel gears is designed whose axes are at 90°. The pinion has 40 teeth and the gear has 80 teeth with a module of 1.5 mm. Determine the pitch diameter of the gear and pinion, pitch cone radius (R) for both gear and pinion, and addendum for both gear and pinion. (4 marks)
- b) List **FOUR** broad classifications of milling machines (2 marks)
- c) State **FOUR** applications of gas welding. (4 marks)
- d) Explain the working principle of TIG welding process using a neat sketch. (6 marks)
- e) Highlight **FOUR** advantages of MIG welding process. (4 marks)

QUESTION FIVE (20 MARKS)

- a) Explain the working principle of MIG welding process using a neat sketch. (6 marks)
- b) Highlight **FOUR** differences between TIG and MIG welding processes. (4 marks)
- c) When milling a slot 20 mm wide by 100 mm long in a rectangular plate 100 mm by 200 mm, the cutting speed = 60 m/min.; Diameter of end drill = 20 mm; Number of flutes = 8; Feed = 0.01 mm/flute; Depth of cut = 3 mm. Determine the cutting time for the operation to be completed in a single pass. (6 marks)
- d) Define the following terms as applied in machining processes. (4 marks)
 - i. Milling.
 - ii. Grinding.
 - iii. Plain Milling.
 - iv. Gear hobbing.