



MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

EMM 410: MANUFACTURING PROCESSES II

DATE:

TIME:

INSTRUCTIONS

- i. This paper contains five questions.
- ii. Question 1 is compulsory
- iii. Question 1 carries 30 Marks while the rest carry 20 Marks each
- iv. Answer QUESTION 1 and any other TWO questions.

Please Turn Over

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Using a clear illustration, explain the Electron Beam Machining (EBM) process. (15 marks)
- b) What similarities and differences exist between the Electron Beam Machining (EBM) and Laser Beam Machining (LBM). (15 marks)

QUESTION TWO (20 MARKS)

- a) Which of the following material characteristics will present a higher material removal rate with ultrasonic machining process? Explain your answer. (5 marks)
- i. higher ductility
 - ii. higher fracture strain
 - iii. higher toughness
 - iv. lower toughness
- b) Consider an ultrasonic machining process that throws abrasive grains of size 150 – Micron in diameter and calculate (using the grain throwing model) the depth of indentation produced in a ceramic surface based on the following data:- (6 marks)
- Amplitude of vibration: 0.15 mm.
Frequency of vibration: 21 kc/s,
Abrasive density: 3.5 kgf/m³
Yield strength of ceramics: 4.5×10^{11} N/m²
- c) Consider a glass specimen being machined at a metal removal rate (MRR) of 6 mm³/min using Al₂O₃ abrasive grits of average diameter 150 microns. If 100 micron Al₂O₃ grits were to be used, what would be the MRR? (9 marks)

QUESTION THREE (20 MARKS)

- a) Using an appropriate schematic diagram, explain the process of electrochemical machining (ECM). (10 marks)
- b) In electrochemical machining of pure iron a material removal rate of 600 mm³/min is required. Estimate current requirement. (6 marks)
- c) What similarities exist between Chemical machining process (CHM) and Electrochemical Machining Process (ECM)? (4 marks)

QUESTION FOUR (20 MARKS)

- a) A fault is an imperfection in the weld which may result in failure of a welded joint while in service, Explain at least five faults that occur during gas welding and explain their cause(s). (5 marks)
- b) Using an appropriate illustration, explain the process of submerged arc welding. (11 marks)

c) What advantages does submerged arc welding present?

(4 marks)

QUESTION FIVE (20 MARKS)

a) Explain the principle of resistance welding process, its variants and outline its advantages. (15

marks)

b) If 20 amperes of current is flowing in a wire for 1 minute of time having a resistance of 1000 ohm, calculate in kilo joules, the amount of heat generated in resistance welding operation. (5

marks)