MACHAKOS UNIVERSITY

University Examinations for 2022/2023

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:7/3/2023 **TIME:2:00-4:00 P.M**

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.

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Using a clear illustration demonstrate the classification of non-conventional machining processes. (12 marks)

b) Using a clear illustration, explain the Electro Chemical Machining (ECM) process in terms of working principle, application, advantages and disadvantages. (12 marks)

c) The frontal working area of the electrode in an ECM operation is 2000 mm2. The applied current = 1800 amps and the voltage = 12 volts. The material being cut is nickel (valence = 2), whose specific removal rate is $C = 3.42 \times 10^{-2}$ mm^3/A-s.

i) If the process is 90% efficient, determine the rate of metal removal in mm3/min.

ii) If the resistivity of the electrolyte = 140 ohm-mm, determine the working gap.

(6 marks)

QUESTION TWO (20 MARKS)

Discuss the following processes:

i) TIG Welding (10 marks)

ii) Brazing and soldering (10 marks)

QUESTION THREE (20 MARKS)

a) Much of the work at a Company involves cutting and forming of flat sheets of fiber-glass for the pleasure boat industry. Manual methods based on portable saws are currently used to perform the cutting operation, but production is slow and scrap rates are high. The foreman says the company should invest in a plasma arc cutting machine, but the plant manager thinks it would be too expensive. What do you think? Justify your answer by indicating the characteristics of the process that make PAC attractive or unattractive in this application. (3 marks)

b) Using well labelled diagrams, explain the process of Chemical Milling (CM) and its application in manufacturing. (12 marks)

c) In a certain chemical blanking operation, a sulfuric acid etchant is used to remove material from a sheet of magnesium alloy. The sheet is 0.25 mm thick. The screen resist method of masking was used to permit high production rates to be achieved. As it turns out, the process is producing a large proportion of scrap. Specified tolerances of ±0.025 mm are not being achieved. The foreman in the CHM department complains that there must be something wrong with the sulfuric acid. "Perhaps the concentration is incorrect," he suggests. Analyze the problem and recommend a solution. (5 marks)

QUESTION FOUR (20 MARKS)

a) For the following application, identify one or more nontraditional machining processes that might be used, and present arguments to support your selection. Assume that either the part geometry or the work material (or both) preclude the use of conventional machining. The application is a through-hole in the shape of the letter L in a 12.5 mm (0.5 in) thick plate of glass. The size of the "L" is 25 by 15 mm (1.0 by 0.6 in) and the width of the hole is 3 mm (1/8 in). (3 marks)

b) In a wire EDM operation performed on 7-mm-thick C1080 steel using a tungsten wire electrode whose diameter = 0.125 mm, past experience suggests that the overcut will be 0.02 mm, so that the kerf width will be 0.165 mm. Using a discharge current = 10 amps, what is the

allowable feed rate that can be used in the operation? Take the melting temperature of 0.80% carbon steel to be 1500^{o}C. (5 marks)

c) Explain with a neat sketch, the working principle of ultrasonic machining process. (12 marks)

QUESTION FIVE (20 MARKS)

Using a clear and well-labelled diagram explain the abrasive jet machining Process.