



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMM 410: MANUFACTURING PROCESSES II

DATE: 15/5/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS: Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

- a) Define manufacturing processes (2 marks)
- b) Briefly describe THREE benefits of advanced manufacturing technologies (3 marks)
- c) Differentiate between the following terms as used in manufacturing process technology
 - i. Dielectric and electrolyte (2 marks)
 - ii. Reverse polarity and straight polarity in arc-weld (2 marks)
- d) What is meant by the term non-conventional manufacturing processes? (2 marks)
- e) The Electro-discharge Machining (EDM) process is widely used in the tool making industry. In this context, describe the principle of operation of general EDM, stating THREE advantages and TWO disadvantage associated with Die Sinking EDM process. (11 marks)
- f) With the help of neat sketches, explain the features and uses of neutral, reducing and oxidizing flames during oxy-acetylene gas welding (8 marks)

QUESTION TWO (20 MARKS)

- a) i Differentiate between a jig and a fixture (2 marks)
- ii With help of neat sketches briefly describe FOUR types of locating devices used for both Jigs and Fixture (8 marks)
- b) i An electromechanical machining (ECM) process, using a 9 mm by 9 mm square tool, is applied to a zinc workpiece. A feed rate of 0.5 mm/s is required. Determine an expression for the volumetric removal rate w (mm³/s) and hence the current setting I (A) needed. The density of zinc is $\rho = 7.13 \times 10^{-3} \text{ g mm}^{-3}$ and the process has a current efficiency of 90%. Would a machine rated 1.4 kA be sufficient for the job?
- Assume that; $m = e \cdot I \cdot t$ where;
- m is mass of material removed (g)
- e is the electrochemical equivalent zinc = $0.34 \times 10^{-3} \text{ g/As}$
- I is current (A)
- t is time during which current is applied (s) (6 marks)
- ii List TWO merits and TWO demerits of ECM as a non-conventional machining process (4 marks)

QUESTION THREE (20 MARKS)

- a) Differentiate between the following in the context of welding principles
- i. Fusion welding and solid state welding (2 marks)
- ii. Consumable and non-consumable electrode welding processes (2 marks)
- b) i Define heat source efficiency in a welding process (2 marks)
- ii Describe briefly the method of determining heat source efficiency in an arc welding operation (3 marks)
- iii Calculate the efficiency of heat source in oxy-acetylene welding given the following data:
- Energy collected by wet calorimeter in 1 minute = 320 kJ;
- Flow rate of acetylene gas = 100 l/hour
- Heat of combustion of acetylene under standard atmospheric and pressure = 48 kJ/l (5 marks)

- c) With aid of sketches differentiate between the following welding processes
- i. Gas Tungsten Arc Welding;
 - ii. Gas Metal Arc Welding (6 marks)

QUESTION FOUR (20 MARKS)

- a) i Discuss mass production under the following; definition, characteristic, merits and demerits (8 marks)
- ii Briefly describe the rationale of manufacturing automation as a tool for mass production (7 marks)
- b) Differentiate between Numerical control (NC) and Computer numerical controlled (CNC) (5 marks)

QUESTION FIVE (20 MARKS)

- a) Briefly explain the following processes used in the surface treatment or finishing of a workpiece:
- i. Anodizing (2 marks)
 - ii. Electroplating (2 marks)
 - iii. Tumbling (2 marks)
 - iv. Cladding (2 marks)
- b) What factors (give at least four) are taken into account when selecting and designing a joint for a welding application (4 marks)
- c) Briefly explain the applications of numerical control in machine operations (4 marks)
- d) Describe additive manufacturing (AM) technology, hence or otherwise state the areas of application of this advanced manufacturing techniques. (4 marks)