UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DTD 3042
COURSE	: NON-TRADITIONAL MACHINING PROCESSES
SEMESTER/SESSION	: 1- 2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **5** questions. Answer ALL.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 5 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) **Classify** the material commonly used for producing LASER beam.

(2 marks)

b) **Explain** the function of the following components in LBM.

i. Flash lamp

ii. Partial mirror

iii. Lens

(6 marks)

c) **Sketch** the photon emission model of LASER. (2 marks)

d) **Describe** the *spontaneous emission* model and LASER *material removal process*.

(8 marks)

e) **Distinguish** the CO^2 laser advantages/disadvantages over the solid Ruby laser.

(2 marks)

QUESTION 2

a) In your own words, **define** the ultrasonic machining (USM).

(2 marks)

b) Suggest four (4) abrasive grain materials suitably used for USM.

(4 marks)

c) **Describe** briefly how material removal takes place in USM.

(4 marks)

d) **Explain** the function of *transducer* in USM

(2 marks)

e) **Compare** the production of oscillation motion to the tool by *magnetostrictive* and *piezo-electric* principles for USM machining.

(8 marks)

QUESTION 3

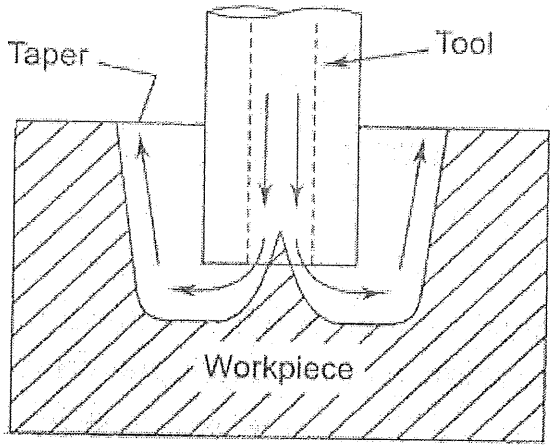

Figure 1: ECM material removal process.

a) Figure 1 shows the electrochemical machining (ECM) process in which a taper was formed at the resulting hole. **Propose** how to solve the steep taper problem.

(4 marks)

b) There are several applications of electrolyte flow in the ECM. **Compare** the application of *reverse flow* and *common streamlined flow* of electrolytes.

(6 marks)

c) Briefly **describe** the *masking* and *de-masking* process for ECM.

(6 marks)

d) **Provide** four (4) ECM applications in today's industry.

(4 marks)

QUESTION 4

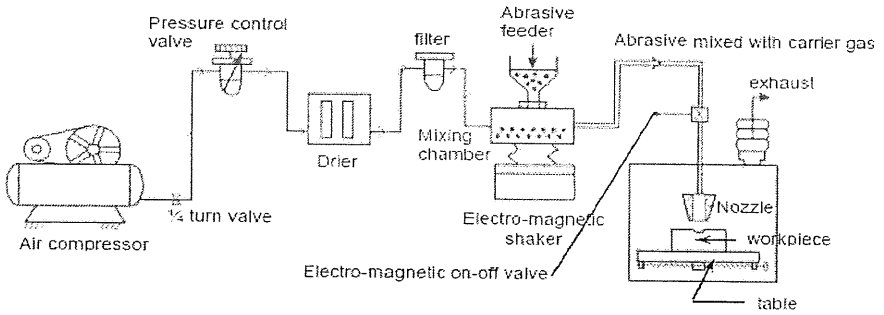

Figure 2: Schematic illustration of AJM.

a) Abrasive jet machining is an alternative machining process for metal and non-metal materials. Based on Figure 2, **describe** how the material removal process takes place.

(8 marks)

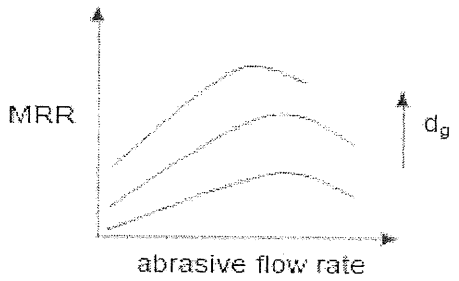

Figure 3: MRR of abrasive jet machining.

b) The graph in Figure 3 shows the phenomenon occurs in abrasive jet machining. **Interpret** the relationship between material removal rate and abrasive flow rate as shown in the figure.

(4 marks)

c) **Sketch** the impingement model of how the material removal process occurs for abrasive jet machining.

(4 marks)

d) **State** four (4) drawbacks resulting from the abrasive jet machining process.

(4 marks)

QUESTION 5

a) **Provide** the four (4) main elements of the Electric Discharge Machine.

(4 marks)

b) **Explain** the functions of dielectric fluid for EDM machining.

(4 marks)

c) **Describe** how spark discharge is produced between the electrode and the workpiece. You may include sketches when necessary.

(6 marks)

d) **Distinguish** the effect of *high peak current* and *low peak current* on:

i. material removal rate

ii. tool wear and

iii. the surface quality.

(6 marks)

----------End of question----------

Criteria	Marks
All question answered will be marked according to the answer scheme	/100