Code : 102808

B.Tech 8th Semester Exam., 2022

(New Course)

NON-CONVENTIONAL MANUFACTURING

Time : 3 hours   Full Marks : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are **NINE** questions in this paper.

(iii) Attempt **FIVE** questions in all.

(iv) Question No. **1** is compulsory.

1. Choose the correct answer of the following (any *seven*) :   2×7=14

   (a) Detonation velocity of RDX explosive in m/sec is

       (i) 6000

       (ii) 8100

       (iii) 7800

       (iv) 6600

   (b) Water hammer is due to

       (i) sudden change in pressure

       (ii) sudden change in temperature

       (iii) sudden change in momentum

       (iv) None of the above

   (c) In EDM, which of the following mechanisms is used for material removal?

       (i) Electro-discharge erosion

       (ii) Magnetic abrasion

       (iii) Electrochemical dissolution

       (iv) Mechanical erosion

   (d) Increasing volume concentration of abrasive in slurry would affect MRR in which of the following manners?

       (i) Increase MRR

       (ii) Decrease MRR

       (iii) Would not change MRR

       (iv) Initially decreases and then increases MRR

   (e) Chemical equivalent is the ratio of which of the following factors?

       (i) Work piece valence to the atomic weight

       (ii) Atomic weight to workpiece valence

       (iii) Tool valence to molecular weight

       (iv) Molecular weight to tool valence

(f) Which of the following is not a factor for explosive welding?

   (i) High relative velocity

   (ii) Less amount of plastics

   (iii) Proper orientation

   (iv) High pressure

(g) What is the maximum frequency used in ultrasonic welding?

   (i) 30000 Hz

   (ii) 40000 Hz

   (iii) 50000 Hz

   (iv) 60000 Hz

(h) High energy forming process is performed at

   (i) very high velocity

   (ii) extremely high pressure

   (iii) very high velocity and extremely high pressure

   (iv) None of the above

(i) Electron beam welding is carried in

   (i) inert atmosphere

   (ii) partially filled chamber

   (iii) vacuum

   (iv) partially vacuum

(j) Which is not the merit of plasma arc welding?

   (i) Stability of arc

   (ii) Penetration

   (iii) Weld quality

   (iv) Inert gas consumption

2. (a) Discuss the effect of different process parameters of ultrasonic machining (USM) on material removal rate (MRR).   7

   (b) Find out the approximate time required to machine a square hole (5 mm × 5 mm) in a tungsten carbide plate of thickness 4 mm. The abrasive grains are of 0·01 mm diameter. The feeding is done with a constant force of 3·5 N. The amplitude of tool oscillation is about 25 μm, the frequency being 25 kHz. The fracture hardness of WC can be approximately taken as 6900 N/mm^2. The slurry contains 1 part of abrasive to about 1 part of water.   7

(5)

3. (a) What is the 'self-adjusting feature' in electrochemical machining (ECM)? 4

(b) Write down the assumptions and fundamental principles of micro-manufacturing. 4

(c) What is the difference between transferred and non-transferred arc processes in plasma arc welding? 6

4. (a) State the selection criterion of suitable unconventional forming process. 6

(b) What is laser? Explain the principle and mechanism of laser operation. 8

5. (a) Write four specific applications where electron beam welding should be the preferable. https://www.akubihar.com 6

(b) Draw and explain the principle of operation of the ultrasonic welding. 8

6. (a) With neat sketch, explain the jet formation in explosive welding. 6

(b) A 10 mm diameter hole has to be drilled in a 5 mm HSS sheet by EDM using a relaxation circuit. The required surface finish is 20 μm. Determine the capacitance to be used when the supply and discharge voltage are 220 V and 150 V, respectively, the resistance being 50 Ω. Also, estimate the time required to complete the job. 8

(6)

7. (a) Write a short note on under-water welding. 4

(b) What is the significance of micro- to nano-machining? Explain with application. 4

(c) Prepare a comparative chart between conventional and high-energy forming method. 6

8. (a) What is the need of unconventional manufacturing? List its four advantages over conventional manufacturing. 4

(b) During an electrochemical machining (ECM) operation on an iron workpiece with a square-face copper tool (using brine as the electrolyte), both having a flat surface, a feed rate of 2 mm/min is used. The DC voltage used is 10 V and the total overvoltage is 1·5 V. The dimension of the tool face is 25·4 mm × 25·4 mm. The boiling temperature of the electrolyte is 95 °C. Find out the total force acting on the tool. Use the following data :

Viscosity of electrolyte
$= 0.876 \times 10^{-3}$ kg/m-sec

Density of electrolyte = 1·088 g/cm^3

Specific heat of electrolyte = 0·997

Conductivity of electrolyte
$$= 0 \cdot 2 \, \Omega^{-1} \, cm^{-1}$$

Ambient temperature (initial temperature of electrolyte) = 35 °C

Neglect the variation in electrolyte conductivity due to the temperature change. The electrolyte is fed from one side of the square-shaped tool.   10

9. (a) ECM, EDM and USM, etc., are commonly referred to as unconventional machining processes. What is unconventional in these processes? Explain in detail.   6

   (b) Describe the basic principle, working and general applications of explosive forming process.   8

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