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K 4551

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Sixth Semester

(Regulation 2004)

Mechanical Engineering

ME 1001 — UNCONVENTIONAL MACHINING PROCESSES

(Common to Production Engineering)

(Common to B.E. (Part-Time) Fifth Semester Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the industrial needs for unconventional machining processes?
2. Write down the energy transfer media, energy source and mechanism of metal removal for the following process.
 - (a) Water jet machining
 - (b) Electrochemical grinding.
3. What are the variables that affect the cutting phenomena in abrasive jet machining?
4. What are the major elements of ultrasonic machining equipment?
5. What are the ways of gap-flushing used in EDM?
6. What are the categories into which the variety of power supply circuits in EDM process can be classified?
7. Distinguish between electrochemical machining and electroplating process.
8. What are the various process parameters which the effectiveness of electrochemical grinding process depend upon?

9. What is the principle of plasma arc machining? What are the two stages in which the process of material removal is affected?
10. In electron beam machining, why is a high vacuum created in the apparatus?

PART B — (5 × 16 = 80 marks)

11. (a) For different nonconventional processes, present in the form of a table, various process parameters recommended. (16)

Or

- (b) How will you analyze the applicability of different processes to different types of materials, namely metals, alloys and non-metals? Presentation in the form of a table is preferred. (16)

12. (a) (i) Make a comparison between ultrasonic machining and conventional grinding. (6)
- (ii) What are the actions do the ultrasonic vibrations imparted to the fluid medium surrounding the tool have? What are the process criteria of USM? What are the various process parameters that govern the process criteria? (10)

Or

- (b) (i) Draw the schematic layout of Abrasive Jet Machine and explain its operational characteristics. What are the methods adopted to have an effective control over the mass flow rate of the abrasive? (12)
- (ii) What are the applications of water jet machining? (4)

13. (a) How will you carry out the analysis for optimization of metal removal rate in EDM process? What are the steps that are to be adopted in sequence while applying the linear programming technique to optimize the metal removal rate in EDM process? (16)

Or

- (b) Draw the scheme of electro-discharge wire cutting machine and explain its principle of operation. Also discuss the operating process parameters and their effects. (16)

14. (a) Briefly explain the following with respect to chemical machining.
- (i) Characteristics of Cut and Peel Maskants
- (ii) Selection of Maskants
- (iii) Advantages of Photoresist Maskant
- (iv) Limitations of chemical machining. (4 × 4 = 16)

Or

- (b) (i) What are the three methods of metal removal by electrolytic action in combination with rubbing of workpiece in ECG process? Explain with diagram. What are the conditions to be satisfied to ensure high effectiveness of ECG method of machining? (12)
- (ii) In chemical machining, what are the factors by which the selection of etchants is governed? (4)
15. (a) (i) What are the unique characteristics a laser machining technique possesses that make it the only choice for the job? (6)
- (ii) What is meant by "Optical Pumping"? Briefly explain the "Population inversion between energy levels" with respect to laser beam machining. (10)

Or

- (b) (i) Derive an expression for the dimensionless analysis to establish correlation between EBM parameters. (9)
- (ii) Draw the schematic set-up of Plasma Arc Machine. Indicate various parts. (7)