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SUBJECT :- NEWER MACHINING METHODS

[6ME2A]

1st MID-TERM PAPER SOLUTION

1. What are the difference between conventional and non-conventional machining method?

or

1. (a) Explain abrasive flow machining (AFM) with a neat sketch.
   (b) Applications of magnetic Abrasive finishing.

Q:1. Ans Conventional machining required the presence of a tool that is harder than the work piece to machined. Conventional machining can be classified according to the machining action of cutting and mechanical Abrasion.

non-conventional machining material Removel mechanism is basically different than those in conventional processes i.e different form of energy is applied to remove the excess material from the work surface, or to seperate the workpiece into smaller parts

① Difference between conventional and non conventional

S.No.	conventional machining.	non conventional machining
1	Generally microscopic chip formation by shear deformation	→ material removel may occurs with chip formation or even no-chip formation may takes place. Ex. AJM

S.No	Conventional	non - Conventional
2.	Cutting tool is harder than work piece at room temperature as well as under machining condition.	There may not be a physical tool present for example in laser Jet machining, machining is is carried is carried out be laser beam.
3.	Conventional machining involve direct contact of tool and work piece.	→ whereas unconventional machining does not require the direct contact of tool and work piece.
4.	Lower Accuracy and surface finish	high Accuracy and surface finish
5.	They may be physical tool present for example a cutting tool in a lathe machine.	→ There may not be a physical tool present. for example in laser Jet machining, machining is carried out be laser beam.
6.	Suitable for every type of material economically	→ According to material Required different type of machining - Ex: ECM, EDM conductive material.
7.	tool life is less due to high surface contact and wear	→ Tool life is more.
8.	high waste of material due to high wear	→ No. waste of material
9.	Noisy operation mostly cause Sound Pollution.	→ less noisy operation as compared to conventional process
10.	Lower Capital Cost	→ higher Capital Cost.
11.	Easy set-up of equipment	→ Complex set up but one time set up.

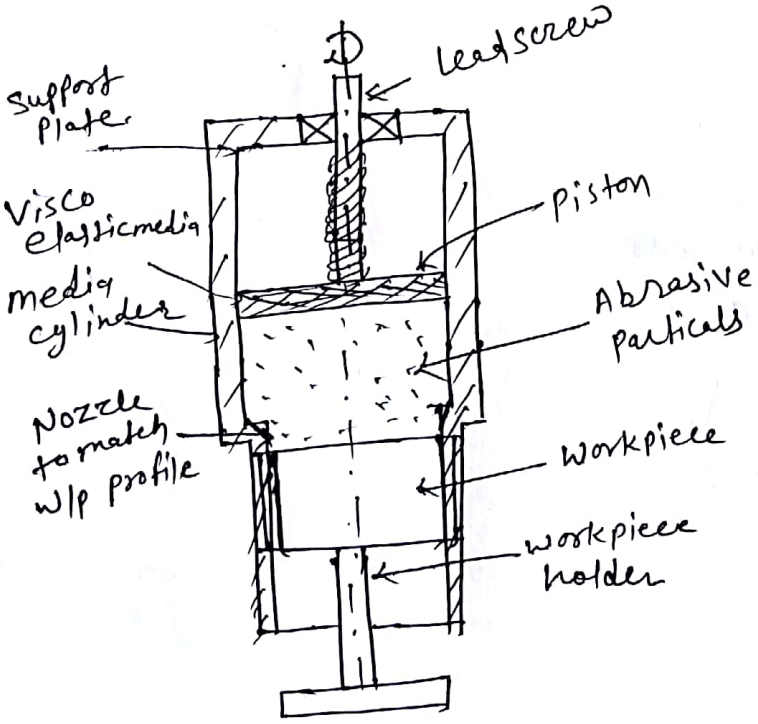
(1)(A) Ans The abrasive flow machining is the subpart of the mechanical advanced machining process, it is done with the help of abrasive particles and advanced technique.

It uses two vertically opposed cylinder, which extrude an abrasive medium back and forth through passage formed by the workpiece and tooling. Extraction pressure Number of cycles, grit Composition and type of fixture design are the process parameter that have the largest Impact on AFM Result.

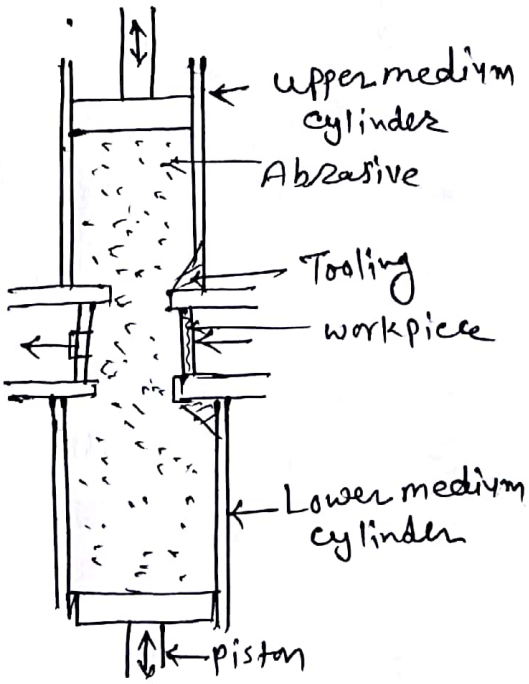
The abrasive media is flown across the surface to be super finished either in a single direction or two way and this extrude through the work-piece thereby finishing and smoothing the surface.

In case of one way system, the media is flown/passed through the workpiece and it returns form the other end.

Whereas in a two way process, two vertically opposite hydraulic cylinders push the abrasive mixed media to and fro.



One way AFM process



Two way AFM process

Q: (1)(B) :- Ans In magnetic abrasive finishing, the development of multiple pole tip system using a partially head-treated magnetic tool allows the finishing of multiple regions simultaneously in capillary tubes and thus improves the finishing efficiency.

To further Reduce the processing time required a new high speed machine is fabricated.

→ magnetic filed-Assisted finishing (MAF) process have been developed for a wide variaty of Applications Including the manufacturing of medical component

- → fluid system, optics
- → dies and mould
- → electronic components
- → microelectromechanical system
- → mechanical Component.

Q. 2. Explain Abrasive Jet machining with Neat Sketch.

OR

In an EDM process using RC relaxation circuit, a 12 mm diameter through hole is made in a steel plate of 50mm thickness using a graphite tool and Kerosene as dielectric Assume discharge time to be negligible. machining is carried out under the following conditions.

Resistance = 40Ω
Capacitance = 20 μF
Supply Voltage = 220V
Discharge Voltage = 110V
find (1) Time for one cycle
(2) Average power output

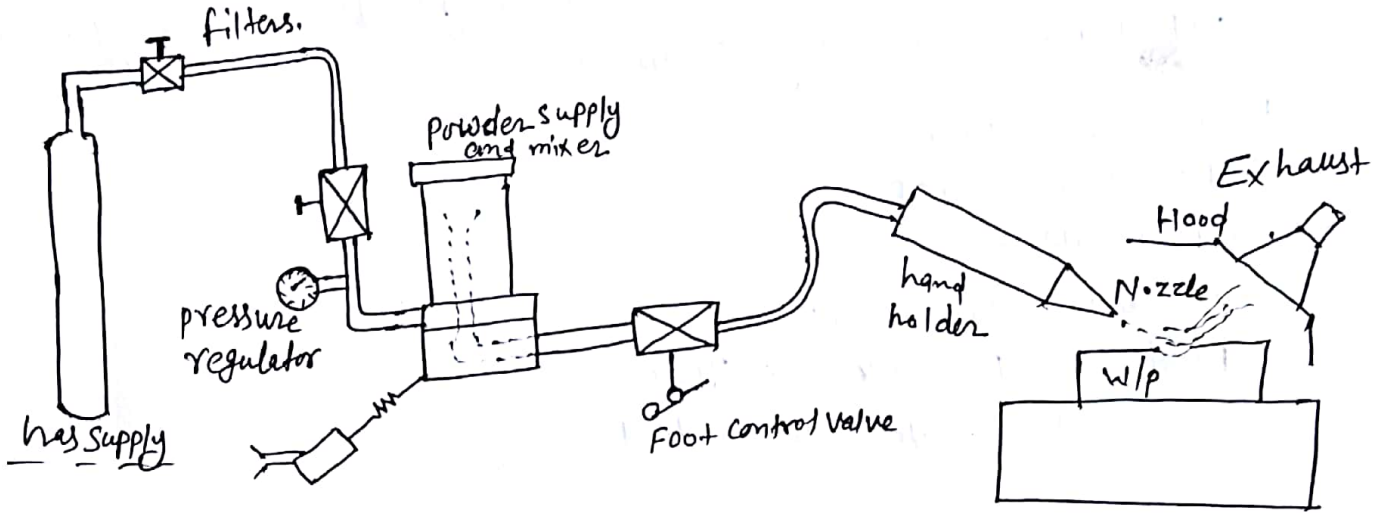
Q:(2) Any principle:-

→ The fundamental principle of abrasive Jet machining involve the use of high velocity stream of abrasive particles carried by a high pressure gas through Nozzle on the work piece.

→ Metal Removal occurs due to erosion by the abrasive particals Impacting the work surface at high speed.

→ In abrasive Jet machining (AJM), a high velocity Jet of dry air, nitrogen or carbon dioxide, containing abrasive particles is aimed at the workpiece under controlled condition. The Impact of the particles develops a sufficiently concentrated force to perform operation such as cutting small holes, slots or Intricate patterns in very hard or brittle metallic and nonmetallic material deburring or removing small flash from parts, trimming and beveling, Removing oxides and other surfaces ~~tints~~ films and general cleaning of components with irregular surfaces.

The gas supply pressure is on the order of 850 kPa and the abrasive Jet velocity can be as high as 300 m/s and is controlled by a value. The hand Nozzle are usually made of tungusten carbide or sapphire.
The abrasive size is in the range of form 1 to 50 mm.



Abrasive-Jet machining

Q.(2) Solution

$R = 4\Omega$

$C = 20\mu F = 20 \times 10^{-6} F$

Supply voltage $V_0 = 220V$

discharge voltage $V_d = 110V$

1. The time for one cycle

$$V_d = V_0(1 - e^{-t/RC})$$

$$110 = 220\left(1 - e^{-t/4 \times 20 \times 10^{-6}}\right)$$

$$0.5 = 1 - e^{-t/8 \times 10^{-4}}$$

$$e^{-t/8 \times 10^{-4}} = 0.5$$

$$-\frac{t_1}{8 \times 10^{-4}} = \ln 0.5$$

$$-\frac{t_1}{8 \times 10^{-4}} = -0.693$$

$$\boxed{t_1 = 5.545 \times 10^{-4} \text{ sec.}}$$

2. Average power

$$P_{avg} = \frac{E}{t_1} = \frac{\frac{1}{2} C V_d^2}{t_1}$$

$$= \frac{0.5 \times 20 \times 10^{-6} \times 110^2}{0.554 \times 10^{-3}}$$

$$= 218.4 W$$

$$P_{avg} = .2184 kW$$