ABRASIVE JET MACHINING

1. Define AJM?

   It is the material removal process where the material is removed or machined by the impact erosion of the high velocity stream of air or gas and abrasive mixture, which is focused on to the work piece.

2. How does AJM differ from conventional sand blasting process?

   AJM differ from the conventional sand blasting process in the way that the abrasive is much finer and effective control over the process parameters and cutting. Used mainly to cut hard and brittle materials, which are thin and sensitive to heat.

3. What are the advantages of AJM process?

   1. Low capital cost
   2. Less vibration.
   3. Good for difficult to reach area.
   4. No heat is generated in work piece.
   5. Ability to cut intricate holes of any hardness and brittleness in the material.
   6. Ability to cut fragile, brittle hard and heat sensitive material without damage.

4. What are the applications of AJM?

   1. For abrading and frosting glass, it is more economical than acid etching and grinding.
   2. For doing hard suffuses, safe removal of smears and ceramics oxides on metals.
   3. Resistive coating etc from ports to delicate to withstand normal scrapping
   4. Delicate cleaning such as removal of smudges from antique documents.
   5. Machining semiconductors such as germanium etc.
5. Write the Disadvantages of AJM process?

1. Low metal removal rate.
2. Due to stay cutting accuracy is affected.
3. Parivles is imbedding in work piece.
4. Abrasive powder cannot be reused.

6. Give the formula for find the material remove rate for brittle metal?

\[
MRR = 1.04 \left( \frac{MV^{3/2}}{\rho^{1/4}H^{3/4}} \right)
\]

7. Give a summary of the abrasive of their application for different operation?

(1) Aluminum Cleaning, Cutting and Debar
(2) Silicon Carbide. Faster cleaning, Cutting.
(3) Glass Heads Matt polishing, cleaning
(4) Crushed glass Peening and cleaning.

8. Write the formula for find the MRR for ductile materials?

\[
MRR = 0.5 \left( \frac{MV^2}{H} \right)
\]

9. What are the Process parameters affecting the MRR in AJM?

1. Gas Pressure.
2. Velocity of Particles.
3. Abrasive mass flow rate.
4. Mixing ratio.
5. Nozzle Tip Distance.

10. What are the disadvantages of using abrasives again and again?

1. Cutting ability of the abrasives decreases after the large
2. Contamination of wears materials clogging the nozzle and the cutting unit orifices.

11. What are the different types of nozzles heads used in AJM?

1. Right angle head.
2. Straight head.
12. Why oxygen should not be used in AJM?

Oxygen should not be used because of fire hazard problem.

13. What are the different types abrasives used in AJM?

Aluminum oxides, silicon carbides, Crushed glass, Sodium bicarbonate, Dolomite.

14. Reuse of abrasives is not recommended in AJM. Why?

Reuse of abrasives is not recommended since the cutting ability of abrasive decrease after the usage and also the contamination of wear materials clogging the nozzle and the cutting unit orifice.

**WATER JET MACHINING**

1. What are the properties of water jet machining about effect cutting action?

   High pressure, high velocity jet of water.

2. What are the types of units and its purpose used in water jet cutting system?

   a. Pump -- to generate high pressure
   b. Machining unit-- to actually cut the material with the jet nozzle.
   c. Filtration unit -- to clear the water after use.

3. Why we are using the diamond nozzle?

   a. High hardness metal
   b. Working life is more compared to other jewel nozzle such as ruby or sapphire.

4. Why do you select proper cutting fluid in WJM?

   Cutting fluids mainly depends on the operation requirement, quality of finish, cutting speed and overall cost

5. Does there is any environmental effects while using the water jet machining?

   There is no environmental pollution such as dust suspended in the air because the water jet drains any dust simultaneously when cutting.
6. What are the advantages of WJC over conventional cutting methods?

   a. Because of point cutting WJC is able to cut materials almost any pattern.

   b. Material loss due to machining is minimum.

   c. WJC will not burn surfaces or produces a **heat** affected zone.

   d. No environmental pollution.

7. What are the applications of WJM?

   * Aero space
   * Automobile
   * Paper pulp industries

8. What are the commonly used additives in WJM?

   1. Crly cerine
   2. Polyethylene oxide
   3. Long chain polymers

9. What is optical tracing system?

   It employs an optical scanner that traces a line drawing and produces electronic signals that control the X-rays.

**ULTRA SONIC MACHINING**

1. What is ultrasonic machining?

   USM is a mechanical material removal process in which the material is removed by repetitive impact of abrasive particles carried in liquid medium on to the work surface, by a shaped tool, vibrating at ultrasonic frequency.

2. What are the advantages of USM?

   1. High accuracy and good surface finish
   2. No **heat** generation during machining
   4. No thermal effects on mechanical work piece.
5. Non-conductive materials can be machined.

3. What are the Disadvantages of USM?

   1. Tool wear
   2. Frequent turning is required
   3. Low material removal rate.
   5. Not suitable for heavy stock removal.

4. What are the applications of USM?

   1. Almost all the material can be machined except some soft materials.
   2. Diamond, Tungsten, Tungsten carbide, and synthetic ruby can be successfully machined.
   3. USM can be used for drilling, grinding, profiling, coining, threading and even for welding.
   4. For preparing wire drawing dies and tool room items.
   5. Used in jewellery for shaping jewels
   6. Drilling of screw threads and curved holes in brittle materials.

5. What are the components of USM?

   1. Ultrasonic transducer
   2. Concentrator
   3. Tool
   4. Abrasive slurry
   5. Abrasive feed mechanism
   6. Tool feed mechanism

6. What is ultrasonic transducer?

   The device used for converting any type of energy into ultrasonic wavers or vibration is called ultrasonic transducer.

7. Write short noted on piezoelectric crystals?

   Piezoelectric crystals are used for inducing ultrasonic vibrations since they possess the capability of changing their dimensions to the given electrical energy or in other sense they have the capability converting electrical energy into mechanical vibrations.

8. What is magnetostrictive effect?

   It is the one in which the material changes its dimension in response to a magnetic field.
9. What are the magnetostrictive materials employed in USM?

Nickel, Iron – cobalt called as permendum, iron – aluminum called as alter.

10. What is the purpose of concentrator used in USM?

The main purpose of the concentrator is to increase the amplitude of the vibration obtained from the transducer.

11. What is abrasive Slurry?

The abrasive slurry is nothing but a mixture of abrasive grains and the carrier fluid, generally water.

12. What are the different types of concentrators?

   1. Conical Type
   2. Exponential type
   3. Stepped type.

13. What are the characteristics of carrier fluid?

   1. Good wetting characteristic
   2. High thermal conductivity
   4. Should have low viscosity.

14. What are the elements of Carrier Fluid?

   1. Act as a coolant.
   2. Act as an acoustic bond between the work piece and the tool.
   3. Helps efficient transfer of energy.
   4. Act as medium to carry the abrasive machined materials and worm abrasives.

15. What are the types of feed mechanisms used in USM?

   1. Spring type
   2. Counter – weight type
   3. Motor type
   4. Pneumatic and hydraulic type.
1. Define electrical discharge machining?

EDM is the controlled erosion of electrically conductive materials by the initiation of rapid and repetitive spark discharge between the electrode tool to the cathode and work to anode separated by a small gap kept in the path of dielectric medium. This process also called spark erosion.

2. What are functions of dielectric fluid used in EDM?

1. It acts as an insulating medium
2. It cools the spark region and helps in keeping the tool and work piece cool.
3. It maintains a constant resistance across the gap.
4. It carries away the eroded metal particles.

3. Basic requirement of dielectric fluid used in EDM?

1. Stable Dielectric strength.
2. It should have optimum viscosity.
3. It should have high flash point.
4. It should be chemically stable at high temperature and neutral.
5. It should not emit toxic vapors.

4. What the dielectric fluids commonly used in EDM?

1. Petroleum based hydrocarbon fluids.
2. Parafin, white sprite, transformer oil.
4. Ethylene glycol and water miscible compounds.
5. What are the prime requirements of tool material in EDM?

1. It should be electrically conductive.
2. It should have good mach inability.
3. It should have low erosion rate.
4. It should have low electrical resistance.

6. What is the effect of capacitance in EDM?

Increasing the capacitance causes the discharge to increase and increase both the peak current and discharge time.

7. Name some of the tool material used in EDM?

1. Copper, brass, alloys of Zinc & tin.
2. Hardened plain carbon steel
3. Copper tungsten, silver tungsten, tungsten
4. Copper graphite and graphite.

8. What is the process parameter efficiency the MRR?

1. Energy discharge
2. Capacitance.
3. Size of work piece.
4. M/c tool design

9. Write the formula for finding the energy discharge in EDM?

\[ W = \frac{1}{2} \times EIT \]

W - discharge energy
I - Current, T - time, E - voltage

10. How do you increase the inductance of the circuit?

A piece of iron or steel be allowed to lodge between the leads it would increase the inductance of the circuit and reduce the M/C rate.
11. Define W/T ratio?

It is the ratio of volume of work removed to the volume of tool removed.

12. What is cycle time?

It is the sum of discharge time and waiting time.

13. Define over cut?

It is the discharge by which the machined hole in the work piece exceeds the electrode size and is determined by both the initiating voltage and the discharge energy.

14. Define Rehardening?

While metal heated to a temperature above the critical and then rapidly cooled by the flowing dielectric fluid the metal is rehardened.

15. What is recast metal?

Metal heated to a temperature above the melting point and which is not displaced by the action of the spark discharge, resoldifies as recast metal.

16. Explain electrode wear?

A crater is produced in the electrode, which is likewise dependent on the electrode material and the energy of the discharge.

17. What are types of power supply circuits used in EDM?

1. R-C circuit.

2. Rotary impulse generator.

3. Controlled pulse (vacuum tube).

4. Oscillator controlled pulse.

5. Transister pulsed circuit.
18. What are the design factors to be considered while selecting the machine tool?

1. Number of parts to be produced.
2. Accuracy.
3. Size of work piece.
4. Size of electrode
5. Depth of cavity.

19. Why the servo controlled system is needed in EDM?

EDM requires that a constant arc gap be maintained between the electrode and the work piece to obtain maximum machining efficiency. Therefore EDM tool incorporates some form of servo control.

20. Define wear ratio?

\[ \text{Wear ratio} = \frac{\text{Work piece material removed}}{\text{Loss of electrode material}} \]

**ELECTRO CHEMICAL MACHINING**

1) Define ECM?

It is the controlled removal of metals by the anodic dissolution in an electrolytic medium, where the work piece (anode) and the tool (cathode) are connected to the electrolytic circuit, which is kept, immersed in the electrolytic medium.

2) Write the Faraday’s first law of electrolysis?

The amount of any material dissolved or deposited is proportional to the quantity of electrolyte passed.

3) Write the Faraday’s second law of electrolysis?

The amount of different substances dissolved or deposited by the same quantity of electricity are proportional to their chemical equivalent weight.

4) Write Ohm’s law?

\[ \text{Current, } I = \frac{V}{R} \]

\[ V = \text{Voltage (volt)}, \ R = \text{resistance (ohm)} \]
5) What are the factors that influence oxidation in ECM?

(i) Nature of work piece.

(ii) Type of electrolyte.

(iii) Current density. (iv) Temperature of the electrolyte.

6) What are the materials used to make the tool electrode?

Copper and copper alloys, titanium, aluminum, brass, bronze, carbon, Monel and reinforced plastic.

7) What are the main functions of electrolysis in the ECM?

i) For completing the electric circuit between the tool and the work piece and to allow the reaction to proceed efficiently.

ii) To remove the products of machining from the cutting region.

iii) To carry away the heat generated during the chemical reaction.

iv) To avoid ion concentration at the work piece-tool gap.

8) What are the properties are expected from the electrolysis used in the ECM?

i) High thermal conductivity.

ii) Low viscosity and high specific heat.

iii) Should chemically stable even at high temperature.

iv) Should be non-toxic and non-corrosive.

9) What are the electrolysis commonly used in ECM?

15 -20 % Nacl in water, sodium nitrate, potassium nitrate, sodium sulphate, sodium chromate and potassium chloride.

10) What are the results which is in improper selection of electrolyte in ECM?

(i) Low machining rate. (ii) Over cut and stray cutting.
11) What are the methods generally used to filter the electrolyte?

(i) Running the system until it is contaminated completely and replace it.

(ii) Centrifugal separation.

(iii) Sedimentation.

(iv) Use of clarifiers.

12) What are the characteristics of a good ECM tool?

(i) It should be a good conductor of electricity and heat.

(ii) Easily machinable.

(iii) Resistant to chemical reaction.

(iv) It offers resistance to the high electrolyte pressure.

13) What are the parameters that affect the MRR?

(i) Feed rate. (ii) Voltage. (iii) Concentration of the electrolyte.

(iv) Temperature of the electrolyte. (v) Current density.

(vi) Velocity of the electrolyte.

14) How the current density affect the MRR?

Current density is controlled not only by the amount of current but also by the size of the gap between the tool and the work piece. A small gap results in high current density, which in turn produce more material removal.

15) What are the advantages of ECM?

i. ECM is simple, fast and versatile method.

ii. Surface finish can be extremely good.

iii. Fairly good tolerance can be obtained.
16) What are the limitations of ECM?

   i. Large power consumption and the related problems.
   ii. Sharp internal corners cannot be answered.
   iii. Maintenances of higher tolerances require complicated contours.

17) What are the applications of ECM?

   ECM is used for sinking, profiling and contouring, multi hole drilling, trepanning, broaching, honing, steel mill applications, surfacing, sawing, contour machining of hand to hand machine materials.

**ELECTRO CHEMICAL GRINDING**

1. Define ECG.

   ECG is the material removal process in which the material is removed by the combination of Electro- Chemical decomposition as in ECM process and abrasive due to grinding.

2. Which material is used to make the grinding wheel?

   Metal bonded diamond (or) Aluminum oxide.

3. What are the important functions of abrasive particles used in ECG?

   It acts as insulator to maintain a small gap between the wheel and work piece. They are electrolysis products from the working area. To cut chips if the wheel should contact the work piece particularly in the event of power failure.

4. What are the advantages of ECG?

   i) No thermal damage to work piece.
   ii) Wheel wear is negligible.
   iii) No distortion of the work piece.

5. What are the disadvantages of ECG?

   High capital costs, because of the special wheel tool. Power consumption is quite high. Electrolyte is corrosive.
6. What are the limitations of ECG?

1. The work material must be conductive.
2. Not suitable for machining soft material.
3. Require dressing tools for preparing the wheels.

7. What is the application of ECG?

1. Precision grinding of hard metals economically.
2. Grinding Carbide cutting tools inserts.
3. To grind end mill cutters more precisely.

**LASE BEAM MACHINING**

1. What is Laser?

   It is acronym of light amplification by stimulated emission of radiation.

2. What is Maser?

   Laser can be melt diamond when focused by lens system. The energy density being of two order 100,000 KW/cm$^2$. This energy is due to atoms that have light energy level. When such an atom impinge with electromagnetic waves having resonant frequency.

3. What are the characteristics of Laser beam?

   1. Material removal
   2. Material shaping
   3. Welding
   4. Thermo kinetic change.

4. What are the gases commonly used in LASER?

   The gases commonly used are:
   
   He, Ne, Argon, CO$_2$ etc.
5. What are the advantages of Laser drilling?

No physical contact between work root pair hence there is no possibility if breakage or wear of root. Precision location is ensured by focusing of the beam Large aspect ratio can be achieved.

6. What are the characteristics of Laser used in Laser machining?

   1. Can be focused to maximum intensity or to lower intensity as needed.
   2. Can be moved rapidly on the work.
   3. Remote cutting over long standoff distances.

7. What are the fundamentals of photons used in Laser?

   In the Laser the photons are in ground state at 0°C they are brought to the excited state by means of absorption of energy by temperature change, collision etc.

8. What are the emission lines?

   The atoms when they are bringing down goes to the excited state by stimulated emission and emit photons within 10 nano secs. They have the same wavelength as the excited photons.

9. What is the Maser principle?

   The energy density of laser with 100,000Kw/cm². The atoms at this state will impinge with electrons waves having resonate frequency. This is known as maser.

10. What is population inversion?

    If the atoms in the excited state are greater than that of the ground state then it is known as population inversion.

11. How does Laser melting works?

    It melts and vaporizes the unwanted material by means of narrow pulsed laser operating at 2 to 100pulses/sec Because of this high accuracy is not possible to micro sized holes.
12. What is solid state Laser?

Solid state Laser is the Lasers, which consist of a hot nat, which may be crystalline solid/glass, doped with an active material whose atoms provide the lasing action.

**PLASMA ARC MACHINING**

1. Define plasma.

   Plasma is defined as the gas, which has been heated to a sufficiently high temperature to become ionized.

2. What are the advantages of plasma arc welding?

   a. Exothermic oxidation takes place.

   b. DC power supply

3. What are the metals that can't be machined by plasma arc machining?

   a. Stainless steel

   b. Monel    c. Super alloys

4. What is the basic heating phenomenon that takes place in plasma arc welding?

   The basic heating phenomenon that takes place at the work piece is a combination of anode heating due to direct electron bombardment recombination of molecules on the work piece.

5. How does the basic plasma is generated?

   The basic plasma is generated by subjecting a stream of gas to the electron bombardment of the electric arc.

6. How the initial ionization is accomplished in plasma arc machining?

   A high voltage arc established between electrode and nozzle accomplishes initial ionization.

7. Why does gas formed in plasma do in P.A.M?

   This gas stabilizes the arc and prevents it from diverging.
8. How another source of heating achieved in P.A.M?

It is desirable to achieve a third source of heating by injecting oxygen into work area to take advantage of exothermic oxidation.

9. Write the principle of P.A.M

Once the material has been raised to molten point the high velocity gas stream blows the material away.

10. Write the circuitry details in PAM.

+ ve terminal connected to work piece and -- ve terminal connected to electrode.

11. Which type of power supply is used in P.A.M?

DC power supply is used.

12. Which part is constricted by plasma?

Nozzle duct is constricted by plasma.

**ELECTRON BEAM MACHINING**

1. Define EBM?

It is the thermo-electrical material removal process on which the material is removed by the high velocity electron beam emitted from the tungsten filament made to impinge on the work surface, where kinetic energy of the beam is transferred to the work piece material, producing intense heat, which makes the material to melt or vaporize it locally.

2. What is the characteristic of the electron beam?

   i. High concentrated energy.
   ii. Deep penetration into the metals.
   iii. Low distortion.
   iv. Any material either conductive or non-conductive can be processed.

3. Why vacuum is needed in EBM?
   1) To reduce corrosion    2) To get correct focusing
4. Write the application of electron beam?

- Thin film machining.
- Surface treatment.
- Engraving metals and non-metals.
- Cutting of materials.

5. What are the main elements of the EBM equipment?

2. Beam focusing and deflecting units.
3. Work Table.
4. Vacuum chamber

6. What is the function of magnetic lens used in EBM?

It converges the beam into a narrow spot into the work piece.

7. What are the two types of EBM?

(i) Thermal type. (ii) Non-thermal Type.

8. Explain the thermal type EBM?

In this type the electron beam is used to heat the material up to the point where it is selectively vaporized.

9. Explain Non-thermal type EBM?

In this type, the EBM produces a chemical reaction.

10. Write the advantage of EBM?

(i) High accuracy.
(ii) Any type of material can be processed.
(iii) No mechanical or thermal distortion.
(iv) No physical or metallurgical damage results.
11. Write the disadvantages of EBM?

   (i) High cost of equipment.       (ii) Skilled operator is required for operation.

   (iii) Limited to 10mm material thickness.

12. Write any four application of EBM?

   (i) Micro machining application on materials.

   (ii) Drilling of apertures for electron microscope.

   (iii) Drilling of holes in ruby and diamond crystal.

13. Write the Richardson-Dushman Equation.

\[ J = A t^2 e^{\frac{(E + W)}{K T}} \]

   \( J = \) Current Density

   \( A = \) constant (120 Amphere/cm\(^2\)deg\(^2\))

   \( K = \) Boltzman Constant (1.3x10\(^{-23}\) J/K)

   \( T = \) Absolute temperature (Kelvin)

   \( W = \) work function (Volts)

14. Write general formula for focal length of a magnetic lens?

\[ f/(S + D) = 25V/(NT)^2 \]

   \( V = \) Electron accelerating voltage

   \( NT = \) Ampere turns in the lens winding

   \( S = \) pole piece separation, \( D = \) Bore diameter

   \( F = \) focal length

15. What is the drawback of electron beam machining?

   One major diameter of electron beam welding has been the requirement of high degree of vacuum essential or satisfactory operation of this process because of degassing.
UNIT-I (INTRODUCTION)
PART-A (2 MARKS)
1. What is necessity for unconventional machining processes?
2. How non-traditional machining processes are classified?
3. Enlist the requirement that demands the use of advanced machining process.
4. Why unconventional mechanical machining process is not so effective on soft metals like aluminum?

PART-B (16 MARKS)
1. (i) Explain the factors that should be considered during the selection of an appropriate unconventional machining process for a given job. (8)
   (ii) Compare and contrast the various unconventional machining process on the basis of type of energy employed, material removal rate, transfer media and economical aspects. (8)

UNIT II(MECHANICAL ENERGY BASED PROCESSES)
PART-A (2 MARKS)
1. Define AJM?

2. How does AJM differ from conventional sand blasting process?

3. What are the advantages of AJM process?

4. What are the applications of AJM?

5. Write the Disadvantages of AJM process?

6. Give the formula for find the material remove rate for brittle metal?

7. Give a summary of the abrasive of their application for different operation?

8. Write the formula for find the MRR for ductile materials?
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11. What are the different types of nozzles heads used in AJM?

12. Why oxygen should not be used in AJM?

13. What are the different types abrasives used in AJM?

14. Reuse of abrasives is not recommended in AJM. Why?

15. What are the properties of water jet machining about effect cutting action?

16. What are the types of units and its purpose used in water jet cutting system?

17. Why we are using the diamond nozzle?

18. Why do you select proper cutting fluid in WJM?

19. Does there is any environmental effects while using the water jet machining?

19. What are the advantages of WJC over conventional cutting methods?

20. What are the applications of WJM?

21. What are the commonly used additives in WJM?

22. What is optical tracing system?

23. What is ultrasonic machining?

24. What are the advantages of USM?

25. What are the Disadvantages of USM?

26. What are the applications of USM?

27. What are the components of USM?

28. What is ultrasonic transducer?

29. Write short noted on piezoelectric crystals?

30. What is magnetostrictive effect?

31. What are the magnetostrivtive materials employed in USM?

32. What is the purpose of concentrator used in USM?
33. What is abrasive Slurry?

34. What are the different types of concentrators?

35. What are the characteristics of carrier fluid?

36. What are the elements of Carrier Fluid?

37. What are the types of feed mechanisms used in USM?

38. What is the principle of WJM?

PART-B (16 MARKS)

1. (i) Explain the principle of AJM. Mention some of the specific applications. (6)

   (ii) Discuss in detail about the AJM process variables that influence the rate of material removal and accuracy in the machining. (10)

2. (i) Explain the method of AJM with help of schematic diagram.(10)

   (ii) Mention the advantages and limitations of AJM.(6)

3. Explain the process parameters in WJM processs.(16)

4. With neat sketch explain the process of AJM .List its application and limitations.(16)

5. (i) Explain the process parameters that influence WJM.List the applications and limitations of WJM(10)

   (ii) Briefly discuss the application and limitation of WJM.(6)

6. Explain the USM machine setup an discuss various feed mechanisms.(16)

7. (i) Discuss the influence process parameters and applications of USM (10)

   (ii) Give a note o the various types of transducers.(6)
PART-A (2 MARKS)

1. Define electrical discharge machining?

2. What are functions of dielectric fluid used in EDM?

3. Basic requirement of dielectric fluid used in EDM?

4. What are the dielectric fluids commonly used in EDM?

5. What are the prime requirements of tool material in EDM?

6. Name some of the tool material used in EDM?

7. What is the process parameter efficiency the MRR?

8. Write the formula for finding the energy discharge in EDM?

9. What is the effect of capacitance in EDM?

10. How do you increase the inductance of the circuit?

11. Define W/T ratio?

12. What is cycle time?

13. Define over cut?

14. Define Rehardening?

15. What is recast metal?

16. Explain electrode wear?

17. What are types of power supply circuits used in EDM?

18. What are the design factors to be considered while selecting the machine tool?

19. Why the servo controlled system is needed in EDM?

20. Define wear ratio?

21. What are the functions of adaptive control used for EDM?
PART-B (16 MARKS)

1. Explain the process of electrical discharge machining, its process parameters and applications.
2. Describe the wire cut EDM equipment, its working, applications and advantages

3. (i) With the help of neat sketch, Describe the EDM process.(12)
   (ii) Explain briefly advantages of wire EDM process.(4)

4. (i) Explain the classification and characteristics of various spark erosion generators. (8)
   (ii) With help of neat sketch describe the mechanism of material removal in EDM. (8)

5. (i) Explain the working principle, elements and characteristics of wire EDM. (10)
   (ii) Explain how the stratified wire works. Also discuss about the recent developments in wire EDM. (6)

UNIT-IV (CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES)

PART-A(2 MARKS)

1. Define ECM?

2. Write the Faraday’s first law of electrolysis?

3. Write the Faraday’s second law of electrolysis?

4. Write Ohm’s law?

5. What are the factors that influence oxidation in ECM?

6. What are the materials used to make the tool electrode?

7. What are the main functions of electrolysis in the ECM?

8. What are the properties are expected from the electrolysis used in the ECM?

9. What are the electrolysis commonly used in ECM?

10. What are the results which is in improper selection of electrolyte in ECM?

11. What are the methods generally used to filter the electrolyte?

12. What are the characteristics of a good ECM tool?

13. What are the parameters that affect the MRR?
14. How the current density affect the MRR?

15. What are the advantages of ECM?

16. What are the limitations of ECM?

17. What are the applications of ECM?

18. Define ECG.

19. Which material is used to make the grinding wheel?

20. What are the important functions of abrasive particles used in ECG?

21. What are the advantages of ECG?

22. What are the disadvantages of ECG?

23. What are the limitations of ECG?

24. What is the application of ECG?

25. What is the self adjusting feature in ECM?

26. What do you understand by “Etch Factor”?

**PART-B (16 MARKS)**

1. (i) Describe the chemistry involved in ECM process. (8)

   (ii) Briefly discuss about the effect of high temperature and pressure of electrolyte on the ECM process. (4)

   (iii) Discuss about the economics of ECM. (4)

2. (i) Describe the working principle and elements of chemical machining. What are the factors on which the selection of a resist for use in chemical machining? (10)

   (ii) What are the specific advantages of using chemical machining over electrochemical machining? Give some of the practical applications of chemical machining process. (6)

3. (i) Explain the principle of ECG with sketch. (8)

   (ii) List out the advantage of EGC over conventional grinding. (4)

   (iii) Mention the product application of ECG. (4)
4. Explain in detail the ECM process with neat sketch and also mention the advantages and application. (16)

5. (i) Describe the process of electrochemical machining.

(ii) Discuss about the electrochemical honing and electrochemical grinding.

UNIT-V (THERMAL ENERGY BASED PROCESSES)

PART-A(2 MARKS)

1. What is Laser?
2. What is the principle of LBM?
3. What are the characteristics of Laser beam?
4. What are the gases commonly used in LASER?
5. What are the advantages of Laser drilling?
6. What are the characteristics of Laser used in Laser machining?
7. What are the fundamentals of photons used in Laser?
8. What are the emission lines?
9. What is the Maser principle?
10. What is population inversion?
11. How does Laser melting works?
12. What is solid state Laser?
14. What are the advantages of plasma arc welding?
15. What are the metals that can't be machined by plasma arc machining?
16. What is the basic heating phenomenon that takes place in plasma arc welding?
17. How does the basic plasma is generated?
18. Why does gas formed in plasma do in P.A.M?
19. How another source of heating achieved in P.A.M?
20. Write the principle of P.A.M.

21. Write the circuitry details in PAM.

22. Which type of power supply is used in P.A.M?

23. Which part is constricted by plasma?

24. Describe the commonly used gas mixture in PAM and their corresponding work materials

25. Can you machine electrically non-conducting materials using EBM process?

26. What is the function of water muffler in PAM?

**PART-B (16 MARKS)**

1. Explain the process of LBM and PAM with a neat sketchs.
2. (i) Discuss the process parameters of EBM and their influence on machining quality. (8)
   (ii) Explain the process capabilities of EBM and PAM. (8)
3. (i) Explain the principle of LBM with neat sketch. (10)
   (ii) List out the advantage and limitation of LBM process. (6)
4. (i) Explain the principle of PAM with sketch (10)
   (ii) List out the advantage and limitation of PAM process. (6)
5. (i) Mention the application of EBM. (4)
   (ii) What is EBM? Sketch its set up and indicate its main parts and explain the principle
       of operation. (12)
6. (i) Explain the principles and elements of EBM, also how the work table is protected
       from getting damaged by electron beam. (8)
   (ii) Discuss how the process variables influence MRR, HAZ and pattern generation. (8)