



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	UNCONVENTIONAL MACHINING PROCESSES
Course Code	:	A70359 – JNTUH R15
Class	:	IV B. Tech I Semester
Branch	:	MECH
Year	:	2018 – 2019
Course Coordinator	:	S. Srikrishnan, Assistant Professor, Department of ME
Course Faculty	:	S. Srikrishnan, Assistant Professor, Department of ME

COURSE OBJECTIVES:

The objective of this course is to impart knowledge on the various unconventional machining processes, the process parameters associated with them. Selection of an appropriate machining process for a particular application, properties of the work material and shape to be machined, process capability and economic considerations of these processes.

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
UNIT-I			
Part A (Very Short Answer Questions)			
1	What are the materials used for tool holder in ultrasonic machining?	Understand	1
2	What are the materials used for tool in ultrasonic machining process?	Remember	1
3	What factors to be consider while selecting abrasive for ultrasonic machining?	Understand	1
4	What are abrasives used in ultrasonic machining?	Remember	1
4	What is the Volume of material removed in ultrasonic machining as per model proposed by SHAW?	Understand	1
5	What are the process parameters for controlling the ultrasonic machining performance?	Remember	1
6	What is the effect of amplitude and frequency of vibration on material removal and surface finish obtainable in ultrasonic machining?	Understand	1
7	What is the effect of abrasive grit size on material removal and surface finish obtainable in ultrasonic machining?	Remember	1
8	What is the effect of Static load on material removal and surface finish obtainable in ultrasonic machining?	Understand	1
9	What are the materials used for tool holder in ultrasonic machining?	Remember	1
10	What are the materials used for tool in ultrasonic machining process?	Understand	1
11	What factors to be consider while selecting abrasive for ultrasonic machining?	Remember	1
12	What are abrasives used in ultrasonic machining?	Understand	1
13	What is the Volume of material removed in ultrasonic machining as per model proposed by SHAW?	Remember	2
14	What are the process parameters for controlling the ultrasonic machining performance?	Understand	1
15	What is the effect of amplitude and frequency of vibration on material removal and surface finish obtainable in ultrasonic machining?	Remember	1
16	What is the effect of abrasive grit size on material removal and surface finish obtainable in ultrasonic machining?	Understand	1

17	What is the effect of Static load on material removal and surface finish obtainable in ultrasonic machining?	Understand	1
18	What is the effect of amplitude and frequency of vibration on material removal and surface finish obtainable in ultrasonic machining?	Understand	3
19	What is the effect of abrasive grit size on material removal and surface finish obtainable in ultrasonic machining?	Remember	3
20	What is the effect of Static load on material removal and surface finish obtainable in ultrasonic machining?	Remember	3
Part B (Long Answer Questions)			
1	Explain the reasons for the development of Unconventional Machining Process. Discuss about the criteria recommended in selection of these processes.	Remember	1
2	List the unconventional machining process, which uses thermal or heat energy? Make a comparison between traditional and unconventional machining processes in terms of cost, Application, scope, Machining time, advantages and limitations.	Remember	1
3	List the Unconventional machining process, which uses Electro chemical energy? Compare the mechanical and electrical energy processes in terms of physical parameters. Shape capabilities, Process capability, and Process economy.	Understand	1
4	What is a mechanical energy method of unconventional machining? What is meant by Unconventional Machining Processes?	Remember	2
5	What is meant by Conventional Machining Processes? What are the characteristics of unconventional machining process?	Understand	2
6	Name the unconventional machining process which is used to remove	Remember	3
7	What is a chemical energy method of unconventional machining? List the Unconventional machining process, which uses Electro chemical energy?	Remember	2
8	Differentiate between traditional and nontraditional machining. What are the industrial needs for unconventional machining processes?	Remember	1
9	Name the unconventional machining processes which are used to remove maximum material? Classify the modern machining processes in detail. Justify for its economic aspects.	Understand	1
10	List the unconventional machining process which uses mechanical energy? Compare and contrast the various unconventional machining process on the basis of the type of energy employed, material removal rate, transfer media and economical aspects.	Remember	2
11	Define the functions of transducers in ultrasonic machining. What are the major elements of ultrasonic machining equipment?	Remember	1
12	Give the range of frequency required for ultrasonic machining. Explain the principles equipment's, transducer, of Ultrasonic machining	Understand	2
13	What are the process criteria of USM? What are the various process parameters that govern the process criteria?	Remember	2
14	What are the actions do the ultrasonic vibrations imparted to the fluid medium surrounding the tool have? What are the applications of Ultrasonic Machining?	Remember	3
15	Briefly discuss about the mechanisms involved in material removal by USM. Draw the schematic set-up of Ultrasonic Machine and indicate its various parts.	Remember	3
16	Mention the salient features of Ultrasonic Machining. Explain the principle of USM with neat diagram.	Remember	3
17	List the commonly used abrasive powder for the tooling of USM and their properties. What are the limitations of USM?	Remember	1
18	Discuss in detail about the methods of generating the ultrasonic, characteristics of the various types of tool holder and tool feed mechanisms in USM. Define "Ultrasonic" and describe the process in which these are used to machine the material.	Remember	2
19	Calculate the depth of indentation produced on a glass surface in ultrasonic machining by throwing action of abrasive grain of 100 μm diameter. The following data are given. Amplitude of vibration = 0.1 mm, Frequency = 20kc/s. Abrasive density = 3.0 Kg/m^3 , Yield strength of glass = $4.0 \times 10^{11}\text{N/m}^2$. Outline a method by which the volume rate of material removal could be computed.	Remember	3
20	Describe the design procedure for the Horn (Velocity transformer) used in Ultrasonic Machining process. Describe the entire range of applications of Ultrasonic machining where it can be used economically.	Remember	3

Part C (Critical Analytical Questions)			
1	Mention the salient features of Ultrasonic Machining. Explain the principle of USM with neat diagram.	Remember	3
2	List the commonly used abrasive powder for the tooling of USM and their properties. What are the limitations of USM?	Remember	1
3	Discuss in detail about the methods of generating the ultrasonic, characteristics of the various types of tool holder and tool feed mechanisms in USM. Define "Ultrasonic" and describe the process in which these are used to machine the material.	Remember	2
4	Calculate the depth of indentation produced on a glass surface in ultrasonic machining by throwing action of abrasive grain of 100 μm diameter. The following data are given. Amplitude of vibration = 0.1 mm, Frequency = 20kc/s. Abrasive density = 3.0 Kg/m^3 , Yield strength of glass = $4.0 \times 10^{11} \text{N/m}^2$. Outline a method by which the volume rate of material removal could be computed.	Remember	3
5	Describe the design procedure for the Horn (Velocity transformer) used in Ultrasonic Machining process. Describe the entire range of applications of Ultrasonic machining where it can be used economically.	Remember	3

UNIT – II

Part A (Very Short Answer Questions)

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
1	What is the principle behind abrasive jet machining?	Understand	4
2	What are the major subsystems of AJM?	Remember	4
3	Why the abrasive particles not reused in the AJM?	Remember	4
4	Why is AJM not suitable for soft materials?	Understand	5
5	Name the abrasive materials that are used for the AJM.	Remember	5
6	Mention the abrasives used for different applications.	Remember	5
7	Name different gases used in AJM. Which of these is most widely used?	Remember	4
8	What is the effect of the grain size on the material removal rate (MRR) in the AJM?	Understand	5
9	What is the effect of jet velocity on the MRR in AJM?	Remember	4
10	Define mixing ratio. What is the effect of mixing ratio on the MRR?	Remember	6
11	What is the effect of the abrasive powder flow rate on the MRR in AJM?	Understand	4
12	What are common materials used for the nozzle in AJM?	Remember	4
13	Why are masks used in AJM? Which material is used for fabrication of masks?	Remember	4
14	What is the principle behind abrasive jet machining?	Understand	4
15	What are the advantages of AJM?	Remember	4
16	Mention some typical applications of AJM in engineering?	Understand	4
17	Please identify the principle of ECM.	Remember	7
18	What is Faraday's first law?	Remember	7
19	What is Faraday's second law?	Understand	7
20	Explain the parameters controlling the MRR in ECM.	Remember,	7

Part B (Long Answer Questions)

1	State the working principle of Abrasive Jet Machining with a neat sketch? List the advantages of AJM process?	Understand	4
2	What are the factors that affect the material removal rate in AJM process? What are the applications of AJM process?	Remember	4
3	State the working principles of WJM process? List the unique benefits offered by WJM process?	Understand	4
4	Discuss in detail about the AJM process variables that influence the rate of material removal and accuracy in the machining. Mention the limitations of AJM.	Remember	4
5	Explain the process parameters that influence WJM. Briefly discuss the limitation of WJM.	Understand	4

6	Explain the principles, equipment's, of Abrasive Jet Machining. Explain mechanics of metal removal, MRR of AJM.	Understand	5
7	Describe the variables that affect the metal removal rate in AJM. How the restriction offered bypass way governs MRR and quality of surface produced in AFM?	Remember	5
8	What are the advantages of water jet machining? Describe the practical applications of water jet machining?	Remember	5
9	Explain the effect of following parameters on the metal removal rate in AJM. i) Velocity of fluid. ii) Design of nozzle. iii) Gas pressure. Describe the operation of AJM in detail.	Remember	4
10	Discuss why the AJM technique, when applied to ductile materials, leads to a low rate of metal removal. What are the applications of Abrasive Jet Machining?	Remember	5
Part C (Critical Analytical Questions)			
1	State the principle of chemical machining process. Explain the principle of ECM process with a neat sketch.	Understand	6
2	What are the requirements of tool materials in ECM process? What are the factors to be considered while designing the tool?	Remember	6
3	State the function of electrolyte used in ECM process? What are essential characteristics of an electrolyte used in ECM process?	Remember	6
4	List the applications of ECM process? What are the limitations of ECM process?	Remember	6
5	What is the difference between ECG and conventional grinding? List the disadvantages of ECG process?	Remember	6
UNIT – III			
Part A (Very Short Answer Questions); MID – I (10 Questions)			
1	What is the principle of EDM?	Understand	7
2	What causes the material to be removed from the work piece surface?	Remember	7
3	What are MNA components of EDM process?	Remember	7
4	What is the use of dielectric in EDM process?	Understand	8
5	What the dielectric fluids commonly used in EDM?	Remember	8
6	List the desirable characteristics of a dielectric.	Understand	8
7	What is tool wear in the EDM process?	Remember	8
8	How to minimize tool wear in EDM?	Remember	8
9	Please identify the characteristics of an electrode material in order to serve as a good tool.	Understand	8
10	Name some of the tool material used in EDM?	Remember	8
Part A (Very Short Answer Questions); MID – II (10 Questions)			
1	Why is graphite the most preferred electrode material in EDM?	Understand	9
2	How does the melting temperature of work material affect the MRR in EDM?	Remember	9
3	What is the effect of capacitance in EDM?	Remember	9
4	Define wear ratio?	Understand	9
5	Define over cut.	Remember	10
6	What is recast layer?	Remember	10
7	What are the factors upon which the material removal rate and surface roughness depends in EDM?	Understand	10
8	What are the design factors to be considered while selecting electro discharge machine?	Remember	10
9	Why is a servo-controlled system required in EDM?	Understand	11
10	What are the various applications of EDM?	Remember	11
Part B (Long Answer Questions)			
1	Explain the mechanism of material removal in EDM with the help of a neat sketch.	Understand	7
2	What are the advantages and applications of EDM?	Remember	7
3	Discuss the nature of inaccuracies of machining surface obtained by EDM and WEDM process and mention the methods of reducing their effects?	Remember	8

4	Explain types of flushing used in EDM.	Remember	8
5	Explain the effect of various process parameters of EDM?	Remember	8
6	Describe with a neat sketch the working of Wire EDM?	Remember	8
7	Sketch the rotary pulse generator used in EDM process and mention its advantages over relaxation circuit.	Remember	8
8	What is flushing and why is it required in EDM?	Remember	7
9	Explain the effect of following parameters in MRR during EDM. i) Resistance ii) Magnitude of current iii) Capacitance.	Remember	7
10	Differentiate between electro discharge grinding and wire EDM process	Remember	7
Part C (Critical Analytical Questions)			
1	Sketch the rotary pulse generator used in EDM process and mention its advantages over Relaxation circuit.	Understand	9
2	Describe about the importance of supply voltage, break down voltage, charging resistance, gap setting and die electric strength of gap in EDM.	Remember	9
3	Explain the various Thermal metal removal process and differentiate between them.	Remember	9
4	For a relaxation circuit used in EDM process prove that $V_e = V_o (1 - e^{-t/RC})$.	Remember	10
5	Explain the closed loop hydraulic circuit used in EDM process with a neat sketch.	Remember	10
6	Describe with a neat sketch the electro mechanical servo control unit to maintain the correct gap in EDM?	Remember	10
UNIT – IV			
Short Answer Questions			
1	What is the principle of EBM?	Understand	12
2	What is the principle of LBM?	Remember	12
3	Identify the major components of the electron gun?	Remember	12
4	Compare EBM and LBM	Understand	12
5	What are the applications of LBM?	Remember	13
6	What is the mechanism of material removal in electron beam machining?	Remember	13
7	Is EBM is suitable of for non-conducting materials.	Understand	13
8	Is LBM is suitable for non-conductivity materials.	Remember	13
9	Can the work table be moved in the described path in EBM process?	Understand	12
10	What is the function as of magnetic	Remember	12
11	What are the process parameters in EBM?	Remember	13
12	Indicate specific energy required to vaporize a material	Understand	13
13	What is layer?	Remember	13
14	What are the components of gas a layer	Remember	13
15	What is Laser?	Understand	13
16	Discuss the advantages of EDM as compared to other non-traditional methods with regard to metal removal rate?	Remember	13
17	Discuss the advantages of EDM as compared to other non-traditional methods with regard to accuracy?	Understand	13
18	Discuss the advantages of EDM as compared to other non-traditional methods with regard to surface finish?	Remember	13
19	Compare between thermal and non-thermal features of EBM.	Understand	13
20	Compare between LBM and EBM processes on the basis of their applications and limitations.	Remember	13
Part B (Long Answer Questions)			
1	Explain the construction and working of Electron beam machining process with a neat sketch.	Understand	12
2	Describe the suitability of LBM and its machining performance, and industrial applications?	Remember	12
3	What are the various LASERS used in practice for machining and explain the requirements of “LASERS”?	Understand	12
4	Compare EBM and LBM on the following aspects: i)Machiningrate ii) Tool wear rate iii)Accuracy.	Remember	12
5	How does vacuum and heating of cathode help the performance of electron beam?	Understand	13

6	b) Describe the thermal features of melting and evaporation process in LBM?	Remember	13
7	Explain the working of CO ₂ laser with neat sketch.	Remember	13
8	Explain the production of laser beam with a neat sketch.	Understand	13
9	Write an equation to compute specific energy of vaporization and mention the applications of EBM.	Remember	12
10	Explain the working of electron gun used in EBM with a neat sketch.	Understand	12
11	Describe the construction and working of "Micro-Drilling" by LASER?	Remember	12
12	What is the need of doping of LASER and mention various doping materials and their relative advantages?	Remember	12
13	Differentiate between EBM and LBM considering at least five aspects?	Understand	13
14	Compare the edge production in EBM and LBM. What are the factors influencing edge for maintain in both the processes?	Remember	13
15	Explain variation of temperature with distance from the surface for various pulse durations in EBM.	Remember	13
16	Describe the principles, equipments, solid state laser, gas laser, thermal features applications and advantages of Laser Beam Machining.	Understand	13
Part C (Analytical Questions)			
1	What is the function of electron beam gun?	Understand	12
2	Derive an expression for the dimensionless analysis to establish correlation between EBM parameters.	Understand	12
3	Explain the principle and elements of EBM, also how the work table is protected from getting damaged by electron beam.	Understand	12
4	What is laser? Explain how it is used to machine the materials.	Remember	12
UNIT-V			
S. No.	Question	Blooms Taxonomy Level	Course Outcomes
Part A (Short Answer Questions)			
1	What is plasma?	Understand	14
2	What are the elements of the plasma arc cutting?	Remember	14
3	What are types of plasma?	Remember	14
4	What are applications of plasma arc cutting machines?	Understand	14
5	What is plasma arc surfacing?	Remember	14
6	What is plasma arc spraying?	Understand	14
7	What is metal rest mechanism in plasma arc cutting?	Remember	14
8	What is chemical machining?	Remember	14
9	Indicate the functions of etchants.	Understand	14
10	What is the function of maskant?	Remember	14
11	List etchants used in chemical machining.	Understand	14
12	List maskants and in chemical machining.	Remember	15
13	What is etch factor?	Understand	15
14	How maskants are applied to the work piece?	Remember	15
15	Explain PAM parameters.	Understand	15
16	Classify torches in PAM.	Remember	15
17	What are the applications of plasma jets?	Understand	15
18	Explain non-transferred mode of plasma arc.	Remember	15
19	What are the advantages of non-transferred mode of plasma arc?	Understand	15
20	Explain transferred mode of plasma arc.	Remember	15
Part B (Long Answer Questions)			
1	What are the various Etchants used in chemical machining? Mention their characteristics?	Remember	14
2	Explain the advantages of dual gas and water injected plasma torch.	Remember	14
3	What is Etch factor and how can it be controlled in chemical machining?	Remember	14
4	What are the various process parameters to be considered to obtain higher MRR and quality of machined surface?	Remember	14

5	Describe the quality of machining and accuracies obtainable in chemical machining?	Understand	14
6	Explain what is meant by non-transferred and transferred mode of plasma arc. What are the advantages of each?	Remember	14
7	What are the advantages of water circulation in the torch of the PAM?	Understand	14
8	Why the surface finish and tolerance obtained are poor in Plasma Arc Machining?	Remember	14
9	How the material removal takes place in chemical machining?	Remember	14
10	Explain the advantages of various types of plasma torches.	Remember	15
Part C (Analytical Questions)			
1	Explain the working of PAM with a neat sketch.	Understand	15
2	Explain the construction details of air plasma torch.	Remember	15
3	What are the factors to be considered while selecting maskant?	Remember	15
4	What do you understand by fourth state of matter with reference to PAM?	Remember	15
5	Explain the metal removal mechanism, process parameters, accuracy, and surface finish of Plasma Machining.	Remember	15
6	Write short notes on the following i) Shaped tube Electrolytic Machining. ii) Electro StreamDrilling.	Remember	15
7	Explain the construction details of air plasma torch.	Remember	15

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