



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Title	MANUFACTURING TECHNOLOGY				
Course Code	AMEB16				
Program	B. Tech				
Semester	FIVE				
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	1	4	3	2
Course Coordinator	Dr. K. China Apparao, Associate Professor				

COURSE OBJECTIVES:

The student will try to learn:	
I	The fundamental concepts of the metal cutting principles to study the behavior of various machining processes
II	The importance of tool materials, cutting parameters, cutting fluids and tool wear mechanisms for optimized machining
III	The principles of linear and angular measuring instruments for accurate and precise measurement of a given component
IV	The mechanics of machining process and optimization of various significant parameters in order to yield the optimum machining.

COURSE OUTCOMES:

Upon the successful completion of this course, students will be able to:		
Course Outcomes		Knowledge Level (Bloom's Taxonomy)
CO 1	Recognize the importance of geometry of cutting tools, coolants and tool materials for the analysis of material behavior during manufacturing processes	Remember
CO 2	Illustrate mechanism of orthogonal and oblique cutting along with developed cutting forces	Understand
CO 3	Explain the chip formation mechanism by measuring the cutting forces during the chip formation process	Understand
CO 4	Explain the operational principles of different lathe machines and various reciprocating machines for quality machining	Understand
CO 5	Select a machining operation, corresponding machine tool for a specific application in real time	Remember
CO 6	Identify most significant process parameters in machine tool for optimal machining	Remember
CO 7	Explain the working principles of Milling, drilling and surface grinding machines for manufacturing the components of their requirement	Understand
CO 8	Estimate machining times for machining operations at specified levels of cutting parameters of machine tools	Apply
CO 9	Apply the principles of limits, fits and tolerance while designing and manufacturing the components of their requirement	Apply
CO10	Choose an appropriate measuring instrument for accurate inspection of the dimensional and geometric features of a given component	Apply
CO11	Apply various methods for the measurements of screw threads, surface roughness parameters and the working of optical measuring instruments	Apply
CO12	Analyze the results of various measuring systems and instruments for motion and dimensional measurements	Analyze

MAPPING OF EACH CO WITH PO(s), PSO(s):

[illegible]

CO 3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 6	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 7	3	4	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 8	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 9	2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 10	3	-	3	-	-	-	-	-	-	-	-	-	2	-	-
CO 11	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 12	-	3	3	-	-	-	-	-	-	-	-	-	2	-	-

TUTORIAL QUESTION BANK

MODULE- I				
BASIC MECHANISM OF METAL CUTTING				
PART - A (SHORT ANSWER QUESTIONS)				
S No	QUESTION	Blooms Taxonomy Level	How does this Subsume the level below	Course Outcomes
1	Write a short note on heat zone in cutting	Remember	---	CO 1
2	What is tool life and its effects on machinability.	Remember	---	CO 1
3	Mention any two modern tool materials	Understand	The learner to recall the suitable tool materials which are used to prepare modern tools to machine advanced materials	CO 1
4	What are the different types of cutting fluids in material removing process?	Remember	---	CO 1
5	What is the difference between straight oils and synthetic fluids?	Remember	---	CO 1
6	Explain different types of application modes of cutting fluids in machining.	Understand	The learner to know the types of application modes of cutting fluids in machining to find their use in machining	CO 1
7	Illustrate the orthogonal cutting process and its advantages and limitations.	Understand	The learner to find the importance of orthogonal cutting process to apply for machining in different operations	CO 2
8	Explain about Oblique cutting and its use in metal cutting process.	Understand	The learner to know the specific importance of Oblique cutting	CO 2

			process to apply for machining in different operations	
9	Classify the cutting tools with respect to different material removal process and machining conditions.	Understand	The learner to recall the classification and specific application of cutting tools to able to choose cutting tool for machining as per their requirement	CO 1
10	Illustrate the various parts in single point cutting tool.	Understand	The learner to know the nomenclature of single point cutting tool to yield smooth machining by turning operation	CO 1
11	What are the assumptions made in drawing Merchant's circle?	Remember	---	CO 3
12	Explain briefly about chip thickness ratio.	Understand	The learner to recall the chip formation to formula the chip thickness ratio to know the thickness of chip at before and after cut and their relationships	CO 3
13	What is the importance of the rake angle?	Remember	---	CO 1
14	Explain are three important heat developing zones in machining	Understand	The learner to describe the importance of heat developing zones in machining to overcome the built-up edges problem by applying suitable cutting fluids.	CO 1
15	What are the objectives and functions of cutting fluids	Remember	---	CO 1
16	Classify various cutting tool materials.	Understand	The learner to recall the classification of various cutting tool materials to select high hardness and good performance in wear resistance cutting tools, so that they play an important role in machining	CO 1
17	Explain the nose radius?	Understand	The learner to know the importance of nose radius of single point cutting tools in order to increase the tool life and better surface finish on the work piece	CO 1
18	List the different factors that contribute to poor surface finish in cutting	Remember	---	CO 1
19	Summarize the four important characteristics of materials used for cutting tools	Remember	---	CO 1
20	Explain the advantage of high machinability	Understand	The learner to know the advantage of high machinability to enhance the productivity by choosing proper machine tools and cutting fluids	CO 1
PART - B (LONG ANSWER QUESTIONS)				
1	Explain various cutting tool materials, also List the properties of cutting tool materials.	Understand	The learner to recall the various cutting tool materials for preparing advanced machine tools in order to yield the good productivity	CO 1
2	What is shear angle? Derive the shear angle	Apply	The learner to know about the shear angle formula and its parameters to	CO 2

	formula with neat sketch.		analyse the material shear in the form of chips by assigning correct values in the shear angle formula	
3	Explain cutting speed, feed and depth of cut, mention their units in machining process.	Understand	The learner to recall the significant process parameters like cutting speed, feed and depth of cut to get the quality machining by optimizing their levels	CO 1
4	Explain the geometry of a single point cutting tool with suitable sketches?	Understand	The learner to describe the geometry of a single point cutting tool to enhance quality machining by maintain the proper nomenclature of tool geometry	CO 1
5	Explain different zones of heat generation with a neat sketch and share of heat among the different zones.	Understand	The learner to recall the heat generation process in different zones in metalcutting for controlling the coefficient of friction to get good surface finish and Tool life	CO 1
6	In orthogonal cutting of mild steel component if the rake angle of the tool is 10° and shear angle is 30° . Find the chip thickness ratio?	Apply	The learner to know the shear angle formula and assigning the given values to know the chip thickness ratio for smooth machining	CO 2
7	Determine the cutting speed and machining time per cut when the work having 35mm diameter is rotated at 200 rpm. The feed given is 0.2mm/rev and length of cut is 60mm.	Apply	The learner to describe Material removal rate formula and assigning the given values to know optimized the cutting speed and machining time per cut	CO 1
8	(a) Examine the parameters that influence the life of tool and discuss. . (b) Illustrate the formulas involved in life of tool.	Apply	The learner to recall the influencing parameters of life of tool and tool life formula then explaining significant influence on tool life to maintain good tool life	CO 1
9	Explain briefly about formation of chip with built up edge and its disadvantages.	Understand	The learner to know the formation of built up edge and its disadvantages to overcome that problem by maintaining the rake angle and cutting fluids	CO 3
10	Explain different types of chips formed while machining and how they get effected in varying the machining conditions.	Analyze	The learner to recall the chip formation mechanism to understand the influencing parameters by varying the machining conditions to analyze the machining mechanism	CO 3
11	Briefly, differentiate between orthogonal cutting and oblique cutting?	Analyze	The learner to recall the difference between orthogonal cutting and oblique cutting to choose the suitable cutting operation as per the requirement	CO 1
12	Explain the role of work piece material in machinability in material removing process.	Understand	The learner to recall the different work piece materials to understand the role of work piece material in machinability to enhance good material removal rate	CO 1
13	Draw merchant force diagram and also resolve the forces related to it, derive the	Understand	The learner to should understand the different forces acting in machining	CO 3

	different forces in machining.		and resolve the forces (F_c , F_t , F_f) by merchant force diagram to derive the formulas to determine them	
14	What are the angles related to single point cutting tool? Explain the significance of each angle?	Analyze	The learner to recall the different angles and their relationships related to single point cutting tool to analyze their significance in machining	CO 1
15	State the advantages and limitations of ceramics as tool materials.	Understand	The learner to recall advantages and limitations of ceramics as tool materials for preparing advanced tool as per the requirements	CO 1
16	What are the different types of cemented carbide tools available and explain their composition and properties?	Remember	---	CO 1
17	Derive the equation for finding shear force and normal to shear force using merchants circle diagram.	Apply	The learner to recall the different influencing machining parameters and Formulate the equation for finding shear force and normal to shear force using merchants circle diagram to know the shear force values	CO 3
18	Explain the role of work piece material and tool material on machinability in a metal removing process.	Understand	The learner to recall the characteristics of work piece material and tool materials to understand the role of work piece and tool material in machinability to enhance good material removal rate	CO 1
19	Derive the equation for finding friction force and normal to friction force in a metal cutting process using merchants circle diagram.	Apply	The learner to Formulate the equation for finding friction force and normal to friction force using merchants circle diagram to analyse power losses	CO 3
20	Explain the different tool materials with their compositions and related properties and limitations of the materials.	Understand	The learner to understand the various cutting tool materials to improve the MRR in order to yield the good productivity	CO 1

PART - C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)

1	The useful tool life of HSS tool machinery mild steel at 18m/min is 3 hrs. calculate the tool life when the tool operates at 24m/min.	Apply	The learner to recall the tool life formula and its parameters to understand the tool life of HSS tool materials at given levels parameters	CO 1
2	In a turning operation it was observed that the tool life was 100 minutes and 50 minutes at cutting speeds of 25m/min and 100/min respectively. Find out tool life at 200m/min under the same cutting conditions?	Apply	The learner to recall the tool life formula and its parameters to understand the tool life of HSS tool materials at given levels parameters	CO 1, CO 3
3	In an orthogonal cutting operation on a work piece of width 2.5mm, the uncut chip thickness was 0.25mm and 25 degree. It was observed that the chip thickness was 1.25mm. The cutting force was measured to be	Apply	The learner to recall the shear angle formula and their influencing parameters to understands the relationship between different angles in cutting mechanism at different values of process parameters for better	CO 1, CO 3

	900N and the thrust force was found to be 810 N. (a) Find the shear angle. (b) If the coefficient of friction between the chip and the tool, was 0.5, what is the machining constant C_m		machining	
4	Determine the cutting speed and machining time per cut when the work having 50mm diameter is rotated at 1000rpm. The feed given is 0.8mm/rev and length of cut is 50mm.	Understand	The learner to recall the influencing parameters on machining to understand the cutting speed and machining time per at different values of process parameters for better machining	CO 1,CO 3
5	The useful tool life of a HSS tool machining MS at 28 m/min is hours, calculate the tool life when the tool operates at 14 m/min	Apply	The learner to recall the tool life formula and its parameters to understand the tool life of HSS tool materials at given levels parameters	CO 1,CO 3
6	The Taylor's tool life equation for machining C-40 steel with a 18-4-1 HSS cutting tool at a feed of 0.8 m/min and a depth of cut 4mm. The following V and T observation have been noted. Calculate n, C and also recommended the cutting speed for a desire tool life of 60min V (m/min) 35, 25 and T (min) 80,30.	Apply	The learner to recall the tool life formula and its parameters to understand the tool life of HSS tool materials at given levels parameters	CO 1,CO 3
7	Calculate the power required during cutting of a low carbon steel bar 40mm diameter of cutting force is force is 150 kg at 200rpm.	Apply	The learner to find the cutting parameters to know the consumed power at different values of process parameters for better machining	CO1,CO 2
8	Give your understanding of the basic metal-cutting process, what are the important physical and chemical Properties of a cutting tool.	Understand	The learner to recall the important physical and chemical Properties of a cutting tool to Understand basic metal-cutting process for better machining	CO1,CO 2
9	Calculate the power required during cutting of a low carbon steel bar 80mm diameter of cutting force is force is 250 kg at 1000rpm	Apply	The learner to recall the cutting parameters to know the consumed power at different values of process parameters for better machining	CO1,CO 3
10	Why is it not always advisable to increase cutting speed in order to increase production rate?	Understand	The learner to find the impact of cutting speed on machining to understand the production rate with respect to cutting speed for better machining	CO 1,CO 3

MODULE - II

MACHINE TOOLS -I

PART – A (SHORT ANSWER QUESTIONS)

1	Explain the working principle of engine lathe in metal removing process.	Understand	The learner to desrcibe the basic parts and their functions of engine lathe then explaining the working principle	CO 4
---	--	------------	---	------

			of engine lathe in metal removing process.	
2	Discuss about the head stock of engine lathe used in turning and facing operations.	Understand	The learner to know the basic functions of head stock of engine lathe then explaining the importance of head stock in turning and facing operations.	CO 4
3	Explain about the carriage in a central lathe used in metal removing process.	Understand	The learner to recall the basic parts and their functions of the carriage in a central lathe then explaining the importance of carriage in metal removing process..	CO 4
4	What are the different parts of a central lathe explain about them briefly?	Remember		CO 4
5	Explain the meaning of "swing of the lathe"	Understand	The learner to recall the basic parts and their functions of the swing of the lathe then explaining the importance of swing plate in turning operation.	CO 4
6	What are the different types of operations done on a central lathe?	Remember	---	CO 4
7	Discuss the difference between feed rod and lead screw .	Analyze	The learner to know the functions of feed rod and lead screw to Understand the importance of feed rod and lead screw to perform different operation, mainly in tread cutting operation	CO 4
8	Differentiate between shaping and planning operation in metal cutting process?	Analyze	The learner to know functions of shaping and planning operation then explaining the difference between shaping and planning operation in metal cutting process to choose and perform the different operation as per their requirement	CO 6
9	Explain why the slotting machine is called as vertical shaper.	Understand	The learner to desrribe the functions of slotting machine and vertical shaper machine then explaining the similarity of both machines to produce keys and grooves	CO 5
10	Illustrate the methods of taper turning on lathe.	Apply	The learner to know the concept of taper turning operation then explaining the methods of taper turning on lathe to operate turning operation smoothly as per their requirement	CO 4
11	Calculate the angle at which the compound rest will be swivelled when cutting a taper on a piece of work having the following dimensions. OD = 60 mm; Length of the tapered portion 80 mm and smallest diameter – 20mm	Apply	The learner to recall the turnig operation steps to understand the taper angle to perform taper turning operation on lathe for different sizes of work pieces	CO 4,CO 5
12	What are the specifications of a central lathe.	Remember	---	CO 5

13	Explain the offsetting the tail stock method in taper turning process on a lathe.	Understand	The learner to know the advantages of tail stock then explaining the offsetting process of tail stock to perform turning operation	CO 4
14	Discuss the different taper turning methods used on a central lathe machine.	Analyze	The learner to describe different taper turning methods used on a central lathe machine to perform taper turning operation as per their requirement	CO 4
15	Define cutting speed feed and depth of cut in shaping process.	Remember	---	CO 6
16	Discuss the working principle of a slotting machine used in metal removing process.	Analyze	The learner to know basic working principle of slotting machine in metal removing process and perform the slotting operation to form the desired shape then analyze machining performance	CO 4
17	Briefly explain whitworth quick return mechanism used in a slotting machine.	Understand	The learner to describe the concept of whitworth quick return mechanism then explaining that method to provide forward reciprocating motion is slower rate than the return stroke	CO 4
18	Discuss about the principle parts of a planer machine.	Understand	The learner to know basic working principle and their parts of planer machine in metal removing process to form the desired shape	CO 5
19	Explain the principle of quick return mechanism used in a planning machine.	Understand	The learner to recall the concept of whitworth quick return mechanism then explaining that method to provide forward reciprocating motion is planning machine	CO 4
20	Classify the different types of automatic semi-automatic and non-automatic lathes.	Analyze	The learner to Understand Classification of the different types of automatic semi-automatic and non-automatic lathes to use them as per their requirement then analyze the results	CO 5
PART - B (LONG ANSWER QUESTIONS)				
1	Explain with the help of a diagram the working of a quick return mechanism of a planer table.	Understand	The learner to recall concept of quick return mechanism then explaining the working of a quick return mechanism of a planer table	CO 4
2	List the various work holding devices in planer indicating indicating special features if any?	Analyze	The learner to Understand various work holding devices in planer indicating and apply them to maintain proper rigidity of work piece and tool	CO 5
3	Discuss the in brief the main parts of a planer machine using in metal removing process.	Analyze	The learner to recall the main parts of planer machine then applying them in machining to Analyze their in metal removing process to perform smooth machining	CO 4

4	Explain the different types of operations can be performed efficiently by a planer. List and explain.	understand	The learner to recall the planer operations then explaining various operations to perform efficiently by a planer	CO 5
5	Describe with a diagram of whit worth quick return mechanism used in a slotting machine?	understand	The learner to demonstrate the concept of worth quick return mechanism used in a slotting machine then explaining that mechanism in slotting machine	CO 4
6	Discuss the main parts of a slotting machine and describe them briefly.	understand	The learner to describe the main parts and their functions of a slotting machine to perform machining operation properly	CO 4
7	Explain the various slotting tools used and slotting operations performed in a slotting machine.	Understand	The learner to recall various slotting tools used and slotting operations then explaining the performance in a slotting machine	CO 6
8	Evaluate with the help of a neat sketch the working of the main parts of a shaping machine.	Analyze	The learner to understand functions of main parts of a shaping machine to analyze the proper machining operation	CO 4
9	Sketch and describe the working of automatic table feed mechanism for the shaper.	understand	The learner to describe the concept of working of automatic table feed mechanism for the shaper then explaining the performance of that mechanism in automatic machining	CO 5
10	Differentiate between a hydraulic and mechanical shaping machine.	Analyze	The learner to understand the difference between hydraulic and mechanical shaping machine then apply to perform smooth machining operation based on size of work	CO 5
11	Explain with a neat sketch the quick return mechanism used in a shaping machine.	understand	The learner to recall the concept of quick return mechanism used in a shaping machine then explaining that mechanism to provide reciprocating motion of tool to perform grooving operation	CO 5
12	Explain with a neat sketch the crank and slotted lever mechanism used in a shaping machine.	Understand	The learner to recall the concept of crank and slotted lever mechanism used in a shaping machine then explaining that mechanism to provide reciprocating motion of tool to perform grooving operation	CO 5
13	Classify the different types of shapers according to the cutting stroke, mechanisms etc.	Analyze	The learner to understand Classifications of the different types of shapers according to the cutting stroke, mechanisms then apply them to provide effective machining process	CO 4
14	Describe the working of a copying lathe with a neat sketch.	Analyze	The learner to understand working of a copying lathe then apply to perform specified operations as per their requirement	CO 4

15	Explain the working of a capstan lathe with a neat sketch?	understand	The learner to recall the concept of a capstan lathe then explaining the working of a capstan lathe	CO 4
16	Draw a neat sketch of a turret lathe and label all parts and explain its working.	understand	The learner to recall all parts of turret lathe then explaining the working of a turret lathe	CO 4
17	Define taper. Name the different methods of taper turning done on a center lathe drawing simple sketches.	Remember	---	CO 5
18	List out the major parts of a center lathe and describe them briefly.	Understand	The learner to recall the uses of major parts of a center lathe then explaining their uses to perform smooth machining	CO 4
19	Discuss the function of a tail stock, head stock and tool post with neat sketch.	Analyze	The learner to understand the function of a tail stock, head stock and tool post to perform smooth turning operation to analyze the machining process operation	CO 4
20	What are the different types of lathes? Describe the centre lathe with a neat sketch.	Analyze	The learner to understand the classifications of different lathes to choose the machine tool as per the requirement to analyse the machining process operation of different lathes	CO 4
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	Determine the machining time to turn the dimensions given in figure. The material is brass, the cutting speed with HSS tool being 80 m/min and feed is 0.8 mm rev.	Apply	The learner to recall the significant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4,CO 8
2	Estimate the machine time to turn a MS bar of 30mm diameter down to 25mm for a length of 100mm in a single cut. Assume cutting as 30 m/min and feed as 0.4 mm/rev.	Apply	The learner to find the relevant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4,CO 8
3	Determine the machining time to turn the dimensions. The material is mild steel, the cutting speed with HSS tool being 100 m/min and feed is 0.9 mm rev.	Analyze	The learner find the relevant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4,CO 8
4	Estimate the machine time to turn a MS bar of 40mm diameter down to 35mm for a length of 150mm in a single cut. Assume cutting as 20 m/min and feed as 0.5 mm/rev.	Apply	The learner to find the relevant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4,CO 8

5	A CI flange of 300mm OD has a bore of 100 mm. This is to be faced on a lathe. Calculate the machining time to face the part, given the feed 0.8 mm/rev and cutting speed of 80 m/min	Apply	The learner to recall the significant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4, CO 8
6	Explain the salient features of an automatic lathes.	Understand	The learner to recall the concept of automatic lathe then explaining the salient features of an automatic lathes to perform power machining for complicated shapes	CO 4
7	A CI flange of 200mm OD has a bore of 80 mm. This is to be faced on a lathe. Calculate the machining time to face the part, given the feed 0.9 mm/rev and cutting speed of 70 m/min	Apply	The learner to find the significant then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4, CO 8
8	Estimate the machine time to turn a MS bar of 50mm diameter down to 65mm for a length of 250mm in a single cut. Assume cutting as 20 m/min and feed as 0.3 mm/rev.	Apply	The learner to recall the significant then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO4, CO 8
9	Determine the machining time to turn the dimensions. The material is mild steel, the cutting speed with HSS tool being 200 m/min and feed is 0.7mm rev.	Apply	The learner to find the significant then then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4, CO 8
10	Determine the machining time to turn the dimensions given in figure. The material is brass, the cutting speed with HSS tool being 90 m/min and feed is 0.5 mm rev.	Apply	The learner to find the significant then then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 4, CO 8

MODULE – III

MACHINE TOOLS –II

PART - A (SHORT ANSWER QUESTIONS)

1	What is meant by up milling and down milling?	Remember	---	CO 7
2	What are the different types of milling machines used in metal removing process.	Remember	---	CO 7
3	List out the different operations performed on a milling machine.	Understand	The learner to know the concept of milling machine then explaining the different operations performed on a milling machine	CO 7
4	Explain with a neat sketch the process of up milling.	Understand	The learner to describe the concept of up milling process and explain the up	CO 7

			milling process to perform machining process effectively	
5	Discuss with a neat sketch the process of climb or down milling.	Analyze	The learner to desrcibe the process of climb or down milling to perform machining operation then analyzing the machining process in climb or down milling	CO 7
6	Describe universal milling machine and its advantages.	Analyze	The learner to desrcibe the process of of universal milling to perform machining operation then analyzing the machining process in universal milling machine	CO 7
7	Explain with a neat sketch the process of gang milling.	Understand	The learner to recall concept of gang milling then explain the the process of gang milling to perform machining process effectively	CO 7
8	List out the types of milling cutters used in milling operation.	Remember	---	CO 5
9	List out the different materials used in manufacturing milling cutters.	Remember	---	CO 5
10	Discuss the different cutter angles used in milling operation	Analyze	The learner to demonstrate the different cutter angles used in milling operation then applying the uses of them in machining process	CO 5
CIE – II				
11	what the various methods of indexing in milling operation.	Remember	---	CO 7
12	Differentiate between compound indexing and differential indexing.	Analyse	The learner to Understand Difference between compound indexing and differential indexing then apply for evenly dividing the circumference of a circular work piece into equally spaced divisions	CO 7
13	Explain the peripheral milling with a neat sketch in milling operation.	Understand	The learner to recall the concept of peripheral milling in milling operation then explaing the proper position of the milling cutter at the top of the workpiece	CO 7
14	Describe the face milling operation with a neat sketch	Analyze	The learner to describe the face milling operation then apply the process of cutting a flat surface perpendicular to the axes of the milling cutter	CO 7
15	List out the different drill bit materials. Name the material which is used mostly.	Remember	---	CO 7
16	Classify the drill bits according to their geometry	Understand	The learner to recall the classifications of drill bits then explaining the importance of their geometry	CO 5
17	List out the different drilling operations	Remember	---	CO 7

	performed on a drilling machine.			
18	What is a spade drill? When it is used? Sketch a neat diagram of a spade drill.	Remember	---	CO 7
19	Discuss the difference between boring and drilling operations in making a hole.	Analyze	The learner to Understand difference between boring and drilling operations and explaining their importance to make different sizes of holes	CO 7
20	Classify the types of boring machines used in metal removing process.	Understand	The learner to find the types of boring machines used in metal removing process explaining their importance to make different sizes of holes	CO 6

PART – B (LONG ANSWER QUESTIONS)

1	Describe in brief the various types of operations that can be performed on a horizontal boring machine.	Analyze	The learner to Understand the various of operations of horizontal boring machine and explaining them to enlarge the holes in required size	CO 7
2	Explain with a neat sketch the nomenclature of a milling cutter and label the required units.	Understand	The learner to recall concept of milling cutter then explaining the nomenclature of a milling cutter to use them proper metal cutting process	CO 7
3	What is indexing? Discuss any two types of indexing methods used in milling.	Analyze	The learner to describe the various methods of indexing in milling operation and apply them to know their use in machining process	CO 7
4	Describe the various features of plain milling machine and vertical milling machine.	Analyze	The learner to discuss the features of plain milling machine and vertical milling machine and apply them effectively to set the right orientation of the spindle	CO 7
5	With a neat sketch explain the column and knee type milling.	Understand	The learner to recall the column and knee type milling and explaining the column and knee type milling	CO 7
6	Explain the applications and differences with neat sketches reference to milling operation such as straddle milling and gang milling.	Analyze	The learner to describe the applications and differences of straddle milling and gang milling then analyze the effective machining process in both milling machines	CO 7
7	Draw a neat sketch of a plain milling machine indicating the principal parts and give brief description.	Understand	The learner to know the nomenclature of plain milling machine and describing how the machining process will be performed	CO 7
8	Name the common methods of indexing and explain direct and simple indexing in detail.	Understand	The learner to recall common methods of indexing then explaining direct and simple indexing will be performed	CO 6
9	What is the purpose of differential indexing? Explain with a neat sketch and where it is performed.	Analyze	The learner to understand various purposes of differential indexing and analyze the function of differential indexing in milling	CO 6
10	Sketch and contrast the two milling methods of machining flat surfaces.	Analyze	The learner to recall different methods of flat surface machining and	CO 7

			contrasting the two milling methods of machining flat surfaces and analyse machining of different methods	
CIE - II				
11	Draw a sketch of a simple twist drill with tapered shank and show its various elements.	Understand	The learner to recall various elements of twist drill and illustrate simple twist drill with tapered shank	CO 5
12	Describe with a neat sketch the nomenclature of a twist drill.	Analyze	The learner to find the different parts of twist drill then analyze the effective utilization of twist drill in cutting holes	CO 5
13	Explain counter boring and counter sinking operations with a neat sketch.	Understand	The learner to know boring operations and Explaining counter boring and counter sinking operations	CO 7
14	Name various work holding devices of drilling machine. Describe one with neat sketch.	Understand	The learner to find work holding devices of drilling machine and explaining any one of them	CO 7
15	Sketch and describe in brief of a radial drilling machine.	Analyze	The learner to know the uses of radial drilling machine and describing the process of radial drilling machine	CO 7
16	Give a brief description of portable drilling machine.	Remember	---	CO 7
17	With the help of a neat sketch explain the working principle of a drilling machine.	Understand	The learner to recall the principles of milling machine and explaining the working principle of a drilling machine.	CO 7
18	What are the different horizontal boring machines? List them and describe any one.	Understand	The learner to know the concept of boring machine then explaining the functions of different horizontal boring machines	CO 7
19	With the help of a neat diagram describe a horizontal boring machine.	Analyze	The learner to recall the concept of boring machine then explaining the procedure of horizontal boring machine	CO 7
20	Describe in brief the various types of operations performed on a horizontal and vertical boring machine.	Understand	The learner to know the concept of boring machine then explaining the performance of horizontal and vertical boring machine.	CO 7
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	What do you understand by approach length of a milling cutter for face milling operations? Discuss with neat sketch.	Analyze	The learner to understand the concept of approach length of a milling cutter then explaining their purpose in face milling operations to analyze their results	CO 7
2	What is cam milling? What attachments are specifically required to perform it? Describe the process.	Understand	The learner to know the concept of cam milling then explaining the process	CO 7
3	What are the differences between single angle and double angle milling cutter?	Analyze	The learner to Understand the concept of angle milling cutter then apply the single angle and double	CO 5

			angle milling cutter in milling operation and analyse their results	
4	Could a side milling be used efficiently for cutting on one side only? Give reasons.	Apply	The learner to Understand the concept of side milling cutter then apply the those milling cutter in milling operation and analyse the function of side milling	CO 5
5	Discuss how cutting for changes with variation of speed and rake angle of a milling cutter.	Analyze	The learner to recall the importance of rake angles of milling cutters then explaining their in milling cutting operation then analyse their results	CO 5
CIE - II				
6	Find the time required to drill 4 holes in a CI flange of 20mm depth, if the hole diameter is 20mm. Assume cutting speed as 21.9 m/min and feed as 0.02 cm/rev.	Apply	The learner to identify the significant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 5,CO 8
7	A 9 cm thick laminated plate consists of a 7cm thick brass and a 2cm thick mild steel plate. A 20 mm diameter hole is to be drilled through the plate. Estimate the total time taken for drilling if Cutting speed of brass = 44 m/min Cutting speed for mild steel = 30 m/min Feed of 20mm drill for brass = 0.26 mm/rev	Apply	The learner to find the significant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 5,CO 8
8	Find the time required to drill 5 holes in a CI flange of 40mm depth, if the hole diameter is 30mm. Assume cutting speed as 24.9 m/min and feed as 0.06 cm/rev.	Apply	The learner to identify the significant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 5,CO 8
9	A 9 cm thick laminated plate consists of a 7.5cm thick brass and a 2.5cm thick mild steel plate. A 30 mm diameter hole is to be drilled through the plate. Estimate the total time taken for drilling if Cutting speed of brass = 47 m/min Cutting speed for mild steel = 32 m/min Feed of 20mm drill for brass = 0.36 mm/rev	Apply	The learner to find the significant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 5,CO 8
10	How long will it take a 12.7 mm to drill a hole 50mm deep in brass. Take cutting speed as 75 m/min and feed as 0.175 mm/rev. Take $A=0.8D$ for through hole.	Apply	The learner to identify the significant parameters then assigning given values for those parameters to estimate machining time by turning process at given specifications to know material removal rate in machining	CO 5,CO 8

MODULE – IV

GEOMETRICAL DIMENSIONING AND TOLERANCES

PART – A (SHORT ANSWER QUESTIONS)

1	Define fits. Describe the various types of fits in brief.	Understand	The learner to recall the Definition of fits, Understand various types of fits	CO 9
2	Differentiate between Tolerance and Allowance	Analyze	The learner to recall the Tolerance and Allowances, and Understand difference between them and apply it in checking the dimension	CO 9
3	With the help of the neat sketches state the essential conditions for i) clearance fit ii) interference fit	Understand	The learner to know the Definition of fits, Understand various types of fits and Demonstrate the difference between them	CO 9
4	Define the terms i) Allowance ii) Limits iii) Tolerance iv) Fit	Remember	---	CO 9
5	Explain clearly the following types of fits a) push fit b) wringing fit c) force fit	Understand	The learner to know the Definition of fits, Understand various types of fits and Demonstrate the difference between them	CO 9
6	What is hole basis system?	Remember	---	CO 9
7	Why it is necessary to give tolerance on engineering dimensions?	Apply	The learner to describe tolerance then explaining usefulness in engineering dimensions	CO 9
8	Draw the conventional diagram of limits and fits of basic size and zero line	Understand	The learner to know the Definition of fits, Understand various types of fits and Demonstrate the difference between them with picture	CO 9
9	Define the terms limits and tolerance	Remember	---	CO 9
10	Explain about unilateral system	Understand	The learner to recall unilateral system explaining it	CO 9
11	What is interchangeable assembly?	Remember	---	CO 9
12	Explain about dial indicator	Understand	The learner to recall to dial indicator explaining about it	CO 9
13	Write about limit gauges?	Remember	---	CO 9
14	Draw the conventional diagram of limits and fits of upper deviation and lower deviation	Understand	The learner to recall the Definition of limits, Understand various types of limits and Demonstrate the difference between them with picture	CO 9
15	Define the terms M.M.L and L. M. L.	Remember	---	CO 9
16	What is shaft basis system?	Remember	---	CO 9
17	Explain about bilateral system.	Understand	The learner to recall bilateral system explaining about it	CO 9
18	Draw the conventional diagram of limits and fits of fundamental deviation.	Understand	The learner to know the Definition of limits and fits, Demonstrate difference between them with picture	CO 9

19	What is selective assembly?	Remember	---	CO 10
20	Explain about micrometre.	Understand	The learner to recall micrometre and explaining about it	CO 10
PART – B (LONG ANSWER QUESTIONS)				
1	What is meant by nominal size and tolerance? Explain	Understand	The learner to recall the Tolerance and Allowance, Understand difference between them and apply it in checking the dimension	CO 9
2	Why hole basis system of fit is generally employed? Explain	Understand	The learner to recall the Definition of fits, explaining various types of fits	CO 9
3	What are the essential considerations in selection of materials for gauges.	Remember	---	CO 9
4	Explain briefly the difference between the interchangeable manufacturing and selective assembly.	Analyze	The learner to recall the Definition interchangeable manufacturing and selective assembly., Demonstrate difference between them	CO 10
5	What are the common materials used for gauges. Explain why?	Remember	---	CO 10
6	Sketch and explain the use of limit gauges in mass production.	Understand	The learner to recall the Definition of limit gauge, Apply its use in mass production for measuring applications	CO 10
7	What are the various types of plug gauges? Sketch any four of them and state their specific applications.	Analyze	The learner to find types of plug gauges, Demonstrate difference between them with picture	CO 10
8	Distinguish between measuring instrument and a gauge.	Analyze	The learner to know measuring instruments and gauges , Demonstrate difference between them	CO 10
9	Explain with a neat sketch the working mechanism of a gear and pinion type dial indicator.	Understand	The learner to recall the measuring instruments, Understand the working mechanism of a gear and pinion and apply them on measuring parts	CO 10
10	Explain about simple lever and compound lever in dial indicator mechanism.	Understand	The learner to recall the measuring instruments, explaining about the mechanism of simple and compound dial indicator demonstrating its working principle.	CO 10
11	Explain the term magnification of dial indicator.	Understand	The learner to recall the measuring instruments explaining about the magnification used on measuring parts and analyse their results	CO 10
12	Explain the principal and use of a spirit level.	Understand	The learner to recall the measuring instruments explaining about the working principle of spirit level and its industrial applications	CO 10
13	What are the various instruments used for measuring flatness of a surface plate?	Remember	---	CO 10
14	State and explain the principal and use of a micrometer.	Remember	---	CO 10

15	Describe the procedure for checking a) zero error b) flatness and parallelism of a micrometer	Analyze	The learner to find the error in measuring instruments, Demonstrate difference between errors while measuring	CO 10
16	State the difference between the hole basis systems and shaft basis system	Remember	---	CO 9
17	Explain the gauge design terminology with procedure and neat sketch	Understand	The learner to recall gauge and Demonstrate design terminology with picture	CO 10
18	What is sine bar? How it is used for angle measurements.	Remember	---	CO 10
19	Explain why it is not preferred to use sine bar for measuring angles more than 90°	Understand	The learner to know measuring instruments, explaining about sin bar applications	CO 10
20	Explain the use of sine bar for measuring angle of a taper plug gauges with the help of neat diagrams.	Understand	The learner to recall measuring instruments, explaining about sin bar applications	CO 10
Part – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	A 50mm diameter shaft is made to rotate in the bush. The tolerances for both shaft and bush are 0.0050mm. Determine the dimension of the shaft and the bush to give a maximum clearance of 0.075mm with the hole basis system.	Apply	The learner to recall limits fits and tolerances, Understand what is hole and shaft base systems and their formula	CO 9,CO 10
2	In an assembly of two parts 50mm nominal diameter the lower deviation of the hole is zero and the higher is 4 microns; while that of shaft is -4 and -8 microns respectively. Estimate the allowance and state the type of fit of the assembly	Apply	The learner to recall limits fits and tolerances, Understand what is hole and shaft base systems and their formula	CO 9,CO 10
3	Between mating parts of 100mm basic size, the actual interference fit is to be from 0.05mm to 0.12mm. tolerance for the hole is the same as the tolerance for the shaft. Find the size of both the shaft and the hole on a) hole basis unilateral system and b) shaft basis unilateral system.	Apply	The learner to recall limits fits and tolerances, Understand what is hole and shaft base systems and their formula and Analyse their results	CO 9,CO 10
4	Discuss several types of tolerances. Explain about geometrical tolerance.	Understand	The learner to know tolerances, explaining about geometrical tolerance and analyse their results	CO 9
5	How the following are designated? a) Standard tolerance grade b) Position of tolerance zone c) Upper deviation d) Lower deviation	Understand	The learner to know tolerances, explaining about the deviations	CO 9
6	Calculate the cone angle of the taper plug gauge from the following data: Height of slip	Apply	The learner to recall gauges Understand what is taper plug gauge	CO 9,CO 10

	gauges, $h_1 = 50.667$, $h_2 = 38.667$ Length of sine bar = 125mm.		and their formula	
7	A 200mm sine bar is to be set up to an angle of 25° . Determine the slip gauges needed from 87 pieces set.	Understand	The learner to recall sin bar Understand application of formula for slip gauge needed	CO 9,CO 10
8	Select the size of angle gauges required to build the following angles: i) $10^\circ 20'$ ii) $20^\circ 29' 54''$ iii) $32^\circ 51' 24''$.	Remember	---	CO 10
9	An angle of $102^\circ - 8' - 42''$ is to be measured with the help of standard 13 pieces set of angle gauges and a square block.	Understand	The learner to recall sin bar Understand application of formula for slip gauge needed	CO 9,CO 10
10	A 100mm sine bar is to be set up to an angle of 33° . Determine the slip gauges needed from 87 pieces set.	Apply	The learner to recall sin bar Understand application of formula for slip gauge needed	CO 9,CO 10

UNIT-V

MEASURING INSTRUMENTS

PART – A (SHORT ANSWER QUESTIONS)

1	What is the purpose of tools makers microscope?	Remember	---	CO 11
2	Explain about collimator	Understand	The learner to recall collimator explaining its principle of working	CO 11
3	What is the application of optical projector	Remember	---	CO 11
4	Discuss about interferometer	Understand	The learner to recall interferometer explaining about working principle	CO 11
5	Write about screw threads element of measurement	Remember	---	CO 11
6	What are the errors in screw threads?	Remember	---	CO 11
7	How to measurement of effective diameter in screw threads?	Apply	The learner to recall measuring instruments demonstrate about working principle of screw thread measurement	CO 11
8	Write about angle of thread and thread pitch.	Remember	---	CO 11
9	Discuss about profile thread gauges	Analyze	The learner to recall measuring instruments demonstrate principle of profile thread gauges	CO 11
10	What are the applications of Surface roughness measurement	Understand	The learner to recall measuring instruments explaining different applications of surface roughness measurements	CO 11
11	Write about Numerical assessment of surface finish	Remember	---	CO 11
12	Explain about CLA.	Understand	The learner to recall measuring instruments explaining surface roughness measurements with Average measure	CO 11

13	Write about R.M.S Values.	Remember	---	CO 12
14	Discuss about Rz values.	Analyze	The learner to recall measuring instruments explaining surface roughness measurements with Average measure	CO 12
15	What are the methods of measurement of surface finish	Remember	---	CO 11
16	Write about Profilograph.	Remember	---	CO 12
17	Discuss any two ISI symbols for indication of surface finish	Analyze	The learner to identify measuring instruments explaining surface roughness measurement indications	CO 12
18	What is meant by “Best size wire” in screw thread measurement?	Remember	---	CO 11
19	How to find pitch errors	Remember	---	CO 11
20	Explain about Screw thread terminology	Understand	The learner to know thread terminology explaining about Screw thread	CO 11

Part – B (Long Answer Questions)

1	Describe the working principal and applications of Tool’s makers microscope	Analyze	The learner to identify measuring instruments then demonstrate principle of Tool’s makers microscope and apply in thread measurement	CO 11
2	What do you mean by Ra and Rz values?	Remember	---	CO 12
3	State how surface finish is designated on drawings.	Remember	---	CO 12
4	Define the terms primary texture and secondary texture.	Understand	The learner to identify measuring instruments then explaining surface roughness measurements with Average measure	CO 11
5	Describe the principal and operation of Taylor-Hobson Talysurf surface roughness instrument.	Apply	The learner to find the suitable measuring instruments then explaining principal surface roughness measurements with formula to measure the roughness on surfaces	CO 11
6	Draw and explain the measurement of effective diameter of a screw thread using three wires.	Analyze	The learner to know measuring instruments demonstrate principle of three wires apply in thread measurement	CO 11
7	Describe a method to find out flatness of a surface plate.	Apply	The learner to recall measuring instruments explaining surface roughness measurements with Average measure	CO 11
8	State the reasons for controlling the surface finish.	Apply	The learner to recall measuring instruments explaining surface roughness measurements with Average measure	CO 12

9	Explain about the micro irregularities and macro irregularities	Understand	The learner to know measuring instruments explaining surface roughness measurements with Average measure	CO 11
10	Name the various methods of inspecting the surface finish by comparison. State their advantages and limitations.	Analyze	The learner to identify measuring instruments explaining surface roughness measurements with Average measure and analyse their results	CO 11
11	It is not possible to produce perfectly smooth surface. Justify the statement.	Apply	The learner to recall measuring instruments explaining surface roughness measurements with Average measure	CO 12
12	Name the various types of pitch errors found in screw. State their causes.	Remember	---	CO 12
13	Describe the effects of pitch errors on the effective diameter of a screw thread.	Apply	The learner to know measuring instruments then demonstrate principle of thread terminology	CO 11
14	Enumerate the effect of flank angle error on the effective diameter of a screw thread.	Understand	The learner to recall measuring instruments demonstrate principle of thread terminology	CO 12
15	Name and describe the various methods of measuring the minor diameter of the thread.	Understand	The learner to recall measuring instruments explaining different instruments used to measure thread apply to determine the diameter	CO 11
16	Describe the following pitch errors of thread in brief: i) Periodic error ii) Drunken error	Analyze	The learner to find measuring instruments explaining different instruments used to measure thread apply to determine pitch errors	CO 11
17	Describe any one method of measuring effective diameter of internal threads.	Analyze	The learner to recall measuring instruments explaining different instruments used to measure thread apply to determine the diameter	CO 11
18	With the help of a neat sketch explain the construction, working and applications of Tool maker's microscope.	Understand	The learner to know measuring instruments demonstrate principle of Tool's makers microscope and apply in thread measurement	CO 11
19	How does the error in flank angles affect the effective diameter of a screw threads?	Apply	The learner to recall measuring instruments explaining different instruments used to measure thread apply to determine the diameter	CO 12
20	What is the best size wire? Derive the expression for the same in terms of the pitch and angle of the thread.	Apply	The learner to know measuring instruments, demonstrate the expression of pitch and angle of thread for apply in selection of best size wire	CO 12
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	In the measurement of surface roughness heights of successive 10 peaks and troughs were measured from a datum and were 33, 25, 30, 19, 22 18, 27, 29 and 20 microns. If these measurements were obtained on 10mm length,	Apply	The learner to find the measuring instruments, Understand what is surface roughness and their formula .	CO 11,CO 12

	determine CLA and RMS values of surface roughness.			
2	Calculate the CLA(Ra) value of a surface for which the sampling length was 0.8mm. The graph was drawn to a vertical magnification of 10,000 and a horizontal magnification of 100, and the areas above and below the datum line were: Above: 150 80 170 40mm ² Below: 80 60 150 120mm ²	Apply	The learner to find the measuring instruments, Understand what is surface roughness and their formula .	CO 11,CO 12
3	How CLA Index number is determined? Explain why CLA Index Number alone is not sufficient to specify the surface texture required and to make the information complete, what else is to be specified?	Apply	The learner to recall the measuring instruments, Understand why is surface roughness texture required for specific information	CO 11,CO 12
4	Describe various methods of measuring surface texture giving their relative advantages.	Analyze	The learner to recall the measuring instruments, explaining different methods for surface roughness measurement and its advantages	CO 11
5	Explain with the help of neat sketches the principal and construction of an auto-collimator.	Understand	The learner to recall the measuring instruments, explaining principle of collimator with a picture	CO 11
6	In the measurement of surface roughness heights of 20 successive peaks and troughs were measured from a datum and were 35, 25, 40, 22, 35, 18, 42, 25, 35, 22, 36, 18, 42, 22, 32, 21, 37, 18, 35, 20 microns. If these measurements were obtained on 20mm length, determine CLA and RMS values of rough surface.	Apply	The learner to find the measuring instruments, Understand what is surface roughness and their formula .	CO 11,CO 12
7	Calculate the Ra value of a surface for which the sampling length was 8mm, the graph was drawn to a vertical magnification of 1000 and areas above and below the datum line were: Above: 180 90 155 55mm ² Below: 70 90 170 150mm ²	Apply	The learner to find the measuring instruments, Understand what is surface roughness and their formula .	CO 11,CO 12
8	How Tomlinson surface recorded and Talysurf machine work? What are their relative merits?	Apply	The learner to find the measuring instruments, Understand how is surface roughness measured using Tomlinson surface recorded and Talysurf	CO 11
9	State the possible causes of each of the various types of irregularities found in surface texture.	Remember	---	CO 11
10	Which of the methods is recommended by IS: 3073-1967 for specifying the surface texture on machined parts? Explain	Apply	The learner to find the measuring instruments, Understand how is surface roughness measured Apply IS standards on machined parts	CO 11,CO 12

Prepared By:

Dr. K. China Apparao, Associate Professor

HOD, ME