INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**MACHINE TOOLS AND METROLOGY**				
Course Code	**AME010**				
Programme	**B.Tech**				
Semester	V	ME			
Course Type	Foundation				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Dr. K. China Apparao, Associate Professor				
Course Faculty	Dr. K. China Apparao, Associate Professor Mr. C. Labesh Kumar, Assistant Professor				

COURSE OBJECTIVES:

The course should enable the students:

I	Visualize the generation of surface profiles using the relative motion between directrix and generatrix.
II	Understand the basic mechanism involved in metal cutting processes using different cutting tools.
III	Understand the measurement of different attributes of metal cutting using various measuring instruments.
IV	Analyze surface topography, establish geometrical dimensioning and tolerancing.

COURSE OUTCOMES (COs):

CO 1	Explain metal cutting principles, various materials used for metal cutting and types of lathes and operations performed on lathe.
CO 2	Acquire the basic structure of various machine tool equipment commonly found in industry such as drilling machines, shaping machines, planning machines, etc.
CO 3	Identify the fine finishing operations to obtain dimensional accuracy and surface finish
CO 4	Apply the concept of system of limits and fits and design limit gauges.
CO 5	Measure surface finish, perform alignment test of machine tools and write applications of coordinate measuring machines.

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

AME010.01	Understand the concepts various metals cutting machines like lathe describe various driving mechanisms of lathe.
AME010.02	Demonstrate knowledge with sketches the constructional features and Describe the various operations related to the shaper and
AME010.03	Explore knowledge & ability to describe the indexing mechanism for a milling machine and also calculate simple indexing values
AME010.04	Derive the constructional features and the terminologies related to grinding, broaching and honing machines
AME010.05	Discuss the nature of steady and unsteady processes under the influence of time
AME010.06	Develop the fundamentals of casting and foundry and discuss metal cutting tool theory.
AME010.07	Determine simple numerical on related concepts discuss in detail various materials used for cutting tools
AME010.08	Understand the various principles and applications of Non-traditional machining (NTM) processes. Look into the concepts related to NTM processes.
AME010.09	Knowledge to operate different machine tools with understanding of work holders and operating principles to produce different part features to the desired quality
AME010.10	Knowledge to identify the uncertainties in dimensional metrology and the define the measurement standards.
AME010.11	Discuss the measure length and angles using line graduated instruments, i.e. Vernier calipers, micrometers, bevel protractor, sine bar and surface plates
AME010.12	Develop measure dimensions of shafts, bearings and linear surfaces in metric and imperial units using calibers, micrometers, and scales.
AME010.13	Understand Principles of measuring instruments and gauges and their uses.
AME010.14	Introduction to Inspection of engineering parts with various precision instruments.
AME010.15	Ability to use comparative length measuring instruments, i.e. dial indicator, to measure variations in the distance between two or more surfaces.
AME010.16	Explore the use of appropriate method for determination of accuracy based on product function and manufacturing capability.

TUTORIAL QUESTION BANK

UNIT – I				
BASIC MECHANISM OF METAL CUTTING				
Part - A (Short Answer Questions)				
S No	**QUESTION**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes**
1	Explain turning process and its process parameters.	Understand	CO 1	CAME010.01
2	Discuss tool life and its effects on machinability.	Remember	CO 1	CAME010.01
3	Explain different types of tool failures and the reasons behind the failure.	Remember	CO 1	CAME010.01
4	What are the different types of cutting fluids in material removing process?	Understand	CO 1	CAME010.01
5	What is the difference between straight oils and synthetic fluids?	Remember	CO 1	CAME010.01
6	Explain different types of application modes of cutting fluids in machining.	Understand	CO 1	CAME010.01
7	Discuss about orthogonal cutting and its advantages and limitations.	Understand	CO 1	CAME010.02
8	Explain about Oblique cutting and its use in metal cutting process.	Remember	CO 1	CAME010.02
9	Classify the cutting tools with respect to different material removal process and machining conditions.	Understand	CO 1	CAME010.04
10	Discuss about Single point cutting tool and its related different angles.	Remember	CO 1	CAME010.05
11	Explain about Multi point cutting tool and its tool geometry in any of the machining operation.	Remember	CO 1	CAME010.01
12	Differentiate single point cutting tools and their uses in different types of material removal process.	Understand	CO 1	CAME010.01
13	Classify Multi point cutting tools and their applications in various machining operations.	Remember	CO 1	CAME010.01
14	Explain about chip formation mechanism and effect of material properties on its formation.	Understand	CO 1	CAME010.01
15	What is rake angle and types of rake angles and their uses?	Remember	CO 1	CAME010.01
16	Define Relief angle and its use and its effect on machined surface.	Understand	CO 1	CAME010.01
17	Discuss about chip breakers and their advantages in improving tool life.	Remember	CO 1	CAME010.01
18	Write about cutting speed, discuss its units and its effects on tool life.	Remember	CO 1	CAME010.01
19	What is feed and give its units and how it varies in different cutting operations.	Understand	CO 1	CAME010.01
20	Define Machinability and the parameters which effects Machinability.	Understand	CO 1	CAME010.01
Part - B (Long Answer Questions)				
1	Explain cutting speed, feed and depth of cut, mention their units in machining process.	Remember	CO 1	CAME010.01
2	Give formula for cutting power in a metal cutting machine and explain about Material removal rate and Specific energy and its significance.	Understand	CO 1	CAME010.01
3	Discuss about tool life and the mechanisms of tool failure.	Understand	CO 1	CAME010.01

4	Discuss about zero rake angle positive rake angle and negative rake angle with a neat sketch showing different types of rake angles.	Remember	CO 1	CAME010.02
5	Explain different zones of heat generation with a neat sketch and share of heat among the different zones.	Understand	CO 1	CAME010.03
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?	Understand	CO 1	CAME010.03
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.	Understand	CO 1	CAME010.03
8	(a) Describe basic requirements of machining. (b) Explain briefly mechanics of chip formation for different properties of materials.	Remember	CO 1	CAME010.02
9	Explain briefly about formation of chip with built up edge and its disadvantages.	Remember	CO 1	CAME010.02
10	Explain different types of chips formed while machining and how they get effected in varying the machining conditions.	Remember	CO 1	CAME010.02
11	Write about built up edge is formed and its effect and the cause for its formation?	Remember	CO 1	CAME010.01
12	Explain the role of work piece material in machinability in material removing process.	Understand	CO 1	CAME010.01
13	Draw merchant force diagram and also resolve the forces related to it, derive the different forces in machining.	Understand	CO 1	CAME010.01
14	What are the angles related to single point cutting tool? Explain the significance of each angle?	Understand	CO 1	CAME010.01
15	State the advantages and limitations of ceramics as tool materials.	Understand	CO 1	CAME010.01
16	What are the different types of cemented carbide tools available and explain their composition and properties?	Remember	CO 1	CAME010.02
17	Derive the equation for finding shear force and normal to shear force using merchants circle diagram.	Remember	CO 1	CAME010.02
18	Explain the role of work piece material and tool material on machinability in a metal removing process.	Remember	CO 1	CAME010.02
19	Derive the equation for finding friction force and normal to friction force in a metal cutting process using merchants circle diagram.	Remember	CO 1	CAME010.02
20	Explain the different tool materials with their compositions and related properties and limitations of the materials.	Understand	CO 1	CAME010.01
Part - C (Problem Solving and Critical Thinking Questions)				
1	The useful tool life of a HSS tool machinery mild steel at 18m/min is 3 hrs. calculate the tool life when the tool operates at 24m/min.	Understand	CO 1	CAME010.01
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?	Understand	CO 1	CAME010.01
3	An orthogonal cut 2.5mm wide is made a a speed of 0.5m/s and feed of 0.26mm with a HSS tool having a 20 degree rake angle. The chip thickness ratio is	Understand	CO 1	CAME010.01

	found to be 0.58, the cutting force is 1400N and the feed thrust force is 360N.			
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.	Remember	CO 1	CAME010.01
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	Remember	CO 1	CAME010.01
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.	Remember	CO 1	CAME010.01
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.	Understand	CO 1	CAME010.01
8	In orthogonal cutting of a mild steel component if the rake angle of tool is 60^{o} and shear angle is 50^{o}, find the chip thickness ratio.	Understand	CO 1	CAME010.02
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	Remember	CO 1	CAME010.02
10	In orthogonal cutting of a mild steel component if the rake angle of tool is 90^{o} and shear angle is 40^{o}, find the chip thickness ratio.	Remember	CO 1	CAME010.02
UNIT - II				
MACHINE TOOLS -I				
Part – A (Short Answer Questions)				
S No	**QUESTION**	**Blooms Taxonomy level**	**Course Outcomes**	**Course Learning Outcomes**
1	Explain the working principle of engine lathe in metal removing process.	Understand	CO 2	CAME010.04
2	Discuss about the head stock of engine lathe used in turning and facing operations.	Understand	CO 2	CAME010.04
3	Explain about the carriage in a central lathe used in metal removing process.	Remember	CO 2	CAME010.04
4	What are the different parts of a central lathe explain about them briefly?	Remember	CO 2	CAME010.04
5	Explain about compound rest in an engine lathe.	Understand	CO 2	CAME010.04
6	What are the different types of operations done on a central lathe?	Understand	CO 2	CAME010.04
7	Discuss any one work holding device used in turret lathe.	Understand	CO 2	CAME010.04
8	Differentiate between shaping and planning operation in metal cutting process?	Remember	CO 2	CAME010.04
9	Explain why the slotting machine is called as vertical shaper.	Understand	CO 2	CAME010.04
10	Discuss the tool and work movements in shaping planning with respect to feed and cutting motions.	Understand	CO 2	CAME010.04
11	Differentiate between capstan and turret lathe according to their structure.	Remember	CO 2	CAME010.04
12	Discuss the specifications of a central lathe.	Understand	CO 2	CAME010.04

13	Explain the offsetting the tail stock method in taper turning process on a lathe.	Remember	CO 2	CAME010.04
14	Discuss the different taper turning methods used on a central lathe machine.	Understand	CO 2	CAME010.04
15	Define cutting speed feed and depth of cut in shaping process.	Understand	CO 2	CAME010.04
16	Discuss the working principle of a slotting machine used in metal removing process.	Understand	CO 2	CAME010.04
17	Briefly explain whitworth quick return mechanism used in a slotting machine.	Remember	CO 2	CAME010.04
18	Discuss about the principle parts of a planer machine.	Understand	CO 2	CAME010.04
19	Explain the principle of quick return mechanism used in a planning machine.	Remember	CO 2	CAME010.04
20	Classify the different types of automatic semi-automatic and non-automatic lathes.	Understand	CO 2	CAME010.04
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	CO 2	CAME010.04
2	List the various work holding devices in planer indicating indicating special features if any?	Remember	CO 2	CAME010.04
3	Discuss the in brief the main parts of a planer machine using in metal removing process.	Understand	CO 2	CAME010.04
4	Explain the different types of operations can be performed efficiently by a planer. List and explain.	Understand	CO 2	CAME010.04
5	Describe with a diagram of whit worth quick return mechanism used in a slotting machine?	Remember	CO 2	CAME010.04
6	Discuss the main parts of a slotting machine and describe them briefly.	Understand	CO 2	CAME010.04
7	Discuss the various slotting tools used and slotting operations performed in a slotting machine.	Remember	CO 2	CAME010.04
8	Explain with the help of a neat sketch the working of the main parts of a shaping machine.	Understand	CO 2	CAME010.04
9	Sketch and describe the working of automatic table feed mechanism for the shaper.	Understand	CO 2	CAME010.04
10	Differentiate between a hydraulic and mechanical shaping machine.	Understand	CO 2	CAME010.04
11	Explain with a neat sketch the quick return mechanism used in a shaping machine.	Remember	CO 2	CAME010.04
12	Explain with a neat sketch the crank and slotted lever mechanism used in a shaping machine.	Understand	CO 2	CAME010.04
13	Classify the different types of shapers according to the cutting stroke, mechanisms etc.	Understand	CO 2	CAME010.04
14	Describe the working of a copying lathe with a neat sketch.	Remember	CO 2	CAME010.04
15	Explain the working of a capstan lathe with a neat sketch?	Understand	CO 2	CAME010.04
16	Draw a neat sketch of a turret lathe and label all parts and explain its working.	Understand	CO 2	CAME010.04
17	Define taper. Name the different methods of taper turning done on a center lathe drawing simple sketches.	Remember	CO 2	CAME010.04
18	List out the major parts of a center lathe and describe them briefly.	Understand	CO 2	CAME010.04
19	Discuss the function of a tail stock, head stock and tool post with neat sketch.	Remember	CO 2	CAME010.04

20	What are the different types of lathes? Describe the centre lathe with a neat sketch.	Understand	CO 2	CAME010.04
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.	Understand	CO 2	CAME010.04
2	Estimate the machine time to turn a MS bar of 30mm diameter down to25mm for a length of 100mm in a single cut. Assume cutting as 30 m/min and feed as 0.4 mm/rev.	Remember	CO 2	CAME010.04
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.	Understand	CO 2	CAME010.04
4	Estimate the machine time to turn a MS bar of 40mm diameter down to35mm for a length of 150mm in a single cut. Assume cutting as 20 m/min and feed as 0.5 mm/rev.	Understand	CO 2	CAME010.04
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	Remember	CO 2	CAME010.04
6	Explain the salient features of an automatic lathes.	Understand	CO 2	CAME010.04
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	Remember	CO 2	CAME010.04
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.	Understand	CO 2	CAME010.04
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 07mm rev.	Understand	CO 2	CAME010.04
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.	Understand	CO 2	CAME010.04
UNIT-III				
MACHINE TOOLS -II				
Part - A (Short Answer Questions)				
S No	**QUESTION**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes**
1	Draw a schematic diagram illustrating the milling operation.	Understand	CO 3	CAME010.04
2	Discuss the different types of milling machines used in metal removing process.	Understand	CO 3	CAME010.04
3	List out the different operations performed on a milling machine.	Understand	CO 3	CAME010.04
4	Explain with a neat sketch the process of up milling.	Remember	CO 3	CAME010.04
5	Discuss with a neat sketch the process of climb or down milling.	Understand	CO 3	CAME010.04
6	Describe universal milling machine and its advantages.	Understand	CO 3	CAME010.04
7	Explain with a neat sketch the process of gang milling.	Remember	CO 3	CAME010.04

8	List out the types of milling cutters used in milling operation.	Understand	CO 3	CAME010.04
9	List out the different materials used in manufacturing milling cutters.	Remember	CO 3	CAME010.04
10	Discuss the different cutter angles used in milling operation	Understand	CO 3	CAME010.04
11	Discuss the various methods of indexing in milling operation.	Remember	CO 3	CAME010.04
12	Differentiate between compound indexing and differential indexing.	Understand	CO 3	CAME010.04
13	Explain the peripheral milling with a neat sketch in milling operation.	Understand	CO 3	CAME010.04
14	Describe the face milling operation with a neat sketch	Remember	CO 3	CAME010.04
15	List out the different drill bit materials. Name the material which is used mostly.	Understand	CO 3	CAME010.04
16	Classify the drill bits according to their geometry	Remember	CO 3	CAME010.04
17	List out the different drilling operations performed on a drilling machine.	Remember	CO 3	CAME010.04
18	What is a spade drill? When t is used? Sketch a neat diagram of a spade drill.	Remember	CO 3	CAME010.04
19	Discuss the difference between boring and drilling operations in making a hole.	Remember	CO 3	CAME010.04
20	Classify the types of boring machines used in metal removing process.	Understand	CO 3	CAME010.07
21	What are the various operations performed on boring machines?	Understand	CO 3	CAME010.04
22	Enumerate the various elements of a horizontal boring machine.	Remember	CO 3	CAME010.04
23	What are the vertical boring machines? Where are they preferred and why?	Remember	CO 3	CAME010.04
Part – B (Long Answer Questions)				
1	Describe in brief the various types of operations that can be performed on a horizontal boring machine.	Understand	CO 3	CAME010.04
2	Explain with a neat sketch the nomenclature of a milling cutter and label the required units.	Understand	CO 3	CAME010.04
3	What is indexing? Discuss any two types of indexing methods used in milling.	Understand	CO 3	CAME010.04
4	Describe the various features of plain milling machine and vertical milling machine.	Understand	CO 3	CAME010.04
5	Give a brief classification of various milling machines used giving a brief note on the application	Understand	CO 3	CAME010.04
6	Explain the applications and differences with neat sketches reference to milling operation such as straddle milling and gang milling.	Understand	CO 3	CAME010.04
7	Draw a neat sketch of a plain milling machine indicating the principal parts and give brief description.	Understand	CO 3	CAME010.04
8	Name the common methods of indexing and explain direct and simple indexing in detail.	Understand	CO 3	CAME010.04
9	What is the purpose of differential indexing? Explain with a neat sketch and where it is performed.	Understand	CO 3	CAME010.04
10	Sketch and contrast the two milling methods of machining flat surfaces.	Understand	CO 3	CAME010.04

11	Draw a sketch of a simple twist drill with tapered shank and show its various elements.	Understand	CO 3	CAME010.04
12	Describe with a neat sketch the nomenclature of a twist drill.	Understand	CO 3	CAME010.04
13	Explain counter boring and counter sinking operations with a neat sketch.	Remember	CO 3	CAME010.04
14	Name various work holding devices of drilling machine. Describe one with neat sketch.	Understand	CO 3	CAME010.05
15	Sketch and describe in brief of a radial drilling machine.	Understand	CO 3	CAME010.05
16	Give a brief description of portable drilling machine.	Remember	CO 3	CAME010.05
17	With the help of a neat sketch explain the working principle of a drilling machine.	Remember	CO 3	CAME010.05
18	What are the different horizontal boring machines? List them and describe any one.	Understand	CO 3	CAME010.06
19	With the help of a neat diagram describe a horizontal boring machine.	Understand	CO 3	CAME010.12
20	Describe in brief the various types of operations performed on a horizontal and vertical boring machine.	Understand	CO 3	CAME010.12
21	Explain with a neat sketch and label all the parts of a jig boring machine.	Understand	CO 3	CAME010.13
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.	Remember	CO 3	CAME010.05
2	What is cam milling? What attachments are specifically required to perform it? Describe the process.	Understand	CO 3	CAME010.06
3	What are the differences between single angle and double angle milling cutter?	Remember	CO 3	CAME010.05
4	Could a side milling be used efficiently for cutting on one side only? Give reasons.	Understand	CO 3	CAME010.06
5	Discuss how cutting for changes with variation of speed and rake angle of a milling cutter.	Remember	CO 3	CAME010.05
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.	Understand	CO 3	CAME010.04
7	A 9 cm thick laminated plate consists of a 7cm thick brass and a 2cm thick mild steel plate. A 20 mm diameter hale 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	Understand	CO 3	CAME010.04
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.06 cm/rev.	Understand	CO 3	CAME010.04
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	Understand	CO 3	CAME010.04

10	How long will it take a 12.7 mm to drill a hole 50mm deep is brass. Take cutting speed as 75 m/min and feed as 0.175 mm/rev. Take A=0.8D for through hole.	Understand	CO 3	CAME010.04
11	A 15mm hole is to be drilled in a CI block with a feed of 0.4 mm/rev. The thickness of the block is 70mm and tool, speed is 25m/min. Determine Rpm, Machining time	Understand	CO 3	CAME010.04
12	Find the time required to drill 5 holes in a CI flange of 30mm depth if the hole diameter is 50mm. Assume cutting speed as 25.8 m/min and feed as.05 cm/rev.	Understand	CO 3	CAME010.04
13	A hollow spindle is bored to enlarge its hole diameter from 20 to 25 mm upto 100mm depth is single cut. Estimate the boring time, if cutting speed is 22 m/min and feed is 0.2 mm/rev.	Understand	CO 3	CAME010.07
14	Find the time required to drill 4 holes in a CI flange of 40mm depth, if the hole diameter is 30mm. Assume cutting speed as 41.5 m/min and feed as 0.04 cm/rev.	Remember	CO 3	CAME010.07
15	A 15mm hole is to be drilled in a CI block with a feed of 0.5 mm/rev. The thickness of the block is 80mm and tool, speed is 26m/min. Determine Rpm ,Machining time	Understand	CO 3	CAME010.15
UNIT-IV				
GEOMETRICAL DIMENSIONING AND TOLERANCES				
Part – A (Short Answer Questions)				
S No	**QUESTION**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes**
1	Define fits. Describe the various types of fits in brief.	Understand	CO 4	CAME010.10
2	Differentiate between Tolerance and Allowance	Understand	CO 4	CAME010.12
3	With the help of the neat sketches state the essential conditions for i) clearance fit ii) interference fit	Understand	CO 4	CAME010.11
4	Define the terms i) Allowance ii) Limits iii) Tolerance iv) Fit	Remember	CO 4	CAME010.11
5	Explain clearly the following types of fits a) push fit b) wringing fit c) force fit	Understand	CO 4	CAME010.13
6	What is hole basis system?	Remember	CO 4	CAME010.10
7	Why it is necessary to give tolerance on engineering dimensions?	Understand	CO 4	CAME010.10
8	Draw the conventional diagram of limits and fits of basic size and zero line	Understand	CO 4	CAME010.11
9	Define the terms limits and tolerance	Understand	CO 4	CAME010.15
10	Explain about unilateral system	Understand	CO 4	CAME010.15
11	What is interchangeable assembly?	Remember	CO 4	CAME010.16
12	Explain about dial indicator	Remember	CO 4	CAME010.14
13	Write about limit gauges?	Understand	CO 4	CAME010.12
14	Draw the conventional diagram of limits and fits of upper deviation and lower deviation	Understand	CO 4	CAME010.13
15	Define the terms M.M.L and L. M. L.	Remember	CO 4	CAME010.15
16	What is shaft basis system?	Understand	CO 4	CAME010.14
17	Explain about bilateral system.	Understand	CO 4	CAME010.11
18	Draw the conventional diagram of limits and fits of fundamental deviation.	Understand	CO 4	CAME010.16
19	What is selective assembly?	Understand	CO 4	CAME010.12
20	Explain about micrometre.	Remember	CO 4	CAME010.15

Part – B (Long Answer Questions)				
1	What is meant by nominal size and tolerance?	Understand	CO 4	CAME010.10
2	Why hole basis system of fit is generally employed?	Remember	CO 4	CAME010.11
3	What are the essential considerations in selection of materials for gauges.	Understand	CO 4	CAME010.15
4	Explain briefly the difference between the interchangeable manufacturing and selective assembly.	Remember	CO 4	CAME010.15
5	What are the common materials used for gauges. Explain why?	Understand	CO 4	CAME010.16
6	Sketch and explain the use of limit gauges in mass production.	Understand	CO 4	CAME010.14
7	What are the various types of plug gauges? Sketch any four of them and state their specific applications.	Understand	CO 4	CAME010.12
8	Distinguish between measuring instrument and a gauge.	Remember	CO 4	CAME010.13
9	Explain with a neat sketch the working mechanism of a gear and pinion type dial indicator.	Understand	CO 4	CAME010.15
10	Explain about simple lever and compound lever in dial indicator mechanism.	Remember	CO 4	CAME010.14
11	Explain the term magnification of dial indicator.	Understand	CO 4	CAME010.10
12	Explain the principal and use of a sprit level.	Understand	CO 4	CAME010.11
13	What are the various instruments used for measuring flatness of a surface plate?	Understand	CO 4	CAME010.15
14	State and explain the principal and use of a micrometer.	Remember	CO 4	CAME010.15
15	Describe the procedure for checking a) zero error b) flatness and parallelism of a micrometer	Understand	CO 4	CAME010.16
16	State the difference between the hole basis systems and shaft basis system	Remember	CO 4	CAME010.14
17	Differentiate between Interchangeability and selective assembly	Understand	CO 4	CAME010.12
18	What is sine bar? How it is used for angle measurements.	Understand	CO 4	CAME010.13
19	Explain why it is not preferred to use sine bar for measuring angles more than 90^0	Understand	CO 4	CAME010.15
20	Explain the use of sine bar for measuring angle of a taper plug gauges with the help of neat diagrams.	Remember	CO 4	CAME010.14
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.	Understand	CO 4	CAME010.10
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	Remember	CO 4	CAME010.11
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.	Understand	CO 4	CAME010.15
4	Discuss several types of tolerances. Explain about geometrical tolerance.	Remember	CO 4	CAME010.15

5	How the following are designated? a) Standard tolerance grade b) Position of tolerance zone c) Upper deviation d) Lower deviation	Understand	CO 4	CAME010.16
6	Calculate the cone angle of the taper plug gauge from the following data: Height of slip gauges, h1=50.667, h2=38.667 Length of sine bar=125mm.	Understand	CO 4	CAME010.14
7	A 200mm sine bar is to be set up to an angle of 25^0 . Determine the slip gauges needed from 87 pieces set.	Understand	CO 4	CAME010.12
8	Select the size of angle gauges required to build the following angles: i) 10^0 20′ ii) 20^0 29′54″ iii) 32^0 51′24″.	Remember	CO 4	CAME010.13
9	An angle of 102^0 -8′-42″ is to be measured with the help of standard 13 pieces set of angle gauges and a square block.	Understand	CO 4	CAME010.15
10	A 100mm sine bar is to be set up to an angle of 33^0 . Determine the slip gauges needed from 87 pieces set.	Remember	CO 4	CAME010.14
UNIT-V				
MEASURING INSTRUMENTS				
Part – A (Short Answer Questions)				
S No	**QUESTION**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes**
1	What is the purpose of tools makers microscope?	Remember	CO 5	CAME010.10
2	Explain about collimator	Understand	CO 5	CAME010.11
3	What is the application of optical projector	Remember	CO 5	CAME010.15
4	Discuss about interferometer	Understand	CO 5	CAME010.15
5	Write about screw threads element of measurement	Understand	CO 5	CAME010.16
6	What are the errors in screw threads?	Understand	CO 5	CAME010.14
7	How to measurement of effective diameter in screw threads?	Remember	CO 5	CAME010.12
8	Write about angle of thread and thread pitch.	Understand	CO 5	CAME010.13
9	Discuss about profile thread gauges	Remember	CO 5	CAME010.15
10	What are the applications of Surface roughness measurement	Understand	CO 5	CAME010.10
11	Write about Numerical assessment of surface finish	Remember	CO 5	CAME010.11
12	Explain about CLA.	Understand	CO 5	CAME010.15
13	Write about R.M.S Values.	Understand	CO 5	CAME010.15
14	Discuss about Rz values.	Understand	CO 5	CAME010.16
15	What are the methods of measurement of surface finish	Remember	CO 5	CAME010.14
16	Write about Profilograph.	Understand	CO 5	CAME010.12
17	Discuss any two ISI symbols for indication of surface finish	Remember	CO 5	CAME010.13
18	What are convention methods	Understand	CO 5	CAME010.10
19	How to find pitch errors	Remember	CO 5	CAME010.11
20	Explain about Screw thread terminology	Understand	CO 5	CAME010.15
Part – B (Long Answer Questions)				
1	Describe the working principal and applications of Tool's makers microscope	Remember	CO 5	CAME010.10
2	What do you mean by Ra and Rz values?	Understand	CO 5	CAME010.11
3	State how surface finish is designated on drawings.	Remember	CO 5	CAME010.15
4	Define the terms primary texture and secondary texture.	Understand	CO 5	CAME010.15

5	Describe the principal and operation of Taylor-Hobson Talysurf surface roughness instrument.	Remember	CO 5	CAME010.16
6	Describe the following surface finish measuring instrument of profilograph.	Understand	CO 5	CAME010.14
7	Different applications demand different surface texture.	Understand	CO 5	CAME010.12
8	State the reasons for controlling the surface finish.	Understand	CO 5	CAME010.13
9	Explain about the micro irregularities and macro irregularities	Remember	CO 5	CAME010.15
10	Name the various methods of inspecting the surface finish by comparison. State their advantages and limitations.	Understand	CO 5	CAME010.10
11	It is not possible to produce perfectly smooth surface. Justify the statement.	Remember	CO 5	CAME010.11
12	Name the various types of pitch errors found in screw. State their causes.	Remember	CO 5	CAME010.15
13	Describe the effects of pitch errors on the effective diameter of a screw thread.	Understand	CO 5	CAME010.10
14	Enumerate the effect of flank angle error on the effective diameter of a screw thread.	Remember	CO 5	CAME010.11
15	Name and describe the various methods of measuring the minor diameter of the thread.	Understand	CO 5	CAME010.15
16	Describe the following pitch errors of thread in brief: i) Periodic error ii) Drunken error	Remember	CO 5	CAME010.15
17	Describe any one method of measuring effective diameter of internal threads.	Understand	CO 5	CAME010.16
18	With the help of a neat sketch explain the construction, working and applications of Tool maker's microscope.	Understand	CO 5	CAME010.14
19	How does the error in flank angles affect the effective diameter of a screw threads?	Understand	CO 5	CAME010.12
20	What is the best size wire? Derive the expression for the same in terms of the pitch and angle of the thread.	Remember	CO 5	CAME010.13
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, determine CLA and RMS values of surface roughness.	Understand	CO 5	CAME010.10
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 40mm2 Below: 80 60 150 120mm2	Remember	CO 5	CAME010.11
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?	Understand	CO 5	CAME010.15
4	Describe various methods of measuring surface texture giving their relative advantages.	Understand	CO 5	CAME010.15
5	Explain with the help of neat sketches the principal and construction of an auto-collimator.	Understand	CO 5	CAME010.16
6	In the measurement of surface roughness heights of	Remember	CO 5	CAME010.14

	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.			
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 55mm2 Below: 70 90 170 150mm2	Understand	CO 5	CAME010.12
8	How Tomlinson surface recorded and Talysurf machine work? What are their relative merits?	Remember	CO 5	CAME010.13
9	State the possible causes of each of the various types of irregularities found in surface texture.	Understand	CO 5	CAME010.15
10	Which of the methods is recommended by IS: 3073-1967 for specifying the surface texture on machined parts?	Understand	CO 5	CAME010.10

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