ME2252 - MANUFACTURING TECHNOLOGY-II

UNIT I - THEORY OF METAL CUTTING

1. Define Metal Cutting.

Metal cutting or machining is the process of by removing unwanted material from a block of metal in the form of chips.

2. What are the important characteristics of materials used for cutting tools?

High red hardness	High wear resistance
High toughness	Low frictional co-efficient
High thermal conductivity.	

3. How do you define tool life?

The time period between two consecutive resharpening, with which the cuts the material effectively is called as tool life.

4. What is tool signature?

The various angles of tools are mentioned in a numerical number in particular order. That is known as tool signature.

5. What is the effect of back rack angle and mention the types?

Back rake angle of tool is increases the strength of cutting tool and cutting action. It can be classified in to two types.

1. Positive rake angle.

2. Negative Rake angle.

6. Explain the nose radius?

Joining of side and end cutting edges by means of small radius in order to increase the tool life and better surface finish on the work piece.

7. What are all conditions for using positive rake angle?

- 1. To machine the work hardened materials.
- 2. to machine low strength ferrous and non-ferrous metals.
- 3. to machine long shaft of small diameters.
- 4. To machine the metal blow recommended cutting speeds.
- 5. Using small machine tools with low horsepower.

8. Define the orthogonal and oblique cutting.

Orthogonal cutting: The cutting edge of tool is perpendicular to the work piece axis. *Oblique cutting:* The cutting edge is inclined at an acute angle with normal to the cutting

velocity vector is called oblique cutting process.

9. What are the favorable factors for discontinuous chip formation?

Maching of brittle materials.	Small rake angle
Higher depth of cut	Low cutting speeds
Excess cutting fluid.	
Cutting ductile materials with low sp	eed and small rake angle of the tool.

10. What are the favorable factors for continuous chip formation?

Small rake angle	Low cutting speed
Strong adhesion between chip and tool face.	Coarse feed
Insufficient cutting fluid.	Large uncut thickness.

11. Define machineability of metal.

Machine ability is defined as the ease with which a material can be satisfactorily machined.

Life of the tool before tool failure or resharpening.

12. What is shear plane?

The material of work piece is stressed beyond its yield point under the compressive force. This causes the material to deform plastically and shear off. The plastic floe takes place in a localized region is called shear plane.

13. What is chip and mention its different types?

The sheared material begins to along the cutting tool face in the form of small pieces is called chip.

The chips are mainly classified into three types.

- a. Continuous chip.
- b. Discontinuous chip.
- c. Continuous chip with built up edge.

14. Write the factors affecting the tool life or Write the Taylor's tool life equation.

Taylor's equation $VT^{n} = C$

- i. Cutting speed
- ii. Feed and Depth of cut.
- iii. Tool Geometry
- iv. Tool material
- v. Type of Cutting Fluid
- vi. Work material
- vii. Rigidity of the Machine tool.

15. Define "Side relief" and "End relief" angle.

Side relief angle: It is the angle between the portion of the side flank immediately below the side cutting edge and a line perpendicular to the base of the tool, and measured at right angle to the side flank.

End relief angle: It is the angle between the portion of the end flank immediately below the end cutting edge and a line perpendicular to the base of the tool, and measured at right angle to the angle.

16. What are the importances of Nose Radius?

Nose radius is favorable to long tool life and good surface finish. A sharp point on the end of a tool is highly stressed, Short lived and leaves a groove in the path of cut. There is an improvement in surface finish and permissible cutting speed as nose radius is increased from zero value.

17. What are the differences between orthogonal cutting and oblique cutting?

orthogonal cutting	oblique cutting
Cutting edge of the tool is perpendicular to	Cutting edge of the tool is inclined to
the direction of tool travel	the direction of tool travel
The direction of chip flow is perpendicular to	The direction of chip flow is angled to
the cutting edge	the cutting edge
The chip coils in a tight flat spiral	The chip flows sideways in a long.
Produces sharp corners.	Produces chamfer at the end of cut.

18. Name the types of chip formed during machining.

Continuous chip Discontinuous chip Continuous chip with built-up edge.

19. What is chip breaker?

The chip coils in a helix and curl around the work and the tool and may injure the operator in case of continuous chip. A chip breaker is a metal piece attached to the tool, breaks the chip and reduces the difficulties.

20. Define "cutting power" and "specific metal removal rate"

Cutting power: The cutting power or the specific energy consumption, is the product of the cutting speed and the cutting force.

Specific metal removal rate : The amount of metal removal per unit power consumption is called "specific metal removal rate".

21. What are the major t	ypes of tool wear?		
Crater wear,	Flank wea	r (Chip breakage.
22. What are the variabl	es that affect the too	l life?	
Tool Geometry,	, Tool material	Work material	Cutting fluid.

23. What are the functions of cutting fluid?

- 1. Cool the tool and the work piece
- 2. Reduce the friction
- 3. Protect the work against rusting
- 4. Improves the surface finish
- 5. Prevent the formation of built up edge.

24. What are the required properties for a tool material?

- 1. High hot hardness
- 2. High Temperature strength
- 3. Low co-efficient of friction
- 4. High thermal conductivity
- 5. Low ductility.

25. What is meant by Shear plane in metal cutting?

A wedge shaped tool is made to move relative to the workpiece. As the tool makes contact with the metal, it exerts a pressure on it resulting in the compression of the metal near the tool tip. This induces shear type deformation within the metal and it starts moving upwards along the top face of the tool. As the tool advances, the material ahead of it is sheared continuously along plane called the shear plane.

26. Define – Rake surface and Flenk surface.

The surface along which the chip moves upwards is called Rake angle and the other surface which is relieved to avoid rubbing with the machined surface is called Flank surface.

27. Define - Rack angle and clearance angle.

The angle between the rake surface and the normal is known as Rake angle, and the angle between the flank and the horizontal machined surface is known as the relief or clearance angle.

28. Name the two systems used in metal cutting to designate the tool shape:

American standards Assosiation. Orthoganal rake system.

29. Define ASA system:

In the ASA system, the angles of tool face, that is, its slope, are defined in two orthogonal planes, one parallel to and the other perpendicular to, the axis of the cutting tool, both planes being perpendicular to the base of the tool.

30. What is the importance of Nose Radius?

Nose radius is favourable to long tool life and good surface finish. Asharp point on the end of a tool is highly stressed, short lived and leaves a groove in the path of cut. There is an improvement in surfacefinish and permissible cutting speed as nose radius is increased from zero value. Too large nose radius will induce chatter.

31. Name the types of chip formed during machining.

1.Discontinuous chips

2.Continuous chips

3.Continuous chips with built up edge.

32. Define tool life.

The total cutting time accumulated before tool failure occurs is termed as tool life.

33. Write the criteria commonly used for measuring tool life.

The two most commonly used criteria for measuring the tool life are

1. Total destruction of the tool when it ceases to cut.

2. A fixed size of wear land on tool flank.

34. What are the variables that affects the tool life?

The process variables that play role in tool life are: Process variables Tool material Work piece material, its hardness and micro structure. Surface condition of the work piece. Cutting.

UNIT II – CENTRE LATHE AND SPECIAL PURPOSE LATHES

1. What is a Lathe?

Lathe is a machine tool which removes the metal from a piece of work to the required shape and size.

2. What are the uses of headstock?

Headstock carries a hollow spindle with nose to hold the work piece. To Mount the driving and speed changing mechanisms.

3. What is an apron?

The integral part of several gears, levers and clutches mounted with the saddle for moving the carriage along with lead screw while thread cutting.

4. What are the advantages semi-automatic lathes?

Production time is minimized Accuracy will be high. Production rate is increased.

1 Chueles	Olding devices.	2 Eacoplatas	1 Angle Diste
T. CHUCKS.	2. Centres.	5. Paceplates.	4. Aligie I late.
. How can the number	of teeth on various o	change gears be cal	culated?
Driver teeth	Teeth on the s	pindle gear	Pitch to be cut on the work.
Driven teeth	teeth on head	lscrew gear	Pith of lead screw.
. Compare the advanta	ges of turret lathe o	ver capstan lathe	
Heavier and Large	it withstands beauty	g can be done.	
whole fight, hence	it withstands neavy c	Juis.	
. Name any four tool he	olding devices used i	in capstan and turr	et lathe.
Multiple cutter ho	lders.	Offset cutter h	older.
Sliding cutter hold	ding cutter holder. Knee tool holder.		ler.
. What are the four typ	es of tool post?		
1. Single screw		2. Open side	
3. Four bolt		4. Four way	
0. List any four types o	f lathe?		
1. Engine lathe		2. Bench lathe	
3. Tool room lathe	;	4. Semi autom	atic lathe
5. Automatic lathe	;		
1. What is a semi-autor	natic lathe?		
The lathe in whi	ch all the machining	g operations are per	rformed automatically and
loading and unloading	, of work piece, coola	ant on or off is perfor	rmed manually
2. State the various fee	d mechanisms used	for obtaining auton	natic feed?
1. Tumbler gear	mechanism	0	
2. Quick change	gearbox		
3. Tumbler gear-	Quick change gearbo	ЭX	
4. Apron mechan	ism		
3. What are the differe	nt operations perfor	med on the lathe?	
Centering, straigh chamfering knurling	t turning, rough tur	ning, finish turning	, shoulder turning, facing,

14. Define the term 'Conicity'?

The ratio of the difference in diameters of tapers its length $k=\underline{D-d}$ d-smaller dia D-larger dia l-length of the work piece

15. State the purpose of providing lead cam in single spindle automatic screw cutting machine?

The turret slide travel is controlled by a lead cam. The lead cam gives a slow forward and fast return movement to the turret slide.

16. What are the advantages of sliding head automatic lathes?

The advantages of a sliding head automatic lathe is that long slender work pieces can be machined with very good surface finish, accuracy and concentricity in sliding head automatic lathes.

17. State the advantages of swiss type screw cutting machine.

- 1. It has five tool Slides
- 2. Wide range of speeds
- 3. Rigid construction.
- 4. Micrometer tool setting
- 5. Inter Changeability of cams.
- 6. Simple design of cams.
- 7. Tolerance of 0.005 to 0.0125 mm are obtained.
- 8. Numerous working stations.

18. Mention any four types of components manufactured in automatic lathes.

It is used for producing small jobs, screws, stepped pins, pins, bolts etc.

19. Define automatic lathes.

Automatic lathes or simply automats are machines tools in which all the operations required to finish off the work piece are done automatically without the attention of an operator.

20. State any four advantages of automatic lathes.

- 1. Mass production of identical parts.
- 2. High accuracy is maintained.
- 3. Time of production is minimized.
- 4. The bar stock is fed automatically

21. What are the types single spindle automatic lathe?

- 1. Automatic cutting off machine.
- 2. Automatic screw cutting machine.
- 3. Swiss type automatic screw machine.

22. State the purpose of providing lead cam in single automatic screw cuffing machine?

The turret slide travel is controlled by a lead cam. Cam gives a slow forward and fast return movement to slide.

23. Mention the applications of single spindle automatic screw cutting machine.

It is used for producing small jobs, screws, stepped pins, pins, bolts etc.

24. What are the advantages of sliding head automatic lathes?

The advantage of a sliding head automatic lathe *is* that *long*, slender work pieces can be machined with very good surface finish, accuracy and concentricity in sliding head autornatic lathes.

25. What are the four major parts of swiss type automatic lathes?

- 1. Sliding headstock 2. Cam shaft 4. Auxiliary attachments 3 Tool bracket

26. State the advantages of Swiss type screw cutting machine

1. Wide range *of speed*

- 2. Rigid construction 4. Simple design of cams
- 3. Micrometer tool setting

27. State the principle of multi spindle automats.

The principle of the multi spindle automate is that it has a tool slide working on the *jobs* on all spindles simultaneously.

28. Define cam controlled automats.

The operating mechanism for sliding, feeding are actuated by cams through levers and gears.

29. How the centre lathe is specified?

Length of the bed Maximum swing Diameter over bed Diameter of the Spindle. Length between the centers. Maximum swing diameter over carriage.

30. How to specify turret and capstan lathe?

Maximum size of the work diameter swing over cross slide and over bed. Number of feeds for the carriage Number of spindle speeds Number of feed s for turret.

31. How automats are classified?

Classification According to the type of work used a) Bar stock machine. b)Chucking machine. Classification According to the number of spindles a) Single spindle machine. b)Multi spindle machine. Classification According to the position of the spindle a) Horizontal Spindle machine. b) Vertical Spindle machine. Classification According to the use. a) General Purpose machine. b) Single purpose machine.

32. How multi spindle automats are classified?

According to the type of work used

a) Bar stock machine. b)Chucking machine.

According to the Arrangement of spindle

a) Horizontal Spindle machine. b) Vertical Spindle machine.

According to the principle of operation

a) Parallel Action type, b)progressive action type.

33. What is Swiss type Automates.

These are designed for machining long accurate parts of small diameter, such as 4 to 25 mm. An exclusive feature of these machines is the longitudinal travel of the headstock, or of a quill carrying the rotating work spindle.

34. Mention the typical operations carried on automatic lathes.

Centering, Boring, Knurling, Cutting off, Reaming, Thread cutting, Drilling and spot facing.

UNIT III – OTHER MACHINE TOOLS

1. Define cutting ratio of the shaper.

The ratio between the cutting stroke time and the return stroke time is called as cutting ratio.

Cutting stroke time

Cutting ratio m=

Return stroke time

2. Mention any four shaper specifications.

- 1. Maximum stroke length.
- 2. Type of driving mechanism.

3. Power of the motor.

4. Speed and feed available.

3. How the planer differs from a shaper?

Planer- The work piece reciprocates while the tool is Stationary. Shaper – The tool reciprocates while the work Stationary.

4. What is the main difference made in divided table planer?

The working principle is similar to that of a planer. But it has two reciprocating table. In that one table is working with work the other is loaded and unloaded

5. What is gang drilling machine?

More number of single spindle with essential speed and feed are mounted side by side on one base and have common work table, is known as the gang- drilling machine.

6. What is the use of a tapping tool?

A tap is a tool which is used for making internal threads in a machined component.

7. What are the applications of boring?

The boring machine is designed for machining large and heavy work piece in mass production work of engine frame, Cylinder, machine housing etc.

8. What is the main difference between boring bar and boring tool?

Boring bar:

The tool which is having single point cutting edge known as boring bar. Boring tool:

The tool which is having multi point cutting edge known as boring tool.

9. How omniversal milling machine differs from universal milling machines?

This is a modified form of a milling machine It is provided with two spindles, one of which is in the horizontal plane while the other is carried by a universal swiveling head.

10. What are the advantages of up milling processes?

- 1. It does not require a backlash eliminator.
- 2. Safer operation due to separating forces between cutter and work.
- 3. Less wear on feed screw and nut due to the absence of pre loaded.
- 4. Milled surface does not have built up edge.

11. What is meant by plain or slab milling?

Plain or Lab milling is the operation of producing flat horizontal surface parallel to the axis of the cutter using a plain or slab milling cutter.

12. What is meant by the term indexing?

Indexing is the process of dividing the periphery of a job in to equal number of divisions.

13. What are the three types dividing heads?

- 1. Plain or simple dividing head.
- 2. Universal dividing head.
- 3. Optical dividing head.

14. What is cam milling?

Cam milling is the operation of producing cams in a milling machine by the use of a universal dividing head and a vertical milling attachment.

15. List the advantages and limitations of thread milling.

Advantages;

- 1. the threads will be smoother and more accurate than those cut in a lathe.
- 2. Threads can be cut closer to shoulders of work piece.
- 3. It is a faster method.
- 4. It is more efficient than cutting threads in a lathe.

Limitations:

1. It is Difficult to produce internal threads.

2. Threads milling cannot be used for making thread with more than 30 helix angle.

16. List the various types of planners?

- 1. Double housing
- 2. Open side planer
- 3. Pit planer
- 4. Edge planer
- 5. Divided table planer

17. Name the various parts of a double housing planer?

- 1. Bed
- 2. Table
- 3. Columns
- 4. Cross rail
- 5. Tool head

18. Mention any four specification of planer?

- 1. Maximum length of the table
- 2. Total weight of the planer
- 3. Power of the motor
- 4. Range of speeds & feed available
- 5. Type of drive required

19. What is meant by drilling?

Drilling is the process of producing hole on the work piece by using a rotating cutter called drill.

20. Mention any four drilling machine specifications

- 1. Maximum size of the drill in mm that the machine can operate
- 2. Table size of maximum dimensions of a job can mount on a table in square meter
- 3. Maximum spindle travel in mm
- 4. Number of spindle speed & range of spindle speeds in rpm.

21. List any four machining operations that can be performed on a drilling machine?

- 1. Drilling
- 2. Counter sinking
- 3. Tapping
- 4. Trepanning

22. What are the different ways to mount the drilling tool?

- 1. Fitting directly in the spindle
- 2. By using a sleeve
- 3. By using a socket
- 4. By means of chucks

23. What are the specifications of the milling machine?

- 1. The table length &width.
- 2. Number of spindle speeds &feeds.
- 3. Power of driving motor.

24. Mention the various movements of universal milling machine table?

- 1. Vertical movement-through the knee.
- 2. Cross vise movement-through the saddle.

25. State any two comparisons between plain & universal milling machine?

- 1. In plain milling machine the table is provided with three movements, longitudinal, cross&vertical. In universal milling machine in addition to these three movements, there is a forth movement to the table. The table can be swiveled horizontally & can be fed at angles to the milling machine spindle.
- 2. The universal milling machine is provided with auxiliaries such as dividing head, vertical milling attachment, rotary table etc. Hence it is possible to make spiral, bevel gears, twist drills, reamers etc on universal milling machine.

26. What are the cutter holding devices?

1. Arbors2. Adaptors3. Collets

27. List the various type of milling attachment?

- 1. Vertical milling
- 2. Universal milling
- 3. High speed milling
- 4. Rotary
- 5. Slotting
- 6. Rack milling

28. Write any ten nomenclature of plain milling cutter?

Body of cutter, cutting edge, face, fillet, gash, lead, land, outside dia, root dia, cutter angles.

29. What are the advantages of milling process?

- 1. It does not require a backlash eliminator.
- 2. Mild surface does not have built up edge.

30. What are the down milling processes?

- 1. Cutter with higher rake angle can be used. This reduces power requirements.
- 2. Cutter wear is less because chip thickness is maximum at the start of cut.

31. List out the various milling operations?

- 1. Plain or slab milling.
- 2. Face milling.
- 3. Angular milling.
- 4. Gang milling.
- 5. End milling.
- 6. Gear cutting.

32. What does term indexing mean?

Indexing is the process of dividing the periphery of a job into equal number of divisions.

33. How the milling machines classified?

Column and knee type

a) Plain milling machine, b)vertical milling machine, c) universal milling machine Plano miller

chine,
achine.

34. Distinguish between up milling and down milling.

Up milling	Down milling
Work is feed against the rotating cutter	Work moves parallel to the cutter rotation
Thickness of the chip is minimum in the	Thickness of the chip is maximum in the
initial stages and increases maximum at	initial stages and minimum at the end of
the end of the cut	the cut
Cutter lifts the work, so requires more	Cutter holds the work. Requires less
claming force	claming force
Surface finish is nod good,	Good surface finish

35. What are the types of drilling machine?

- Portable drilling machine
- Sensitive drilling machine
 - Bench Type, Floor Type
- Upright drilling machine
 - Box Column, Round Column
- Radial drilling machine
 - Plain, Semi universal, Universal
- Gang drilling machine
- Multispindle drilling machine
- Automatic drilling machine
- Deep hole drilling machine
 - Vertical, Horizontal

36. What is multiple spindle drilling machine?

Several drill spindles are mounted in a drill head and driven by a common motor using set of gear with different speeds and drills. This machine is used to drill more number of holes in the work at a time. The feed is given either rising the table and lowering the spindle head.

37. Write the differences between drilling and boring?

Drilling: A process of initiating a hole or enlarging a hole with a tool called Drill. Boring: The process of enlarging a hole that has already drilled using a boring tool is called as boring.

38. What are the types of boring?

Horizontal boring machine. Table type, Floor Type, Planer Type, Multi head type Vertical boring machine Vertical Turret lathe, Standard vertical boring machine Precision boring machine Jig boring machine Vertical milling machine type, planer type.

39. Give the specifications of boring machine.

Column height Table size, Size of the boring bar Distance between the column

40. What is jig boring machine?

Jig boring machine is a specially designed machined machine tool used for precision location and manufacturing of holes in the precision equipments like, jigs, fixtures, dies, gauges.

41. What is meant by counter boring?

Counter boring is a operation of enlarging the end of the hole through a certain distance to form a seat for the bolts and nuts have been seated.

42. What is slotting machine?

A slotting machine is a reciprocating machine tool in which a ram reciprocates in the vertical direction. The work is held stationary in a rotary table.

43. How slotters are specified?

Stroke length, Diameter of the rotary table The maximum travel of the longitudinal and cross wise movement.

44. What is shaping machine?

Shaping machine is a machine tool in which a ram reciprocates in the horizontal direction, indented mainly for the machining of flat surfaces.

45. What are the classification of the shaping machine?

- According to the type of mechanism.
 - Crank and slotted link
 - Whitworth driving mechanism
 - Hydraulic mechanism
- According to the position of the ram travel
 - Horizontal type an vertical type
- According to the Type of the table
 - Plain, Standard, Universal
- According to the type of cutting
 - Draw Type, Push type machine.

46. What is the need of quick return mechanism?

In shaping machine metal is cut during the forward stroke and the return stroke no metal is removed.. It is known as idle stroke. To reduce the total machining time the idle stroke time should be reduced. So the return stroke is made faster than the cutting stroke. This is done by a mechanism called quick return mechanism.

47. What are the types of planer?

Double housing planer Open side planer Pit planer Edge or plate planer Divided table planer.

UNIT IV – ABRASIVE PROCESS AND GEAR CUTTING

1. What is broaching?

Broaching is a processes of machining a surface with a special multipoint cutting tool called ' broach' which has successively higher cutting edges in a fixed path.

2. Indicate any two specification of a broaching machine?

- 1. Maximum length of stroke in mm
- 2. Maximum force developed by the slide in tones

3. What are the advantages and limitation of broaching?

Advantages:

- 1. Roughing, semi finishing & finishing cuts are completed in one pass of the broach
- 2. Broaching can be used for either external or internal surface finish

Limitation:

- 1. High initial cost of the broach tool compare to other tools
- 2. Job work or batch work is not advisable due to the high tool cost.

4. What are the different operations that can be performed on a broaching machine?

- 1. Broaching splines
- 2. Broaching a key way

5. What are the advantages of gear planning process?

Any given module can be cut using a single cutter.

The rate of production is higher when compared to forced cutter method.

It is a simple flexible and accurate method of generating gears.

6. What are the limitations of gear hobbing?

- 1. Internal gears cannot be generated.
- 2. Hobbing process cannot be applied very near to shoulders

7. State the purpose of grinding?

- 1. To remove small amount of metal from work pieces & finish then to close tolerances.
- 2. To obtain the better surface finish.

The machining accuracy of holes produce by this machine tool lies with in a range of 0.0025 mm.

8. Define the term "grade" used in grinding wheel?

Grade or hardness indicates the strength with which the bonding material holds the abrasive grain in the grinding wheel.

9. What is meant by dressing &truing?

The process of loading & breaking away the glazed surface so that new sharp abrasive particles are again present to work for efficient cutting is called dressing.

Truing is a process of trimming the cutting surface of the wheel to run true with the axis.

10. What is process of lapping?

Lapping is a surface finishing process used for producing geometrically accurate flat, cylindrical &spherical surfaces.

11. What are the three types dividing heads?

- 1. Plain or simple.
- 2. Universal.
- 3. Optical

12. What are the other forming methods for manufacturing gears?

- 1. Gear cutting by single point form tool.
- 2. Gear cutting by shear speed shaping process.
- 3. Gear broaching.
- 4. Template method.
- 5. Gear milling using a formed end mill.

13. List the gear generating process?

- 1. Gear shaping process.
- 2. Gear planning process.
- 3. Gear hobbing process.

14. Mention the applications of gear shaping process?

- 1. Gear shaping used for generating both internal & external spur gears.
- 2. Helical gears can also be generated using special attachments.

15. What are the limitations of gear hobbing?

- 1. Internal gears cannot be generated.
- 2. Hobbing process cannot be applied very near to shoulders.

16. What are the advantages of gear planning process?

- 1. Any given model can be cut using a single cutter.
- 2. It is a simple flexible & accurate method of generating gears.

17. List the various gear finishing processes?

1. Gear shaving.

- 2. Gear burnishing.
- 2. Gear grinding.
- 4. Gear lapping.

18. How the centre less grinder operates?

The centre less grinder operates with two wheels as the cutting wheel, to remove the excess stock and a regulating wheel which is used to control the speed of rotation of the work and the rate of feed.

19. What are the advantages of centre les grinding?

The work pieces are suppressed through the wheels No tendency for chatter and deflection of the work piece. Easy size control of the work. No need of chucking or mounting of the work piece.

20. What is honing?

Honing ids also a surface finishing process like grinding, which uses a "hon" tool that consists of stones to abrade the metals.

21. What is meant by polishing?

Polishing is the surface finishing operation performed by a polishing wheel, for the purpose of removing appreciable metal to take out scratches, hole marks, Pits and other defects from rough surfaces.

22. What is meant by buffing?

Buffing is used give much high lustrous, reflective finish that can not be obtained by polishing. The buffing process consists of applying a very fine abrasive with rotating wheel.

23. Distinguish between Gear forming and generating process.

Gear forming	generating
The tool used is a form cutter with standard	One cutter is used for all number of gears
involutes.	
Gear blank is rotated every tooth is over-	Gear blank is not indexed.
indexed	
Each module this process requires a set of	One cutter is enough for more number of
standard cutter.	modules
Time consuming and inaccurate method	Accurate and quick process.

24. Write the advantage of gear shaping/ gear generating.

- With a particular module of DP cutter, Gears having same module of DP but different number of teeth can be cut accurately.
- > Quicker and economical
- > Only one cutter is used for cutting all spur gears of same pitch
- Both internal and external gears can be cut.

25. Give three differences between gear hobbing and milling.

gear hobbing	milling
Hobb operates several teeth at a time	Milling cutter cuts one tooth at a time
It is not necessary to disengage the cutter	It is necessary to disengage the cutter and
and work before indexing	work before indexing
Gear hobbing is faster process than milling	Is a slower process.

26. What is sawing?

Sawing is one of the basic metal cutting processes, in which the cutting off the metal is done by using saws.

27. How broaches are classified?

According to the type of surface broched Internal broaches External broaches According to the method o operation Push broaches Pull broaches According to the operations performed on the work Surface broaches Keyway broaches Round hole broaches Spline broaches

28. Name some broaching operations.

Surface broaching Keyway broaching Round hole broaching Spline broaching. Gear broaching.

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Polishing is the surface finishing operation performed by a polishing wheel, for the purpose of removing appreciable metal to take out scratches, hole marks, Pits and other defects from rough surfaces.

33. What is meant by buffing?

Buffing is used give much high lustrous, reflective finish that can not be obtained by polishing. The buffing process consists of applying a very fine abrasive with rotating wheel.

34. Write the advantage of gear shaping/ gear generating.

- With a particular module of DP cutter, Gears having same module of DP but different number of teeth can be cut accurately.
- Quicker and economical
- > Only one cutter is used for cutting all spur gears of same pitch
- > Both internal and external gears can be cut.

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

	ABRASSIVE	APPLICATION
(1)	Aluminium	Cleaning, Cutting and Deburrig
(2)	Silicon Carbide.	Faster cleaning, Cutting.
(3)	Glass Heads	Matt polishing, cleaning
(4)	rushed glass	Peening and cleaning.

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

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

UNIT V - CNC MACHINE TOOLS AND PART PROGRAMMING

1. Define numeraical control machine

Numerical control machine cane be defined as a form of programmable machine in which the process are controlled by a program of numbers, letters, and symbols.

2. What is NC part programming?

NC part programming is the step by procedure of by which the sequence of processing steps to be performed on the NC machine is controlled by a program of numbers, letters, and symbols.

3. What is APT language?

APT [automated programming language] is a computer program, it automatically calculates the tool path, generates program and controls the machine by receiving general high level languages.

4. Mention any 4 post processor statement in APT.

COOLNT END FEDRAT/ MACHIN/ RAPID

5. What is CNC?

CNC is system consists of a computer, controller and a NC machine tool. Computer is used to store and edit the program. Controller controls the tool path based on the program.

6. What is meant by machining centre?

The machining centre is CNC system with automatic tool changing arrangement that is designed to perform a verity of machining operations, with large number of cutting tools.

7. What is part program?

Part program is a high level language containing the instructions for machining a part to various standard words, codes and symbols.

8. What is post processing?

Post processing is a computer program that takes a generalized part program output and adopts it to a particular machine control unit and machine tool combination. It is the basic intelligence required to change the program into computer language.

9. Write the order of instructions in a part program.

Preparatory function Feed function Tool function End of block

10. What is manual part programming?

Manual part programming is a process of writing programs which consists of a set of instructions [contains codes, symbols and numbers] to carry out the machining of the work.

11. What is preparatory function?

It is word address format represented by the letter G, Followed by a numerical code for the operation of the control unit to instruct the machine tool.

12. What is canned cycle?

Canned cycle simplifies and shortens the programming in such way whenever any one of the operation is required.

13. What are the major areas to be considered in the design of NC machine tools?

- i. Machine structure and frame
- ii. Location of transducer
- iii. Slideways
- iv. Elements of transmission and positioning of sliders
- v. Spindles
- vi. Tool holding arrangements

14. How the heat effect on the machine bed, tool holder can be taken care?

- i. Providing correctly designed mild steel structure with higher stiffness
- ii. Use of ribs, braces, angle plates to increase stiffness
- iii. Normal weight distribution over the entire frame
- iv. The hollow cross section for beds, bases and columns with a number of ribs welded with the walls cater for the rigidity as well as opening for inspection, lubrication and collection of chip coolants.
- v. Thermo symmetrical design of all parts.
- vi. Providing large heat removing surfaces
- vii. Use of excellent coolants
- viii. Avoiding direct as well as local sources of heat such as sunlight and electrical motors.oil pumps respectively.
- ix. Reduction of ambient temperature by using air conditioning units
- x. Proper alignment of the machine elements relative to each other while in operation as well as in stationary conditions

15. Explain Slide and Slideways

In general machine tools are provided with tables, slides, carriages etc., to carry the work pieces or cutting tools etc., These parts are sliding in nature and mounted on the ways that are fixed on the other parts (column, housing, bed or knee) of the machines known as sliding ways.

16. Explain the term "stick-up"

Conventional sliders operating under sliding friction do not have a constant coefficient of friction and the highest value of co-efficient tends to be at the lowest rates of slide velocity. This phenomenon given to the familiar "stricking" of oil lubricated slideing surfaces when the fine adjustment is needed, a jerky action when movement takes place at low velocities. The term "stick-slip" is used to describe these situations.

17. Give the four methods of achieving rolling action in slideways

- i. Vee & Flat roller
- ii. Linear ball bushing
- iii. Rotax Tychoway
- iv. Dexter ball slide

18. Give the requirements of a good slideway system

A good slide way mush possess

- Low coefficient of friction at varying slide velocities
- Minimum difference between static and dynamic friction coefficient
- Positive slope for friction velocity characteristics
- Low rate of wear
- High stiffness at the sliding points
- Sufficient damping.

19. Give the advantages of re-circulating ball screw and nut assembly.

- High efficiency (over 90%)
- Reversibility
- Reduces wear and has longer life without loss of accuracy
- No stick slip in the sliding metal to metal contact is substituted by rolling contact

20. What is the importance of control elements?

The control unit should be situated so that it is convenient for the machine operator to operate the machine from the central place. A control unit should:

- i. Indicate the current status and position of various machine tool features and give feedback
- ii. Allow manual on semi manual control of machine elements
- iii. Enable machine tool to be programmed

21. What are the various types of DC motors used in a CNC machine tool?

- i. DC permanent magnet motors
- ii. Separately excited DC motor with analog thyristor derives

22. What are the advantages of a permanent magnet DC motor?

- i. In general the advantages of permanent magnet DC motor over winded field motors are:
- ii. Indicate the current status and position of various machine tool features and give feedback
- iii. High acceleration torque
- iv. No need for electric power to generate magnetic flux
- v. Smaller frame size

23. What are the advantages of AC spindle drives over DC drives?

- i. AC spindle motors are now preferred for the main drive by CNC machine tool designers due to a variety of reasons as follows:
- ii. AC motors are reliable than DC motors under several operating conditions
- iii. AC motors are being free of brushes and other wearing parts do not require frequent maintenance
- iv. The unique stator cooling system in AC motors result in high speed output characteristics with compact size
- v. AC drive units provide stable and smooth operation with reduced vibration and noise from low speed to high speed.

24. Describe a typical slide way design incorporating plastic inserts.

In slide way system plastic or non metallic inserts are used. These insets are bonded to the underside of the sliding members. They can be of thermoplastics (Turcute-B) or thermosetting (SKC-3, Moglice) types. It is found that for these coated slide ways the static coefficient is less that the dynamic coefficient of friction

25. Discuss the advantages of plastic inserts for slide ways of machine tools?

Plastic inserts / composites are made of two or more materials in which one reduces coefficient of friction. The other increases strength, wear resistance and load bearing capacity. They also have self lubricating capacity. They can take up dirt, dust particles and eliminate scoring. Another advantage is the case with a worn out strip can be replaced without the need of any scraping or machining of bedways.

26. What are the common types of tool magazines?

The concept of the ATC is that the range of tools for a specified job shall be made available for automatic selection and positioning . ATC can be :

- i. Drum type for holding small number of tools store in periphery of drum
- ii. Chain type for more number of tools (30 40 or more tools can be used)

27. Why are the balls re-circulating screws used in CNC machines?

Ball screws are primarily employed in feed mechanism in machine tools. The advantages are as follows:

- i. In the ball screw the lead between the threads of the screw and the nut is not transmitted by direct contract, but through spherical balls. Balls rotate between the helical grooves of the screw and nut in a manner that function in a ball bearing. An essential feature is the provision of recirculation of balls.
- ii. Low coefficient of friction in the order of 0.004
- iii. Higher transmission efficiency allows larger thrust loads to be carried with less torque
- iv. By preloading the assembly, clearances and consequent backlash can be eliminated. The accuracy of ball screw is high.

28. What are the desirable characteristics of tool magazines?

- i. Tool magazines must be capable of holding enough tools needed for performing complete operation for work pieces on the machining centers
- ii. As the magazine gets larger, the space needed is more and more expensive and hence the magazine has to be compact and as simple as possible
- iii. Interchange of tools should not interfere with the workpiece space and tool space. This means that the tool magazine should be located outside the working space of the machine tool
- iv. Easier and safer manual exchange of tools in the tool magazine during loading and unloading should be facilitated
- v. All preparatory works for tool exchange should be made during machining

29. How do you classify Automatic Tool Changer (ATC)?

- According to the kind of cutting tools
 - For single tool

i.

- For multi tool arm
- Special tools such as micro bores
- ii. According to system tool change
 - Without tool change arm
 - With tool change arm
 - With tool parking position
- iii. According to position of axes of tool
 - With parallel axis
 - With intersecting axis
- iv. According to tool position
 - With horizontal tool position
 - With vertical tool position

30. What is automatic pallet changer?

For machines with automatic pallet changer (ATC) the table is replaced by pallet. The pallet when transferred from the pallet changer on the machine gets located and clamped with heavy clamping force either hydraulically or mechanically. The function of pallet changer is to interchange the pallet on the machine which has the finished component and the other pallet with newly loaded component.

31. What are the design requirements of CNC machine spindles?

- High stiffness
- Axial load carrying capacity
- Running accuracy
- Thermal stability
- Axial freedom for thermal expansion
- High speeds of operation

32. What are the techniques used for generating CNC instructions?

- i. Manual part programming
- ii. Computer assisted part programming
- iii. Graphic numeric control programming (CAD/CAM based programming)
- iv. CNC programming based on solid modeling

33. Describe the general form of a program line and explain each term

The tool path of the CNC machine is described in machine tools. The general form is as follows: (some of the terms are optional)

N., G., X., Y., Z., A., B., C., F., S., T., M.,

Where,

- N Sequence number of the instruction
- G Preparatory function referring to a particular machine variety
- X,Y,Z Coordinates
- A,B,C Angular data
- S Spindle speed
- T Tool code to select the tool
- M Miscellaneous function or non-machining operations

Sample line of program given below:

N 001 G 01 X 120,5 Z-43 F 100.0 M08

34. What is meant by Machine datum?

It is the origin of the co-ordinate system with the lathe. It is on the mounting flange of the main spindle and the turning axis. It cannot be changed by the user of the machine. It is fixed by the manufacturer and programmed into the computer. The point generally has the coordinates X=0, Z=0

35. Explain the machine reference point and tool reference point.

Machine reference point:

The position of the reference point R is determined by the manufacturer. The value of the machine reference coordinates X and Z are fixed and cannot changed by the user.

Tool reference point (T):

Point T is exactly the point of rotation of the tool post.

36. What is meant by work piece zero point?

During different machining process, various jaw positions of chuck are used and these are mounted on the main spindle. The distance of the face side of the work piece from the machine datum differs depending on the jaw surface, which is used for chucking. This has to be considered while programming. It is desirable to offset the origin of the coordinate system into the work piece zero point W instead of the machine. Reference point, which is the useful origin of the machine.

37. Describe G functions or Preparatory functions:

These are the commands which prepare the machine for the different modes of movement like positioning, contouring, thread cutting etc., the preparatory functions always precede the dimension word.

Function	Meaning
G00	Point to point, Rapid positioning
G01	Linear interpolation
G02	Circular interpolation Clockwise
G03	Circular interpolation Anti-Clockwise
G04	Dwell

38. What is a canned cycle?

A canned cycle is a combination of machine moves that performs any one particular machining function such as drilling, milling, boring, tapping, dwell etc.,

39. What is zero suspension?

All CNC machines are equipped with the decimal point input. In order to simplify program input the leading zero can be omitted. Ex. 12.145 instead of 0012.145

Consecutive zeros after decimal point need not be entered 12 instead of 12.000 and 10.4 instead of 10.4000

40. What is tool length offset? Where do you store tool length offsets?

- i. In addition to the other data, tool length information as to be input to enable the computer to calculate the toll path. In case of the machining centers tools are preset using a pre setting device. With preset tools the tool tip position has to be programmed in the tool reference point. Some machines have an automatic tools presetting device which can be mounted on the machine tool itself. This slide position information will be used by the computer to determine the slide displacements for particular tool path.
- ii. Another method is to hold the blank in the chuck and jog the tool to touch the diameter and a face of the work piece. The diameter and length information can then be input into the memory of the machine.

41. Why is the tool nose compensation important?

The carbide insert used in turning operation has a certain corner radius and the carbide tip tool will break or melt when working. These radii are standardized according to ISO.

42. Explain subroutines.

Program sections required more than one can be defined as subroutines and stored in the control. They can be called several times in part programs. Geometric values, feed rates, spindle speeds etc., are defined in subroutines as parameters. These parameters are assigned actual values before the subroutines are called making it possible to adopt dimensions and technological data to the actual work piece. A typical application for subroutines is the machining of similar parts with different dimensions.

43. What do you mean by machining cycles?

Machining cycles are technology based subroutines for often needed machining operations such as deep hole drilling, pocket milling etc., in modern CNC systems standard cycles are available for various types of drilling/boring and milling patterns. The machining cycles are programmed in the usual NC programming language.

44. What is the importance of presetting device?

A presetting device is used to preset axial and radial positions of the tip on the tool holder. Once this is done the tool holder is ready to be mounted on the machine or tool magazine and produce a known dimension. The amount of compensation can be quickly decided with the presetting device. Accuracies in the order of 0.0002 mm can be quickly and easily maintained.

45. Explain Preset tools

"The setting of tools in advance at a place away from the machine tool on offline in special holders is known as preset tools." The tools are carefully positioned in the holder so that when the holders are clamped in the machine tool, their effective cutting positions will correspond to these cutting positions assumed while preparation of part programmed.

46. Write brief notes on Modular fixtures.

The multi hole "plug – board" concept has proved very successful in this type of fixtures. Its special advantage is that a work holding fixture can be built with absolute positional accuracy by simple pegging of a few fixture elements. The multi hole grid system enables different jig and fixture combination to be assembled for a wide range of work pieces.

47. What are the different types of dimensioning systems used?

- Absolute dimensioning or Baseline dimensioning system
- Incremental dimensioning or Delta dimensioning system

48. What is a block? Write the significance of it.

Block is the basic unit of a part program input to the control. It contains adequate information for the machine to perform a movement and for functions.

49. List the differences between absolute and incremental dimensioning.

Sl.No	Absolute dimensioning	Incremental dimensioning	
1	All measurements are taken	All the measurements for the	
	from a fixed origin	next position are calculated	
		from the point at where the	
		slide was resting previously	
2	In these all the dimensions	Both positive negative	
	should be positive	dimensions may come	

50. Write the different types of tape programming format

- Word address format
- Table sequential format
- Fined block format

51. What are the steps involved in part programming?

- Selecting the coordinate values i.e., Absolute or incremental mode
- Selecting units of dimensions i.e., inches or metric, spindle speed and tool number if necessary
- Preparing a program sheet where each block will contain the sequence number, details of operation and basic information such as preparatory feed codes, feed rate, miscellaneous M code

52. List some of the canned cycle and mention its use

- G81 Drill cycle
- G82 Dwell cycle
- G79 Basic mill cycle
- G83 Peck drill cycle
- G85 Bore cycle
- G80 Cancel Cycle

53. What is the roll of computer in computer in computer aided part programming

- Input translation
- Arithmetic calculations
- Cutter offset compensators
- Post processors

54. List out some of the important NC languages

	1	0	0
APT			Compact II
ADAPT			PROMPT
EXAPT			CINTURN II

55. What are the four statements used in APT language?

1. Geometric statements	2. Motion statements

3. Post processor statements 4. Auxiliary statements

56. Differentiate 2 ¹/₂ and 3 axis machine

- 2 ½ axis machine implies that machine movements are in planes parallel to the X-Y plane
- 3 axes machine implies that machine movements are in all the 3 axes (X, Y and Z)

PART – B QUESTIONS

UNIT – I

1. What are the conditions that favor the formation of continuous and discontinuous chips?[8][NOV' 03]

What are the functions of rake angle and end relief angle in single point cutting tool? [8]

- What is crater wear? [4] During machining C₂₀ steel with a carbide cutting tool having a tool geometry given by 0-5-6-6-8-75-1 mm ORS, the following forces have been recorded by a two dimensional dynamometer. Cutting force = 1300 N, Feed force = 800 N Determine the following: Radial component of force, Frictional force and Nominal force and Kinetic coefficient of friction μ [12] [NOV' 03], [NOV'04]
- 3. Explain the continuous chip formation process. Discuss the conditions that favor continuous chip formation [6] [NOV'04]
- 4. Discuss the types of wear occurs in the cutting tool due to machining. [6] [NOV'04] Discuss the functions of cutting fluids. List down the essential properties of cutting fluids.[10]
- 5. The following equation for tool life is given for a turning operation: $VT^{0.15} f^{0.8} d^{0.4} = C$

A 60 minute tool life was obtained while cutting at V = 30 m/min, f = 0.4 mm/ rev and d = 2.4mm

Determine the change in tool life if the cutting speed, feed and depth of cut are increased by 15% individually and also taken together [12] [APR'05]

Define the term machinablity. Explain, how it is influenced by work material micro-structure [4]

- Explain 'Merchant Force Circle' with suitable diagram [5] [APR'05] Discuss various types of tool wears [5] Discuss the various types of chips produced during metal cutting [6]
- 7. Explain the different types of tool wear.
- 8. Explain the different types of Tool Material and their composition.
- 9. How the tool life is measured.

- Explain the following methods of taper turning in a lathe [8+8] [NOV' 03] By swiveling the compounding rest. By a taper turning attachment.
- 2. Explain the taper turning operation in a lathe by taper turning attachment. Write the advantages of taper turning attachment. [16] [NOV'04]
- 3. How do you specify a lathe? Explain with suitable diagram. [6] [APR'05] Explain the working principle of apron mechanism with neat diagram [10]
- 4. Differentiate between a Capstan and Turret lathe. [6] [APR'05] Explain the turret indexing mechanism with neat sketch [10]
- 5. Explain the thread cutting operation in a lathe.
- 6. How the automats work? Explain with an example.
- 7. Explain the single spindle automatic lathe.
- 8. Explain the Cutting off machine with diagram.
- 9. Explain the different types of multi spindle automats.
- 10. Explain the automatic Screw machine.

UNIT – III

- 1. With a simple sketch, explain the working of crank and slotted link quick return motion mechanism used in shaper. [12] [NOV' 03] [Apr' 05]
- Write down any four differences between shaper and planer [4]
- 2. Differentiate between a shaper and planer [8] [NOV'04] Explain the counter boring and counter sinking operations [8]
- 4. Explain various operations performed in a planer [6] [APR'05]
- 5. Draw a milling cutter and explain the different nomenclature.
- 6. Explain the standard slotter with sketch.
- 7. Explain the operations carried out in a standard milling machine.
- 8. Explain the standard shaping machine.
- 9. How the stroke length and stroke position is adjusted in shaping machine.
- 10. Explain the radial drilling machine.
- 11. With a neat sketch, indicate the various parts of an arbor assembly. [8] [NOV' 03] Explain the thread milling operation [8]
- 12. With a need sketch, explain the principle parts and angles of a plain milling cutter. [16] [NOV'04]
- 13. Explain the cam milling operation [10] [NOV'04] Explain the gear cutting by form tool [6]
- 14. What are the different methods of production of gears by machining operations? [6] [APR'05] Explain the working principle of universal dividing head [10]

UNIT – IV

- 1. Explain the external cylindrical grinding process [8] [NOV'04] Explain the vitrified and resonid bonding process. [8]
- 2. Explain the working principle of centreless grinding [6] [APR'05] Draw and explain twist drill nomenclature [10]
- 3. Explain the different types broaching machines.
- 4. Explain the different types broaching operations.
- 5. Explain the different indexing methods.
- 6. Explain the gear shaping.

- 7. Explain the gear hobbing.
- 8. Write short notes on Super finishing and lapping.

9. Explain the buffing and polishing.

10. Explain the different sawing operation.

UNIT – V

- 1. Sketch and explain the working of swiss type automatic screw machine. What are the advantages of automatic machines? [16] [NOV' 03]
- 2. Explain the principle of operation of walking beam transfer mechanism used in transfer machines. [12] [NOV' 03]

What are the limitations of transfer machines? [4]

- 3. Explain the tooling layout for the production of a hexagonal bolt in a Capstan lathe. [16] [NOV' 03]
- 4. With a neat sketch, explain the bar-feed mechanism for automatic screw machine. [12] [NOV'04]

What are the advantages of automatic machines? [4]

- 5. Discuss the tooling layout for the production of a hexagonal bolt in a turret lathe [16] [NOV'04]
- 6. Draw and explain the gearing diagram of swiss type automatic [12] [APR'05] What are the relative advantages and disadvantages of single spindle and multi spindle automatics? [4]
- 7. Explain the principle of operation of gear hobbing operation. What are the advantages of gear hobbing? [16] [NOV' 03]
- 8. Calculate all machining particulars for cutting a spur gear of 3 module and 54 teeth with proper index plate hole circle and sector [5] [APR'05] Explain with neat sketches the working principle of bevel gear generator [11]