

ME 6402-MANUFACTURING TECHNOLOGY II

UNIT -1

THEORY OF METAL CUTTING

TWO MARKS QUESTIONS:

1. What is rake angle? What is the effect of nose radius in tools?

The angle between the tool face and the line parallel to the base of the tool is known as side rake angle. It is used to control chip flow.

2. What is tool?

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

3. Explain the nose radius?

It is the 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.

4. Name the factors that contribute to poor surface finish in cutting?

- Cutting speed
- Feed
- Depth of cut.

5. What is orthogonal cutting?

The cutting edge of tool is perpendicular to the work piece axis

6. Define oblique cutting?

Oblique cutting: - The cutting edge is inclined at an acute angle with normal to the cutting velocity vector is called oblique cutting process

7. What is cutting force?

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

8. What is chip reduction co-efficient ?

The reciprocal of chip thickness ratio is called chip reduction co-efficient.

$$K=1/r$$

9. What is the function of chip breakers?

The chip breakers are used to break the chips into small pieces for removal, safety and to prevent both the machine and work damage

10. Define machinability of metal?

Machinability is defined as the ease with which a material can be satisfactorily machined

11. How tool life is defined?

Tool life is defined as the time elapsed between two consecutive tool resharpening. During this period the tool serves effectively and efficiently

12. Write Taylor's tool life equation?

Taylor's tool life equation, $VT^n=C$

Where, V = Cutting speed in m/min.

T = Tool life in minute

C = Constant

N = Index depends upon tool and work.

13. What are the factors affecting tool life?

Cutting speed

Feed and depth of cut

Tool geometry

Tool material

Cutting fluid

Work material

Rigidity of work, tool and machine

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

Hot hardness

Wear resistance

High thermal conductivity

Resistance to thermal shock

Easy to grind and sharpen.

Low mechanical and chemical affinity for the work material

15. Name the various cutting tool materials.

Carbon tool steel

High speed steel

Cemented carbides

Ceramics

Diamonds

16. What are the functions of cutting fluids?

It is used to cool the cutting tool and work piece.

It lubricates the cutting tool and thus reduces the co-efficient of friction between tool and work.

It improves the surface finish as stated earlier.

It causes the chips to break up into small parts.

It protects the finished surface from corrosion.

It washes away the chips from the tool. It prevents the tool from fouling.

It prevents corrosion of work and machine

17. What are the factors responsible for built-up edge in cutting tools?

During cutting process, the interface temperature and pressure are quite high and also high friction between tool chip interfaces causes the chip material to weld itself to the tool face near the nose. This is called built up edge

18. List the essential characteristics of a cutting fluid?

It should have good lubricating properties to reduce frictional forces and to decrease the power consumption.

High heat absorbing capacity.

It should have a high specific heat, high heat conductivity and high film co-efficient.

High flash point.

It should be odorless

It should be non –corrosive to work and tool.

19. What are the causes of wear?

The tool is subjected to three important factors such as force, temperature and sliding action due tool.

20. Briefly, differentiate between orthogonal cutting and oblique cutting?

Sl. No.	Orthogonal cutting	Oblique cutting
1.	The cutting edge of the tool is perpendicular to the cutting velocity vector.	The cutting edge is inclined at an acute angle with the normal to the cutting velocity vector
2.	The chip flows over the tool face and the direction of chip-flow velocity is normal to the cutting edge.	The chip flows on the tool face making an angel with the normal on the cutting edge.
3.	The cutting edge clears the width of the work piece on either ends.(i.e No side flow)	The cutting edge may or may not clear the width of the work piece.
4.	The maximum chip thickness occurs at its middle.	The maximum chip thickness may not occur at the middle.

21. Give two examples for orthogonal cutting.

Turning, facing, thread cutting and parting off

UNIT – 2

TURNING MACHINES

1. What is swing diameter?

The largest diameter of work that will revolve without touching the bed and is twice the height of the center measured from the bed of the lathe.

2. write the specifications of a typical lathe?

i, The length of bed.

ii, maximum distance between dead and live centres.

iii, Types of bed(i,e) straight, semi gap or gap type.

iv, The height of dead centres.

v, swing over the bed.

vi, width of the bed.

vii, spindle bore.

viii, spindle speed.

ix, H.P. of main motor and rpm.

x, Number of spindle speeds.

xi, spindle nose diameter.

xii, Feeds .

3. Write down the names of any four lathe accessories?

lathe centres, catch plates, carriers, chucks, mandrels and rests.

4. What are the operations can be performed on a lathe?

Turning, facing, forming, knurling, chamfering, thread cutting, drilling, boring, recessing, tapping, grooving etc.

5. Write down the names of any four lathe accessories?

lathe centres, catch plates, carriers, chucks, mandrels and rests.

6. What are the functions of feed rod and lead screw?

Feed rod:

It is used to guide the carriage in a straight line when it moves along the bed.

Lead screw:

It is used to move the carriage while thread cutting operation is carried out. It also ensures the proper speed of work relative to the tool thread cutting operation.

7. Mention four types of chucks used in a machine shop?

- i, Three jaw chuck (or) self centering chuck
- ii, Four jaw chuck (or) independent chuck.
- iii, magnetic chuck.

8. What is the application of Air operated chuck?

Heavy work piece are mounted with the help of air operated chucks because they will require more power to hold the work piece.

9. What is the purpose of mandrel? How many types of mandrels is there in common use?

Mandrels are used for holding hollow work pieces.

1. plain mandrel
2. collar mandrel
3. cone mandrel
4. special mandrel
5. step mandrel
6. Expansion mandrel
7. Gang mandrel

10. What is thread cutting operation?

Thread cutting is the operation of producing continuous helical groove on a cylindrical work piece.

11. Name any four work holding devices?

- 1, collets
- 2, chucks
- 3, Fixtures
- 4, power chucks

12. Define automatic machine?

Automatic machine or simply automats are machines tools in which all the operations required to finish off the work piece are done automatically with out the attention of an operator.

13. What are the advantages of automatic lathes?

- a, Mass production of identical parts.
- b, High accuracy is maintained.
- c, Time of production is minimized.
- d, The bar stock is feed automatically.

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UNIT – 3

SHAPER, MILLING AND GEAR CUTTING MACHINES

1. Compare hydraulic shaper with mechanical shaper?

SL.NO	Hydraulic shaper	Mechanical shaper
1.	smooth cutting operation	Rough and noisy cutting operation
2.	changing of cutting speed is easy	changing of cutting speed is difficult
3.	Higher cutting to return ratio can be obtained	Lower cutting to return ratio
4.	Stroke length can be easily adjusted without stopping the machine	Change of stroke length is not possible with out stopping the machine.

2. Write down any four operations performed by a shaper?

Machining horizontal surfaces.

Machining vertical surfaces.

Machining inclined surfaces.

Machining irregular surfaces.

3. Mention the operation performed by planer?

The following operations generally performed in a planer are

a.Planning horizontal surface

b.Planning vertical surface

c.Planning curved surface

d.Planning of an angle

4. What is the function of clapper block in a planer?

During cutting stroke, the tool block fits inside the clapper block rigidly. During the return stroke, the tool block lifts out of the clapper block to avoid rubbing of the tool on the job.

5. State the difference between a vertical shaper and a slotter?

vertical shaper	slotter
1. vertical shapers generally fitted with rotary table to machine curved surfaces 2. Rotary table along with tools will remove. 3. vertical shaper is not fixed in the vertical plane	1.The slides are fitted 2.slides will move to perform slotting. 3. slotter is fixed in the vertical plane.

6. What are the common work holding devices used on milling machines?

- a. 'v' blocks.
- b. machine vises.
- c. milling fixtures.
- d. Dividing heads

7. What is a shell mill?

A shell mill is a large type of face or end mill that mounts onto an arbor, rather than having an integral shank. Typically, there is a hollow or recess in the center of the shell for mounting hardware onto a separate arbor.

8. What is meant by up-milling and down milling?

In up milling, cutters rotates opposites to the direction of a feed of the work piece whereas in down milling, the cutter rotates in the same direction of travel of the workpiece.

9. What are the differences between up milling and down milling?

SL.NO	EVENT OF OPERATION	UP MILLING	DOWN MILLING
1.	Direction of Travel	Cutter rotates against the direction of travel of workpiece.	Cutter rotates in the same direction of travel of workpiece
2.	Chip thickness	Minimum at the beginning of cut Greeches max when the cut terminates.	Maximum at the beginning Greeches min at terminates
3.	cutting force	Increases from zero to max per tooth	Decreases from max to zero per tooth.

10. What is thread milling?

A thread milling has no chamfer. The mill is inserted into the hole along the axis of the spindle, deep enough to produce full thread depth required

11. write down the rule for gear ratio in differential indexing

Rule for gear ratio in differential indexing:

$$\text{Gear ratio} = (A-N)/A$$

A- Selected no which can be indexed by plain indexing and approximately equal to N.

N- Required no. of divisions to be indexed.

12. How do specify radial drilling machine?

A drilling machine is specified by the job following items.

1. Maximum size of the drill in mm that the machine can be operate.
2. Table size of maximum dimension of a job can mount on a table in square meter.
3. maximum spindle speed and range of spindle speeds in r.p.m

13. Write down any four operations that can be performed in a drilling machine?

1. Drilling
2. counter sinking
3. Tapping
4. reaming.

14. What is meant by “sensitive hand feed”?

In drilling machines, manual sensing of the hand does feeding of the tools towards the work piece. it is called as sensitive hand feed

15. What is broaching?

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

16. Why is sawing a commonly used process?

1. Easy handling of machines and spindle construction
2. Fast operation and cost of machinery is less

UNIT – 4

ABRASIVE PROCESSES AND BROACHING

1. What are the types of surfaces that could be produced using plain cylindrical grinders?

Plain cylindrical parts, cylindrical parts, cylinders, tapers, shoulders, fillets, cams, crankshaft etc.

2. State the abrasives used in manufacture of grinding wheels?

a, corundum (75 to 90% crystalline Al_2O_3 + IRON OXIDE)

b, Diamond

Artificial abrasives:

a, Aluminium oxide

b, silicon oxide

3. What do you mean by loading of grinding wheels?

During the operation, the chips formed get entrapped in the inner granular space of abrasive particles. This is called loading.

The surface of the wheel becomes smooth and gets a glassy appearance.

This is known as glazing wheel.

4. What is meant by dressing and truing?

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

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

5. Mention four important factors that influence the selection of grinding wheel?

1. constant factors
 - i. physical properties of material to be ground
 - ii. Amount and rate of stock to be removed.
 - iii. Area of contact.
 - iv. Type of grinding machine
2. variable Factors
 - i. work speed.
 - ii. wheel speed.
 - iii. condition of the grinding machine
 - iv. personal factor

6. What for lapping is used?

- a, Removing small amounts of material from the surfaces of tools.
- b, Removing small defects and surface cracks left during previous operations

c, Eliminating small distortion.

7. What is meant by honing?

An abrading process of finishing previously machined surfaces is known as honing.

8. What are the advantages of honing process?

1. Simple process which can be done on any general purpose machines such as lathes and drilling machines.
2. This process can be applied for both internal cylindrical and flat surfaces.
3. Honing enables the maximum stock removing capacity out of entire surface finishing operations.

9. What is meant by dressing and truing?

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

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

10. What is roller burnishing process?

Roller burnishing is a method of cold working metal surfaces in which hardened sphere or cylindrical roller is pressed against the work to be processed. For example, in roller burnishing on a lathe, the burnishing tool is moved across the surface to be spanned.

UNIT – 5

CNC MACHINING

1. Define NC?

Controlling a machine tool by means of a prepared program is known as numerical control or NC.

2. what are the classifications of NC machines?

1. point to point NC system
2. straight cut NC system
3. Contouring NC system

3. What are G-codes and M-codes? Give examples.

G-codes are preparatory function codes which prepare the machine for different modes of movement like positioning, contouring, thread cutting etc.

Eg. G00 – Point to point positioning

G01 – linear interpolation

M- codes are miscellaneous function codes which denote the auxiliary or switching information such as coolant on/off, spindle speed etc.

Eg. M00 – Program stop

M01 – Optional stop.

4. What is the role of computer for NC machine tool?

computer numerical control is an NC system that utilizes stored program to perform basic numerical control functions. mini or micro computer based controller unit is used.

5. Name the various elements of CNC machines?

1. Tape reader
2. Mini computer
3. servos and interface logic
4. Motion feedback

6. What is the role of computer for NC machine tool?

computer numerical control is an NC system that utilizes stored program to perform basic numerical control functions. mini or micro computer based controller unit is used.

7. What is point –to- point (PTP) system?

It is also called positioning system. The objectives of the machine tool control is to move the cutting tool to a predefined location. The speed or path is not important in this system

8. Mention the main difference between CNC and DNC?

CNC system can do operations on only one machine at a time. But direct numerical control involves that at a time a large central computer to direct the operations of a number of separate NC machines

9. List the commonly used co – ordinate system of CNC machine tools?

Cantilever construction

Bridge construction

Column construction

Gantry construction

10. What is the difference between incremental and absolute system?

In absolute programming, the distance at my point at any instant will be measured from the origin (X=0, Y=0).

Whereas in incremental programming, the instant point will be noted as (X=0,Y=0). Further measurement will be made from the particular point only.

11. Write down the types of statements in APT language.?

1. Geometric statements
2. Motion statements
3. postprocessor statement
4. special control or Auxiliary statements

12. Define subroutine?

If the same machining operations, which was carried out already, is to be performed at many different positions on the work piece, it can be executed by means of a program called as subroutines

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ME6402 MANUFACTURING TECHNOLOGY – II

UNIT I - THEORY OF METAL CUTTING

PART B

1. a. Explain the classification of various cutting tool materials?
b. State the properties of each of the tool materials.
2. a. The Taylor tool life equation for machining C-40 steel with a HSS cutting tool at a feed of 0.2mm/min and a depth of cut of 2mm is given by $VT^n = C$, Where n and C are constants. The following V and T observations have been noted
V , m/min 25 35
T , min 90 20
Calculate
(1) n and C
(2) Hence recommend the cutting speed for a desired tool life of 60min. b.
In an orthogonal cutting operation on a work piece of width 2.5mm, the uncut chip thickness was 0.25mm and the tool rake angle was zero degree. It was observed that the chip thickness was 1.25mm. The cutting force was measured to be 900N and the thrust force was found to be 810 N
(b) Find the shear angle.
(c) If the coefficient of friction between the chip and the tool, was 0.5, what is the machining constant C_m
3. What is a chip breaker? Describe the different types of chips produced during metal machining with neat sketches.
4. With the help of a sketch, show crater wear and flank wear on a cutting tool.
5. a. What is machinability? And explain.
b. Mention the functions and properties of cutting fluids
6. Describe an expression for the determination of shear angle in Orthogonal metal cutting.
7. a. Describe the mechanism of metal cutting?
b. What is meant by orthogonal cutting and oblique cutting?
8. Explain “merchant force circle” along with assumptions.
9. What are the standard angles of cutting tool? Illustrate with an example.
10. a. State the parameters that influence the life of tool and discuss?
b. Explain the geometry of a single point cutting tool with suitable sketches?

UNIT II - TURNING MACHINES

PART B

1. Explain the various taper turning methods?
2. a. Discuss about special attachments of lathe.
b. Mention the specifications of lathe with a neat sketch.
3. a. Describe the turret indexing mechanism.
b. Discuss about the bar feed mechanism.
4. a. Describe the holding devices in a lathe.
b. Explain the working principle of apron mechanism with neat sketch.
5. Draw neat sketches of steady and follower rests and brief their applications.
6. Describe the constructional features of Swiss type automatic screw machine.
7. Explain the working principle of a capstan and turret lathe.
8. Name the various lathe accessories. How does a four jaw chuck differ from a three jaw chuck?
9. Explain the features and classification of multi spindle automatics.
10. a. Discuss the features of ram type and saddle type Turret.
b. What is meant by "Tool layout" of a Turret lathe?

UNIT III - SHAPER, MILLING AND GEAR CUTTING MACHINES

PART-B

1. a. Explain various milling cutters with neat sketches?
b. How will you cut the following types of surfaces on milling machines?
(i) Flat surfaces (ii) Slots and splines
2. Discuss various hole making processes.
3. With a neat sketch explain the column and knee type milling machine and name its main parts.
4. a. Explain hacksaw and band saw with neat sketches.
b. Explain the different types of table drive and feed mechanisms in a planning machine .
5. a. Discuss push and pull type broaching machines with neat sketches.
b. Write short notes on expanding hand reamers and adjustable machine reamers.
6. a. Sketch and explain the hydraulic drive of a horizontal shaper.
b. Describe the working of a crank and slotted link mechanism.
7. a. Discuss the principle of operation of a shaper with a neat sketch.
b. Make a note on different types of work holding devices used in a slotting machine.
8. a. What are the operations performed on a drilling machine?
9. b. Explain different types of drilling machines with their special features?
10. a. List out the differences between shaper and planner.
b. Explain with a sketch “Fast and loose pulleys” quick return mechanism of a planer table.

UNIT - IV - ABRASIVE PROCESSES AND BROACHING

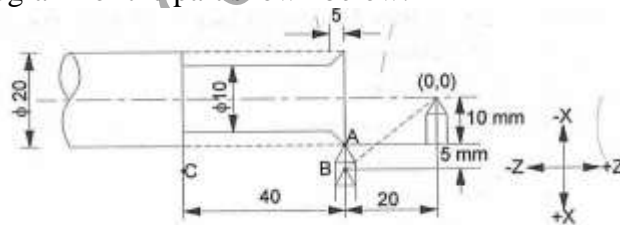
PART- B

1. Explain the working mechanism of cylindrical and surface grinding.
2. a. Describe gear cutting by forming and shaping.
b. Give the specification of grinding wheel.
3. Explain the working principle and various methods of centreless grinding with a neat sketch.
4. Sketch and explain the three methods of external cylindrical centreless grinding.
5. What is meant dressing and truing of grinding wheel?
6. Explain the abrasive jet grinding with diagram.
7. How do you classify cylindrical grinders? What is the difference between “Plain and universal “cylindrical grinder?
8. a. Write short notes on gear shaping.
b. List the advantages and disadvantages of gear shaping process.
9. a. Describe Honing process.
b. Explain gear hobbing process over other gear generation processes.
10. a. Briefly discuss about the different types of abrasives used in a grinding wheel.
b. Describe the use of cutting fluids in grinding.

UNIT - V - CNC MACHINING

PART -B

1. Define CNC and DNC. With a help of a diagram explain the working of NC machine tool.
2. a. Narrate the design considerations of CNC machines.
b. Discuss about slide ways used in CNC machine tools.
3. a. List the difference between manual and computer assisted part programming.
b. Describe the drive systems used in CNC.
4. Explain the following in CNC machining.
 - a. Linear Interpolation
 - b. Circular Interpolation
 - c. Cubic interpolation
5. a. Explain the main difference between point to point and continuous path of numerically controlled machine tools.
b. Under what conditions of production the numerically controlled machine tools are employed.
6. a. With a neat sketch, explain the working of ATC?
b. Write short notes on APT language.
7. Explain the various elements of NC machine with closed loop control system.
8. Describe the spindle and feed drives. State the requirement of the drives of CNC machine tools.
9. a. List any five motions and control statements of computer assisted NC programming and explain.
b. Under what conditions of production the numerically controlled machine tools are employed.
10. a. Write the part program for the part shown below.



- b. Write the part program for drilling holes in the part shown below. The plate thickness is 20mm.

