ME8451 Manufacturing Technology – II
Question Bank
Unit 1 – Theory of Metal Cutting

1. List the various metal removal processes?

a. Non cutting process or chip less process.
b. Cutting process or Chip process

2. How chip formation occurs in metal cutting?

The material of the work piece is stressed beyond its yield point under compressive force .This cause the material to deform plastically and shear off.

3. What is tool wear?

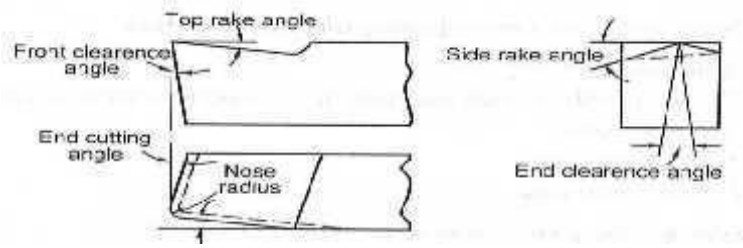
During machining the tool is subjected to three important factors such as forces, temperature and sliding action due to relative motion between tool and work piece. Due to these factors tool will undergo wear.

4. Mention the cutting fluids?

Two basic types are

(i) Water based cutting fluids
(ii) Straight or heat oil based cutting fluids

5. Draw the nomenclature of cutting tool geometry or cutting tool signature.



6. Compare orthogonal 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 angle with the normal on the cutting edge.

7. Define tool life.

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

8. What are the objectives and functions of cutting fluids?
   (i) It is used to cool the cutting tool and work piece
   (ii) It improves surface finish
   (iii) It protects finished surface from corrosion
   (iv) It washes away chips from tool
9. Briefly explain the effect of rake angle during cutting?
   Effect of back rack angle:
   For softer material greater angle should be given for harder material smaller angle is enough
   Effect of Side rack angle:
   Curling of chip depends on this angle.

10. What are the factors responsible for builtup edge in cutting tools?
    (i) Low cutting speed
    (ii) Small rake angle
    (iii) Coarse feed
    (iv) Strong adhesion between chip and tool face.

11. List out the essential characteristics of a cutting fluid.
(i) It should have good lubricating properties
(ii) High heat absorbing capacity
(iii) High flash point
(iv) It should be odorless

12. Name the various cutting tool materials.
(i) Carbon tool steel
(ii) High speed steel
(iii) Cemented carbides
(iv) Ceramics
(v) Diamonds

13. Give two examples of orthogonal cutting.
(i) Turning (ii) Facing (iii) Thread cutting (iv) Parting off

14. What are the four important characteristics of materials used for cutting tools?
(i) Hot hardness (ii) Wear resistance (iii) High thermal conductivity (iv) Easy to grind and sharpen (v) Resistance to thermal shock

15. 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

16. Name the factors that contribute to poor surface finish in cutting.
(i) Cutting speed
(ii) Feed
(iii) Depth of cut

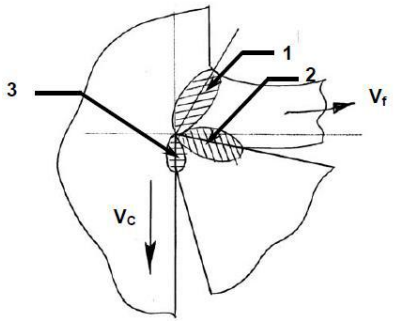
17. Define the term machinability and machinability rating.
Machinability:- It can be defined as ability of being machined the components and more reasonably as ease of machining.

Machinability rating:- Relative machining response of the work materials compared to that of a standard metal was tried to be evaluated quantitatively only based on tool life (VB* = 0.33 mm) by an index

$$= \frac{\text{speed (fpm) of machining the work giving 60 min tool life}}{\text{speed (fpm) of machining the standard metal giving 60 min tool life}} \times 100$$

18. Write a short note on Heat zones in cutting.

- Primary shear zone (1) where the major part of the energy is converted into heat
- Secondary deformation zone (2) at the chip – tool interface where further heat is generated due to rubbing and / or shear
- At the worn out flanks (3) due to rubbing between the tool and the finished surfaces



19. Write a short note on any two modern tool materials.

(a) Coated carbides
(b) Cermets
(c) High Performance Ceramics (HPC)
(d) Cubic Boron Nitride (cBN)
(e) Diamond

Coated Carbides:-The properties and performance of carbide tools could be substantially improved

• Refining microstructure

- Manufacturing by casting – expensive and uncommon
- Surface coating – made remarkable contribution.

Thin but hard coating of single or multilayers of more stable and heat and wear resistive materials like TiC, TiCN, TiOCN, TiN, Al2O3 etc on the tough carbide inserts (substrate) by processes like chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD) etc at controlled pressure and temperature enhanced MRR and overall machining economy

Cermets:- These sintered hard inserts are made by combining 'cer' from ceramics like TiC, TiN, TiCN and 'met' from metal (binder) like Ni, Ni-Co, Fe etc. Since around 1980, the modern cermets providing much better performance are being made by TiCN which is consistently more wear resistant, less porous and easier to make.

20. What are the main requirements of cutting tool materials?

i) High mechanical strength; compressive, tensile, and TRA

ii) Fracture toughness – high or at least adequate

iii) High hardness for abrasion resistance

iv) High hot hardness to resist plastic deformation and reduce wear rate at elevated temperature

v) Chemical stability or inertness against work material, atmospheric gases and cutting fluids

vi) Resistance to adhesion and diffusion

vii) Thermal conductivity – low at the surface to resist incoming of heat and high at the core to quickly dissipate the heat entered

viii) High heat resistance and stiffness

ix) Manufacturability, availability and low cost.

21. List the physical function of a machine tool in machining.

The physical functions of a machine tool machining are

(i) Firmly holding the blank and the tool

(ii) Transmit motions to the tool and the work piece

(iii) Provide power to the tool-work pair for the machining action

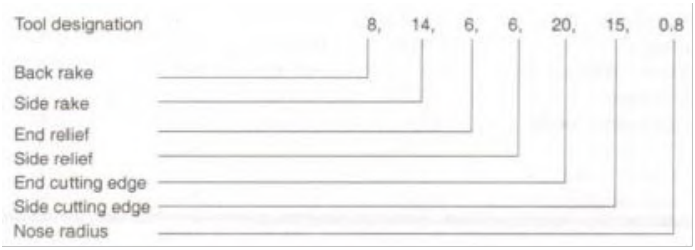
(iv) Control of the machining parameters.

22. Classify the types of cutting fluids.

Oils - mineral, animal, vegetable, compounded, and synthetic oils,
Emulsions - a mixture of oil and water and additives
Semisynthetics - chemical emulsions containing little mineral oil
Synthetics - chemicals with additives

23. What do you understand by the term "Tool Designation or Tool Signature"?

Consider the example



ORA System

–6º, –6º, 10º, 15º, 15º, 45º, 1.2 (mm)
Inclination Angle (λ) = –6º,
Orthogonal Rake Angle (γ) = –6º,
Orthogonal Clearance Angle (α) = 10º,
Auxiliary Orthogonal Clearance Angle (α_o') = 15º,
Auxiliary Cutting Edge Angle (Φ_1) = 15º,
Principal Cutting Edge Angle (Φ) = 45º,
Nose Radius (r) = 1.2 mm.

24. What are the factors that affect the tool life?
Work piece material, Tool Geometry, Use of cutting fluid, Process parameter

ME8451 Manufacturing Technology – II
Question Bank
Unit 2 – Turning Machines

1. What are the various thread cutting methods?
(1) Reversing the machine.
(2) Marking the lathe parts
(3) Using a chasing dial or thread indicator
(4) Using thread chaser

2. What is Swiss type automat?
In this type, the work piece is feed against the tool. The head stock carrying the bar stock moves back and forth for providing the feed movement in the longitudinal direction.

3. Explain the following parts of lathe?
(a) Lathe bed
(b) Carriage
Lathe bed: It is the base of the machine. It carries headstock on its left end and tailstock on its right end.
Carriage: It is the moving part that slides over the guide ways between headstock and tailstock.

4. What is an apron?
It is an integral part of several gears, levers and clutches which are mounted with saddle for moving the carriage along with lead screw while thread cutting.

5. List any four methods by which taper turning is done in a center lathe.

(i) Form tool method
(ii) Tailstock set over method
(iii) Compound rest method
(iv) Taper turning attachment method

6. Distinguish between Capstan lathe and Turret lathe.

S No	CAPSTAN LATHE	TURRET LATHE
1	Turret head is mounted on a ram which slides over the saddle.	Turret head is directly mounted on saddle .But it slides on the bed
2	Turret movement is limited	Turret moves on the entire length of the bed without any restriction.

7. Mention four different 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 purpose of a 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) Step mandrel
(5) Gang mandrel

9. What are the advantages of using a collect chuck?
(i) Job setting will be easy and quicker
(ii) Heavy cut can be taken

10. Why is it essential that the cutting point of the tool should be level with the spindle center while machining taper on a work piece?
It is done to avoid eccentric taper.

11. What is the difference between a ram type turret lathe and saddle type turret lathe?

S No	RAM TYPE TURRET LATHE	SADDLE TYPE TURRET LATHE
1	Turret head can be moved manually	Turret head cannot be moved manually.
2	The maximum size of 60mm diameter work can be accommodated.	It can accommodate only from 125 to 200mm.

12. Calculate the power required for cutting a steel rod of 50mm in diameter at 200rpm. Assume cutting force of 160 kg.
Power Required = FC X V
= FC x DN
= (160 x 9.81) x 1000 X 50 X 200 X 1000 X 60
= 821.8 kW

13. What are the advantages of automatic lathes?
(i) Mass production of identical parts.
(ii) High accuracy is maintained
(iii) Time of production is minimized.
(iv) The bar stock is fed automatically.

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

Feed Rod: It is used to guide the carriage in a straight then 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 for thread cutting operation.

15. Why was power chucks developed?

Power chucks are primarily developed for the application as work holding divides for automatic machines, numerical control and CNC machines

16. Give the specification of a lathe

The size of the lathe is specified as follows

i) The length between the centres
ii) The length of bed
iii) The height of the centres
iv) The maximum diameter
v) The swing diameter of the bed
vi) The swing diameter over carriage

17. What is meant by “swing of the lathe”?

Swing over bed refers to the maximum diameter of work piece the lathe can handle.

Swing over cross slide means the maximum diameter that will clear the cross slide.

18. What do you mean by copy turning?

Copy turning is carried out on special lathes that control the cutting tool in some manner to produce identical items.

The copy lathe uses a template to guide the cutter. They are capable of creating good quality components for little expense in patterns and setting up. Sanding is usually carried out by hand.

19. List out the various types of lathe.

(i) Speed lathe
(ii) Engine lathe
(iii) Bench lathe
(iv) Tool room lathe
(v) Semi-Automatic lathe
(vi) Automatic lathe
(vii) Special purpose lathe
(viii) Copying lathe

20. How are automatic lathes are classified?

The automatic lathes can be classified as follows:

1. Classification according to the type of work materials used
   (a) Bar stock machine
   (b) Chucking machine
2. Classification according to the number of spindles
   (a) Single spindle machine
   (b) Multi spindle machine
3. Classification according to the position of spindles
   (a) Horizontal spindle type
   (b) Vertical spindle type
4. Classification according to the use
   (a) General purpose machine
   (b) Single purpose machine
5. Classification according to the feed control
   (a) Single cam shaft rotating at constant speeds.
   (b) Single can shaft with two speeds.
   (c) Two cam shafts.

21. What are the various mechanisms are used for a automatic feeding in lathes?

(i) Tumbler gear mechanism
(ii) Quick change gear box mechanism
(iii) Tumbler gear mechanism
(iv) Apron mechanism

22. Write the advantages of automat over conventional lathes
    (i) Mass production is identical parts
    (ii) High accuracy is maintained
    (iii) Time of production is minimized
    (iv) The bar stock is feed automatically

23. What is called carrier plate and lathe dog?

    Carrier plate – Threaded hole mounted on lathe spindle for transfer motion

    Lathe dog – Transfer motion from driving plate to workpiece between centers

24. Differentiate semi-automatic and automatic lathe.

    Semi-automatic – Loading and unloading can be done manually

    Automatic lathe - Capable of producing identical process at a time with auto set up

ME8451 Manufacturing Technology – II

Question Bank

Unit 3 – Shaper, Milling and Gear Cutting Machines

1. Mention the differences between shaper and planer.

Sl No	Shaper	Planar
1	Tool reciprocates and the work is stationary	Tool is stationary and work reciprocates
2	Less accuracy due to overhanging of ram	It gives more accuracy as the tool is rigidly supported during cutting.

2. What are the differences between drilling and reaming?

Drilling is the operation of producing cylindrical hole in a work piece. It is done by rotating the cutting edge of a cutter known as drill. The work is rotated at high speed.

Reaming is the operation of finishing and sizing hole which is already drilled while the work is revolved at a very slow speed.

3. Briefly describe the importance of quill mechanism.

If the taper shank of drill is smaller than the taper in the spindle hole, a sleeve is used. The sleeve with drill is fitted in the hole of the spindle. The sleeve has outside taper surface. This fits into the tapered hole of the spindle.

4. List the types of sawing machines.

Types of sawing machines are (1) Reciprocating saw (2) Circular saw (3) Band saw

5. Define the cutting speed, feed and machining time for drilling.

Cutting Speed: It is the peripheral speed of a point on the surface of the drill in contact with the Work piece. It is usually expressed in m/min.

Feed: It is the distance of a drill moved into the work at each revolution of the spindle. It is expressed in mm/rev.

Machining time: The time taken to complete the machining process without considering the idle time of machines is called machining time.

6. What is broaching?

It 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.

7. What is the difference between up milling and down milling?

Sl No	Operation	Up Milling	Down Milling
1	Direction of travel	Cutter rotates against the direction of travel of work piece	Cutter rotates in the same direction of travel of work piece
2	Cutting Force	Increases from zero to max per tooth	Decreases from max to zero per tooth.

8. List four applications of broaching machines.

(i) Straight and helical slots
(ii) External surfaces of various shape
(iii) External and internal toothed gears
(iv) Holes of cross sectional shape

9. How do you classify milling cutters?

They are classified based on following factors

(i) According to the shape of the teeth.

(ii) According to the type of operation

(iii) According to the way of mounting on the machine

10. What do you know about straight fluted drill and fluted drill?

The reamer with helical flutes provides smooth shear cutting action and provides better surface finish .The pitch of the flutes is made uneven to reduce vibration.

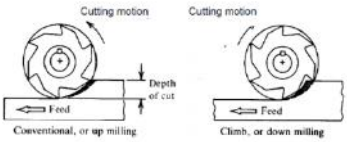
11. Write the differences between drilling and tapping.

Drilling is the operation of producing cylindrical hole in a work piece. It is done by rotating the cutting edge of a cutter known as drill. The work is rotated at high speed.

Tapping is the process used for making internal threads in a machine component by a tool called "TAP"

12. Differentiate conventional and climb milling?

Conventional milling	**Climb milling**
Work is feed against the rotating cutter	Work moves parallel to the cutter rotation
Thickness of the chip is minimum in the initial stages and increases maximum at the end of the cut	Thickness of the chip is maximum in the initial stages and minimum at the end of the cut
Cutter lifts the work, so requires more claiming force	Cutter holds the work. Requires less claiming force
Surface finish is not good,	Good surface finish



13. State the differences between a vertical shaper and slotters.

Sl No.	Vertical Shaper	Slotter
1	Vertical shapers generally fitted with rotary table to machine curved surfaces	Rotary table along with tools will move
2	Slides are fitted	Slides will move to perform slotting.

14. What is a shell mill?

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

15. Mention the operations performed by a planner.

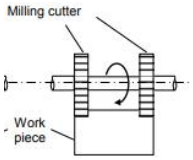
a. Planning horizontal surface
b. Planning of an angle
c. Planning vertical surface
d. Planning curved surface

16. Why is sawing a commonly used process.

a. Easy handling of machines and spindle construction
b. Fast operation and cost of machinery is less

17. What is straddle milling?

It is just like side milling with difference that cutting (milling operation) takes place simultaneously on both the sides of work piece as shown in the figure.



18. What do you mean by differential indexing?

Differential indexing is similar to compound indexing except that the index plate is turned during the indexing operation by gears connected to the dividing head spindle. Because the index plate movement is caused by the spindle movement, only one indexing procedure is required. The gear train between the dividing head spindle and the index plate provides the correct ratio of movement between the spindle and the index plate.

Differential indexing

- Index plate must be revolved either forward or backward part of a turn while index crank turned to attain proper spacing (indexing).
- Change of rotation is effected by idler gear or gears in gear train.

$$\text{Change gear ratio} = (A - N) \times \frac{40}{A}$$
$$= \frac{\text{driver (spindle) gear}}{\text{driven (worm) gear}}$$

A = approximate number of divisions
N = required number of divisions

19. Why is milling a versatile machining process?

Milling machines are very versatile. It is usually used to machine flat surfaces, but can also produce irregular surfaces. It can also be used to drill, bore, cut gears, and produce slots.

20. What do you understand by Gang milling?

Gang milling is the process of producing many surfaces of a job simultaneously by feeding the table against a number of required cutters. In gang milling, being employed, where feasible, for quick production of complex contours comprising a number of parallel flat or curved surfaces a proper combination of several cutters are mounted tightly on the same horizontal milling arbour.

21. What is gear finishing? Why it is done?

Surface of gear teeth with accurate and of good quality cannot be produced by any of the generating processes. Dimensional inaccuracies and rough surface generated so become the source of lot of noise, excessive wear and backlash generated between the pair of gear in mesh, so the result of the loss of power to be transmitted and incorrect velocity ratios. Therefore, these gears cannot transmit power efficiently. Hence these problems can be overcome by finishing operations.

22. Name any four work holding driven in shaper.

(i) Shaper vice
(ii) Angle plate
(iii) V-Block
(iv) Clamps

23. List out the various milling operations.

(i) Plain or Slab Milling
(ii) Face Milling
(iii) Angular Milling
(iv) Straddle Milling

24. List the applications of gear hobbing.

Gear hobbing is used for generating spur gear, helical gear and worm gear

25. Define lapping

The lapping process only corrects minute deviations from the desired gear tooth profiles. The gear to be finished after machining and heat treatment and even after grinding is run in mesh with a gear shaped lapping tool or another mating gear of cast iron. An abrasive lapping compound is used in between them. The gear tooth contact substantially improves by such lapping.

26. Define gear shaving.

The teeth of straight or helical toothed external spur gears and worm wheels of moderate size and made of soft materials like aluminium alloy, brass, bronze, cast iron etc. and unhardened steels are mostly finished by shaving process.

27. Why reaming operation is performed?

Reaming is a machining process that uses a multi edges fluted cutting tool to smoothen, enlarge or accurately sized an existing hole. It is performed using drilling machine

27. Define cutting ratio of the shaper

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

$$\frac{\text{Time of cutting stroke}}{\text{Time of return stroke}} = \frac{\alpha}{\beta} = \frac{\alpha}{360^\circ - \alpha} \quad \text{or} \quad \frac{360^\circ - \beta}{\beta}$$

ME8451 Manufacturing Technology – II
Question Bank
Unit 4 – Abrasive Process and Broaching

1. What are the specifications of grinding wheel?
   (a) Type of bond
   (b) Grit or grain size
   (c) Grade
   (d) Structure Abrasive
   (e) Manufacturer's Code

2. What is honing?
   An abrading process of finishing previously machined surfaces is called honing.

3. Narrate the working principle of abrasive jet machining.
   In this type the electrolyte used is replaced by abrasive jet. But grinding process is as similar that of electrochemical grinding.

4. What is gear hobbing?
   The process of generating a gear by means of rotating a cutter called HOB is known as HOBBING.

5. Define hardness of the grinding wheel.
   Grade or hardness indicates the strength with which the bonding material holds the abrasive grains in the grinding wheel.

6. Define lapping.
   Lapping is a surface finishing process used for producing geometrically accurate flat, cylindrical and spherical surfaces.

7. What is meant by “grade” and “structure” of a grinding wheel?
Grade or hardness indicates the strength with which the bonding material holds the abrasive grains in the grinding wheel. Structure denotes the spacing between the abrasive grains or in other words the density of the wheel.

8. What are all the parameters that would affect the MRR in abrasive jet machining?

The metal removal rate is affected by the following factors
Grinding wheel speed
Type of abrasive used
Capacity of pump
Capacity of filter

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

(1) Constant factors
  (a) Physical properties of material to be ground
  (b) Amount and rate of stock to be removed
  (c) Area of contact
  (d) Type of grinding machine
(2) Variable factors
  (a) Work speed
  (b) Wheel speed (c) Condition of grinding wheel

10. What is roller burnishing process?

It is a method of cold working metal surfaces in which hardened sphere or cylindrical roller is pressed against the work to be processed

11. What is the need of truing and dressing operations in a grinding wheel?

To break away the glazed surface so that the new sharp abrasive particles are again present to work for efficient cutting

To trim the cutting surface of the wheel to run true with the axis.

12. List the advantages of honing?

Simple process which can be done on any general purpose machines such as lathes and drilling machines.

This process can be applied for both internal cylindrical and flat surfaces.

Honing enables the maximum stock removing capacity out of entire surface finishing operation.

13. State the abrasives used in manufacture of grinding wheels.

(1) Natural abrasives
   - (a) Sandstone or solid quartz
   - (b) Emery
   - (c) Corundum
   - (d) Diamond

(2) Artificial abrasives
   - (a) Aluminium oxide
   - (b) Silicon carbide
   - (c) Artificial diamond
   - (d) Boron carbide
   - (e) Cubic Boron Carbide

14. What are the types of surfaces that can be produced using plain cylindrical grinders?

Plain cylindrical parts, Cylinders, Tapers, Shoulders, Fliers etc.,.

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

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

16. How does wheel dressing differ from wheel truing?

Truing is defined as the process of shaping the grinding wheel while it is mounted on the grinding spindle in order to remove out-of-roundness and to impart the desired profile to the surface of the wheel.

Dressing which is sometimes performed after truing, is the process of conditioning the surface of the wheel to expose fresh abrasive particles.

17. How does loading differ from glazing in grinding process?

Loading: During the operation the chips are formed get entrapped in the inner granular space of abrasive particles

Glazing: Surface of the wheel becomes smooth and gets a glass like appearance

18. What are the principal types of broaching machines?

(i) Horizontal broaching machine
(ii) Vertical Broaching machine
(iii) Surface broaching machine
(iv) Continuous broaching machine

19. What do you mean by duplex broach?

Duplex broaching is a machining process that uses a toothed tool, called a duplex broach to remove material.

20. Define grinding ratio

Wheel life in grinding is expressed as a grinding ratio, G, defined as the volume of material removed per unit volume of grinding wheel wear. G-ratio is an important parameter because it is directly related to wheel cost for most operations.

21. Why broaching process is long and laborious?

Broaching is a machining operation that involves the use of a multiple, tooth cutting tool moved linearly relative to the work piece in

the direction of the tool axis. So broaching process is long since all the machining parameters are built into the broach, skill is required from the operator.

ME8451 Manufacturing Technology – II
Question Bank
Unit 5 – CNC Machining

1. Define NC.

Automatically controlling a machine tool based on a set of pre-programmed machining and movement instructions is known as numerical control, or NC.

2. Name the major elements of NC machines.

- Tape reader
- Mini computer
- Servos and interface logic
- Motion feedback

3. What are the classifications of NC machines?

- Point to point NC system
- Straight cut NC system
- Contouring NC system

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 microcomputer based controller unit is used.

5. Define DNC.

Distributive numerical control or Direct Numeric Control (DNC) is a technology that allows a single computer to be networked with one or

more machines that use computer numerical control (CNC) through connection and in real time. Using DNC, an operator can quickly load CNC programs into multiple machines. It is also possible to remove programs and replace them with updated or modified programs.

6. What is the difference between incremental and absolute system.

In an incremental system the movements in each Part program block are expressed as the displacements along each coordinate axes with reference to the final position achieved at the end of executing the previous program block.

An absolute NC system is one in which all position coordinates are referred to one fixed origin called the zero point

7. What are G-Codes and M-Codes?

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

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

8. Define Part programming

Part program is a set of instructions often referred to as blocks, each of which refers to a segment of the machining operation performed by the machine tool. Each block may contain several code words in sequence. These provide:

(i) Coordinate values (X, Y, Z, etc.)
(ii) Machining parameters such as, feed rate, spindle speed, tool number, tool offset compensation parameters etc.
(iii) Codes for initiating machine tool functions
(iv) Program execution control codes

9. List the differences between NC and CNC.

NC Machine	CNC Machine
NC stands for Numerical Control	CNC stands for Computer Numerical Control.
It is defined as the machine which is controlled by the set of instructions in the form of numbers, letters and symbols. The set of instructions is called as program.	It is defined as the machine which is used to control the motions of the work piece and tool with the help of prepared program in computer. The program is written in alphanumeric data.
In NC machine the programs are fed into the punch cards.	In CNC machine the programs are fed directly into the computer by a small key board similar to our traditional keyboard.
Modification in the program is difficult.	Modification in the program is very easy.
The programs in the NC machine cannot be stored.	In CNC machines, the programs can be stored in the computer and can be used again and again.
The accuracy is less as compared with the CNC.	It has high accuracy.
High skilled operator is required.	Less skilled operator is required.
Cost of the machine is less.	Cost of the CNC machine is high.
Maintenance cost is less	Maintenance cost is high.

10. What are feed drives?

Feed drives are used to drive the axis as per the programme fed in the CNC machine.

11. What is meant by APT language?

It is the abbreviation of automatically programmed tools. APT program is used to command the cutting tool through its

sequence of machining process. APT is also used to calculate the cutter positions. APT is a three dimensional system controlling up to five axes including rotational coordinates.

12. Write down the types of statements in APT language.
(i) Geometric statements
(ii) Motion statements
(iii) Post processor statements
(iv) Special control or auxillary statements

13. Compare a closed loop NC system with open loop system.

Open loop	**Closed loop**
The term open-loop means that there is no feedback, and in open loop systems the motion controller produces outputs depending only on its set points, without feedback information about the effect that the output produces on the motion axes.	A closed loop system is also referred as a feedback control system. These systems record the output instead of input and modify it according to the need. It generates preferred condition of the output as compared to the original one. It doesn't encounter any external or internal disturbances.
The primary drawback of open-loop system is that there is no feedback system to check whether the commanded position and velocity has been achieved.	The control law takes the error as the input and drives the actuator, in this case the servo motor and its drive system, to achieve motion variables that are close to the set points.

14. What is a preparatory function? How is it important in CNC programming?

Preparatory commands which prepare the machine or tool for different modes of movement like positioning contouring, thread cutting and also proceed the dimension word .They are grouped .Group cannot affect each other. Only one function from the same group can be at the same time.

15. Write the advantages of a CNC Machine

(i) Higher flexibility
(ii) Increased productivity
(iii) Improved quality
(iv) Reduced scrap rate
(v) Reliable and Safe operation
(vi) Several machines are fused into one.

16. State the limitations of CNC machine tools.

(i) CNC machines are more expensive than manually operated machines, although costs are slowly coming down
(ii) The CNC machine operator only needs basic training and skills, enough to supervise several machines.
(iii) Less workers are required to operate CNC machines compared to manually operated machines

17. State the limitations of NC machine tools.

(i) Relatively higher cost compared to manual versions
(ii) More complicated maintenance due to the complex nature of the technologies
(iii) Need for skilled part programmers.
(iv) It offers less flexibility and computational capability.
(v) It requires more time for the execution of the job.

18. What are linear bearings?

A linear motion bearing or linear slide is a bearing designed to provide free motion in one dimension. Linear motion bearings are widely used to guide, support , locate and accurately move machinery components and products in a wide range of automation application.

19. State the functions of the following G and M codes?

G01 G04 M04 M30

G01 - Linear move

G04 – Dwell

M04 - spindle on CCW

M30 - end of tape (rewind)

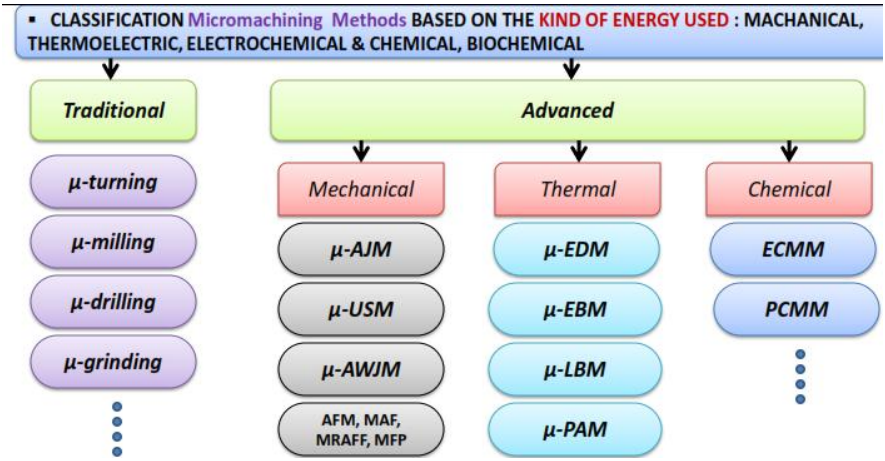
20. Compare Bulk and surface micro machining Process.

Bulk micromachining, the oldest of the micromachining technologies, is accomplished by removing material from a substrate to create holes, cavities, channels, or other desired shapes Surface micromachining etches away layers deposited on top of the silicon substrate. The process starts with a silicon wafer, upon which structural and sacrificial layers are deposited.

Surface Micromachining is the process of forming movable structures by placing the structures on initially rigid platforms, then removing the platforms, usually by etching the material away.

21. Define micromachining?

Micro machining is defined as the ability to produce features with the dimensions from 1 µm to 999 µm or when the volume of the material removed is at the micro level. Classification of micromachining methods as shown in figure.



22. Mention the type of ball screws.

Ball screws can be classified as follows;

(1) By ball circulation method
   - (a) Return pipe type
   - (b) Deflector type
   - (c)End cap type

(2) By preloading method
   - (a) Fixed point preloading method
   - (b) Constant pressure preloading type.

(3) By screw shaft
   - (a) Precision ball screws
   - (b) Rolled ball screws

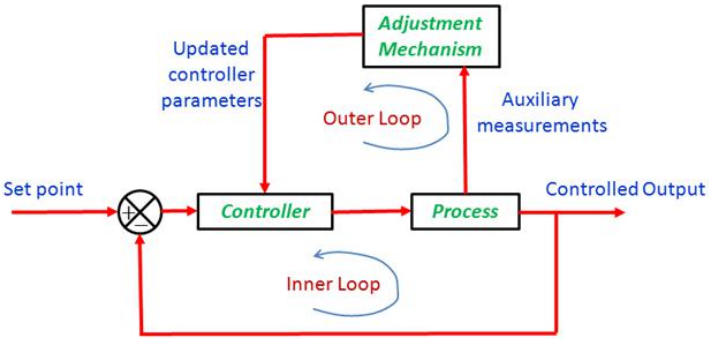
23. Differentiate Automation and Mechanization.

Mechanization is normally defined as the replacement of a human task with a machine. Automatic transplants are an example of mechanization.

Automation involves the entire process, including bringing material to and from the mechanized equipment. It normally involves integrating several operations and ensuring that the different pieces of equipment talk to one another to ensure smooth operation. Many times, true automation requires re-evaluating and changing current processes rather than simply mechanizing them.

24. What is adaptive control?

Adaptive control is the capability of the system to modify its own operation to achieve the best possible mode of operation. Flow chart as shown in figure.



Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 77214

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Mechanical Engineering

ME 6402 — MANUFACTURING TECHNOLOGY – II

(Common to Industrial Engineering, Industrial Engineering and Management and Mechanical and Automation Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write a short note on Heat zones in cutting.

2. Write a short note on any two modern tool materials.

3. What is meant by "swing of the lathe"?

4. What do you mean by copy turning?

5. What do you mean by differential indexing?

6. Why is milling a versatile machining process?

7. How does loading differ from glazing in grinding process?

8. What are the principal types of Broaching machines?

9. Define CNC and DNC.

10. What is adaptive control?

PART B — (5 × 16 = 80 marks)

11. (a) (i) With reference to orthogonal cutting, explain the following terms: Shear stress in shear plane, Shear strain, Cutting ratio, Shear angle. (8)

(ii) Prove that in orthogonal cutting, the kinetic coefficient of friction (μ) is given by $\mu = \dfrac{F_t \sin\alpha + F_c \cos\alpha}{F_c \cos\alpha - F_t \sin\alpha}$. (8)

Or

(b) (i) Tool life tests in turning yield the following data: (1) V = 110m/min, T = 20 min; (2) V = 85 m/min, T = 40 min. (A) Determine the n and C values in the Taylor tool life equation. Based on the equation, compute (B) the tool life for a speed of 95 m/min and (C) the speed corresponding to a tool life of 30 min. (8)

(ii) Explain different types of chips produced in cutting with neat sketches. (8)

12. (a) (i) Enumerate the purpose of various attachments used on a centre lathe. (8)

(ii) Explain with a neat sketch single spindle automatic lathe. (8)

Or

(b) (i) Describe a Universal type milling machine. (8)

(ii) Explain the salient features of an automatic screw machines. (8)

13. (a) (i) Explain with neat sketches the procedure for carrying out the following operations on a shaper: Horizontal cutting, Vertical cutting, concave surface, keyway cutting. (8)

(ii) List out the gear finishing processes. Explain any two with neat sketches. (8)

Or

(b) (i) Enumerate with a neat sketch Gear shaping. (8)

(ii) Compare Plain and Universal milling machine. (8)

14. (a) (i) Enumerate the advantages and disadvantages of centreless grinding. (8)

(ii) Explain the following in grinding (1) Dressing of (2) Truing. (8)

Or

(b) (i) The performance of a grinding wheel depends upon type of abrasive, grain size, grade, structure and bonding material. Discuss the effect of each. (8)

(ii) Discuss with neat sketch Vertical Broaching machine. (8)

15. (a) (i) Discuss the programming of NC machines. (8)

(ii) Discuss the constructional features of a NC machine tool and explain their functions. (8)

Or

(b) (i) List and explain the advantages of CNC systems over conventional NC systems. (8)

(ii) Explain the main difference between point to point and continuous path type numerically controlled machine tools. (8)

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Question Paper Code : 57550

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Mechanical Engineering

ME 6402 – MANUFACTURING TECHNOLOGY – II

(Common to Industrial Engineering, Industrial Engineering and Management and Mechanical and Automation Engineering and also common to sixth semester Mechanical Engineering (SANDWICH))

(Regulation 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Differentiate between orthogonal and oblique cutting.
2. The useful tool life of an HSS tool, machining mild steel at 25 m/min is 5 hours. Calculate the tool life when tool operates at 40 m/min.
3. How do you specify a lathe ?
4. What are the differences between automatic lathe and capstan lathe ?
5. Distinguish between up milling and down milling.
6. Why gear finishing is required ?
7. How do you specify a grinding wheel ?
8. What are the three methods of external cylindrical centreless grinding ?
9. State the functions of the following G & M codes :
   G00 G03 M06 M03
10. Define "micromachining" with the help of an example.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Discuss any four cutting tool materials used in metal cutting. (8)

(ii) In an orthogonal cutting test with a tool of rake angle 8°, the following observations were made :

Chip thickness ratio : 0.2

Horizontal component of the cutting force = 1190 N

Vertical component of the cutting force = 1450 N

From Merchant's theory, calculate the various components of the cutting forces and the coefficient of friction at the chip tool interface. (8)

OR

(b) (i) Enumerate with neat sketch, measurement of cutting temperature using work-tool thermocouple method. (8)

(ii) Describe various methods of applying cutting fluid at the cutting zone. (8)

12. (a) (i) Discuss any two operations that can be performed on a lathe ? (8)

(ii) What are the various methods available for supporting long components and fragile components in a lathe ? Explain with sketches. (8)

OR

(b) (i) Enumerate with neat diagram the principal parts of capstan and turret lathe. (8)

(ii) Describe various types of multi spindle automats. (8)

13. (a) (i) List out various operations carried out on drilling machine. Explain any three. (8)

(ii) What are the various types of milling cutters that are used in milling ? Discuss any three. (8)

OR

(b) (i) What are the various methods used for gear finishing ? Discuss any two methods. (8)

(ii) Enumerate with neat sketch kinematics of gear shaping machine. (8)

14. (a) (i) List out various abrasives used in grinding wheel. Explain any three. (8)

(ii) Explain with neat sketches the three methods of external cylindrical centreless grinding. (8)

OR

(b) (i) Explain with neat sketches Horizontal pull broaching operation and Vertical push broaching operation. (8)

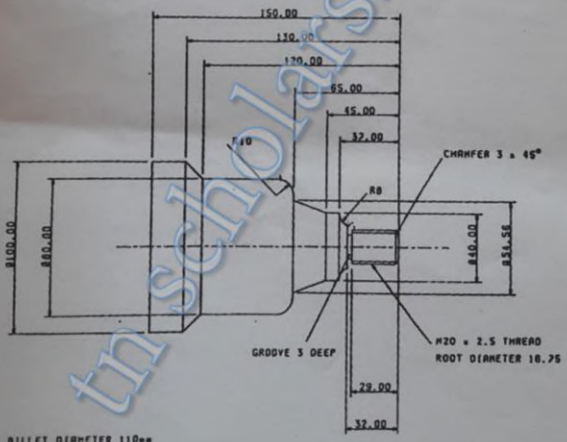
(ii) List out various types of bonding materials used in grinding wheel. Explain any three. (8)

15. (a) (i) Enumerate the constructional features of CNC machining centre. (8)

(ii) Describe various type of CNC machine based on tool motion. (8)

OR

(b) Write CNC part program for the component shown in Fig. Mention the assumptions made. (16)



All dimensions in mm.

Fig. Q 15(b)

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 72142

05/06/2017 FN

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fourth/Sixth Semester

Mechanical Engineering

ME 6402 — MANUFACTURING TECHNOLOGY — II

(Common to Mechanical Engineering (Sandwich), Industrial Engineering, Industrial Engineering and Management, Mechanical and Automation Engineering)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you understand by cutting tool signature?
2. Define the term machinability and machinability index.
3. How do specify lathe size?
4. Name the methods of taper turning on lathe.
5. What do you understand by Gang milling?
6. What is gear finishing? Why it is done?
7. What do you mean by duplex broach?
8. Define the terms 'Glazing' and 'Loading' with respect to grinding wheels.
9. Distinguish Mechanisation and Automation.
10. What is the need for micromachining? Mention the four categories of micromachining techniques.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Describe the mechanism of chip formation. (7)

(ii) How are the chips classified? Specify the condition under which they are formed. (6)

Or

(b) (i) What are the three main regions of heat generation in metal cutting? (4)

(ii) Explain the mechanisms associated with progressive tool wear. (9)

12. (a) (i) Discuss any four operations that can be performed in a lathe. (8)

(ii) A hollow workpiece of 50 mm diameter and 200 mm long is to be turned over in 4 passes. If the approach length is 20 mm over travel 10 mm, feed 0.8 mm/rev and cutting speed 30 m/min. Find machining time. (5)

Or

(b) (i) Explain the classification of automatic lathes. (5)

(ii) Describe the features of Swiss type automatic and Bar type automatics. (8)

13. (a) (i) Sketch a twist drill and label. (5)

(ii) With a help of a diagram explain cranck and slotted link mechanism. (8)

Or

(b) Describe any two methods of gear generation that suits mass production.

14. (a) (i) Discuss briefly the standard specification of Grinding wheel. (6)

(ii) What are the factors to be considered during the selection of appropriate Grindy wheel? (7)

Or

(b) (i) Sketch an internal broach tool and label it. (6)

(ii) What are the different types of broaching machines? Explain any two of them. (7)

15. (a) (i) Discuss the different data input devices of NC machine tool. (6)

(ii) Describe the features of a machinery center. Why the machining centers are particularly advantages for the use of NC? (7)

Or

(b) (i) What are the different types of control systems in Numeric Control? (5)

(ii) Explain the following with respect to manual part programming :

(1) M codes and G codes

(2) Program sheet

(3) Canned cycle

(4) Coordinate system. (8)

PART C — ($1 \times 15 = 15$ marks)

16. (a) What are recent trends in micromaching? Explain the sequential steps in manufacturing silicon wafer.

Or

(b) (i) What is useful life of a tool? What are the factors affects the tool life? How these factors are related in Taylor's tool life equation? (8)

(ii) Describe any two gear finishing operation based on plastic deformation. (7)

Reg. No. :

Question Paper Code : 50861

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fourth/Sixth Semester

Mechanical Engineering

ME 6402 – MANUFACTURING TECHNOLOGY – II

(Regulations 2013)

(Common to : Mechanical Engineering (Sandwich)/Industrial Engineering/ Industrial Engineering and Management/Mechanical and Automation Engineering)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. How does rake angle affect the life of the cutting tool ?
2. Classify the types of cutting fluids.
3. What are the principle parts of lathe ?
4. List out the various types of lathe.
5. Why reaming operation is performed ?
6. Differentiate up milling and down milling.
7. Define grinding ratio.
8. Why broaching process is long and laborious ?
9. What are G-codes and M-codes ?
10. State the limitations of CNC machine tools.

PART – B **(5×13=65 Marks)**

11. a) The following data was obtained from an orthogonal cutting test. Rake angle = 20°, Depth of cut = 6 mm, feed rate = 0.25 mm/rev. cutting speed = 0.6m/s, chip length before cutting = 29.4 mm, vertical cutting force = 1050 N, horizontal cutting force = 630 N, chip length after cutting = 12.9 mm, Using merchant's analysis, calculate (i) Magnitude of resultant force, (ii) Shear plane angle, (iii) friction force and friction angle and (iv) various energies consumed. **(13)**

(OR)

b) i) Enumerate essential requirements of the cutting tool material. **(6)**

ii) With the neat sketch, describe the various types of chips produced during metal machining. **(7)**

12. a) Describe the types of machining operations that can be performed on a lathe, with neat sketch. **(13)**

(OR)

b) Describe the method of operation of the Swiss-type automatic lathe, with application and tools used. **(13)**

13. a) i) Explain, why the sequence of drilling, boring and reaming produces a hole that is more accurate than sequence of drilling and reaming. **(5)**

ii) With the neat sketch, explain the various operation performed in the milling machine. **(8)**

(OR)

b) i) State the principle of gear hobbing and explain how a spur gear is machined in a gear hobbing machine with neat sketches. **(8)**

ii) List the advantages, disadvantages and limitation of gear shaping process. **(5)**

14. a) i) Discuss various bonding material used for making grinding wheel. **(6)**

ii) Explain the working principle of the centreless grinding process. **(7)**

(OR)

b) i) Discuss the concept of surface integrity. **(6)**

ii) Explain continuous surface broaching machine with neat sketch. **(7)**

15. a) Explain the constructional and special features of CNC machine. **(13)**

(OR)

b) With a suitable example, explain the part programming procedure. **(13)**

PART – C **(1×15=15 Marks)**

16. a) With a suitable example, explain the technical and economic factors involved in cutting tool material selection. **(15)**

(OR)

b) List the finishing operations commonly used in manufacturing operations. Why are they necessary ? Explain why they should be minimized. **(15)**

Reg. No. : | | | | | | | | | | | | |

10/05/18 (FN)

Question Paper Code : 41392

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fourth/Sixth Semester

Mechanical Engineering

ME 6402 – MANUFACTURING TECHNOLOGY – II

(Common to Mechanical Engineering(Sandwich)/Industrial Engineering/Industrial Engineering and Management/Mechanical and Automation Engineering)

(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. List the physical functions of a machine tool in machining.
2. Define the oblique cutting.
3. What are the various mechanisms that are used for automatic feeding in lathes ?
4. Write the advantages of automats over conventional lathes.
5. Name any four work holding devices in shaper.
6. List the applications of gear hobbing.
7. What are the specifications of grinding wheel ?
8. Why is the centre less grinders called specialized machine for Cylindrical parts ?
9. Write the disadvantages of manual part programming.
10. What are the challenges in wafer machining ?

PART – B (5×13=65 Marks)

11. a) i) The following data from an orthogonal cutting test is available (9)

a) Rake Angle = 15°
b) Chip Thickness Ratio = 0.383
c) Uncut Chip Thickness = 0.5 mm
d) Width of Cut, B = 3 mm
e) Yield Stress of Material In Shear = 280 N/mm^2
f) Average coefficient of friction on the tool face = 0.7

Determine the normal and tangential forces on the tool face.

ii) Draw the schematic diagram illustrating the characteristics of Built-up-Edge(BUE) formation in the machining process. (4)

(OR)

b) Describe the following :

i) Mechanisms and pattern (geometry) of cutting tool wear. (8)

ii) Essential properties of cutting fluids. (5)

12. a) With the help of suitable sketches describe the following :

i) Taper turning by using taper turning attachment. (9)

ii) Taper turning by combining longitudinal feed and cross feed. (4)

(OR)

b) Enumerate the constructional details and working principle of turret indexing mechanism in Capstan and turret lathes. (9+4)

13. a) Discuss in detail about the features of hydraulic drive of a horizontal shaper and list its advantages also. (9+4)

(OR)

b) Write short notes on gear shaping. List the advantages and disadvantages of gear shaping process.

14. a) Explain the working mechanism of the following grinding process briefly

i) Cylindrical surface grinding. (7)

ii) Centerless grinding. (6)

(OR)

b) Explain the working mechanism of the following broaching process briefly

i) Surface broaching. (7)

ii) Continuous broaching. (6)

15. a) Describe the drive systems used in CNC machine tools. (13)

(OR)

b) Describe the following :

i) With a neat sketch, explain the working of ATC. (8)

ii) Write short notes on APT language. (5)

PART – C (1×15=15 Marks)

16. a) i) Explain the part program segment given below. Draw the trajectory of table motion that this program seeks to create. (4+4)

N0010G90;
N0011G01X1Y2;
N0012G01X2Y2
N0013G91;
N0014G01X1;
N0015G92X2Y2;
N0016G01X1Y1

ii) Is there any connection between the choice of coordinate system and the position sensor used in the machine tool ? (4)

iii) Comment on the sensing requirements for PTP and Contouring axes. (3)

(OR)

b) Write a note on heat generation in metal cutting. What is the importance of analysing the thermal aspects of machining ? (15)

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