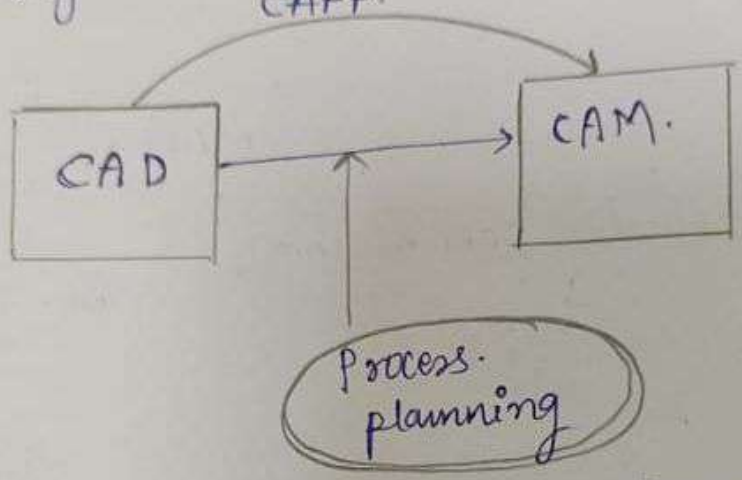
Ans 1 a) (1) Process planning is a act of planning a process using the computer technology to convert the raw material to final product with the aid of Computer Aided Designing and Computer Aided manufacturing



(2) Use of computer technology and its algorithmics to assist in CAD and CAM to Automate and Automatic such process is called Computer Aided process planning.

Ans b) 1) Hybrid CAPP: It is the combination of the Variation or retrieval cap and (generating) Automature cap (computational).

2) In which the part of design is divided into similar group of families based on grouping technology Similar to Retrieval process planning.

3) If no such database is present in the system, it is gene using the AI, algorithms, logic based design. call as Generative CAPP

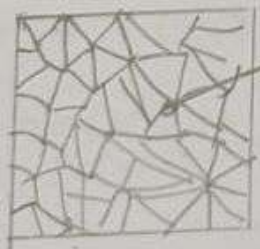
4) Such combination improves the design, tooling and generate new process plans

Hybrid CAPP = Variation CAPP + ~~Automatic~~ generative CAPP.

It is more advantageous than both of them.

c) 1) Meshing is a process in finite element Analysis in which the object is divided into fine region based on the geometry of design, the meshing is done. Each unit is called element.

2) The point of intersection of each region is called node where the equation of real world forces (Stress Strain etc) is calculated

3) 

No of region ∝ Accuracy of meshing

4) Meshing

- Order of region formed
- Numbers of region formed

5) Element in meshing can be
1) 1D element lines, bars. — Beams, bars
2) 2D element triangles, quadrilateral → sheets
3) 3D element geometrical pattern → Volume { Tetrahedral / Hexahedral

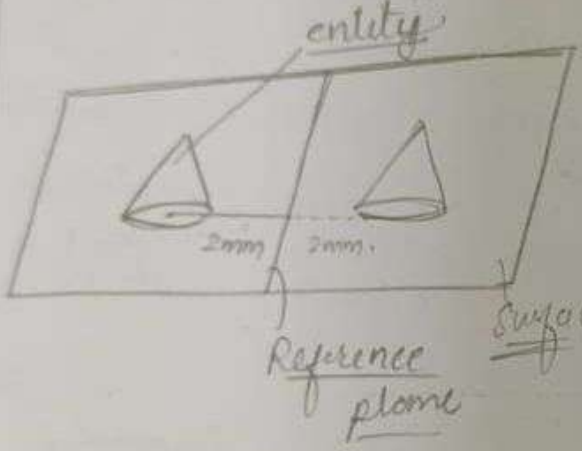
Ans d) >> 3+7*2

ans = 17

} output.

The output of matlab command is 17.

Ans e) mirror tool in solid work does the replication of the entity or object with respect to its reference plane with the coordinates (x, y).



Requirement :

1) we can form multiple entities over surface instead of sketching it individually at same time

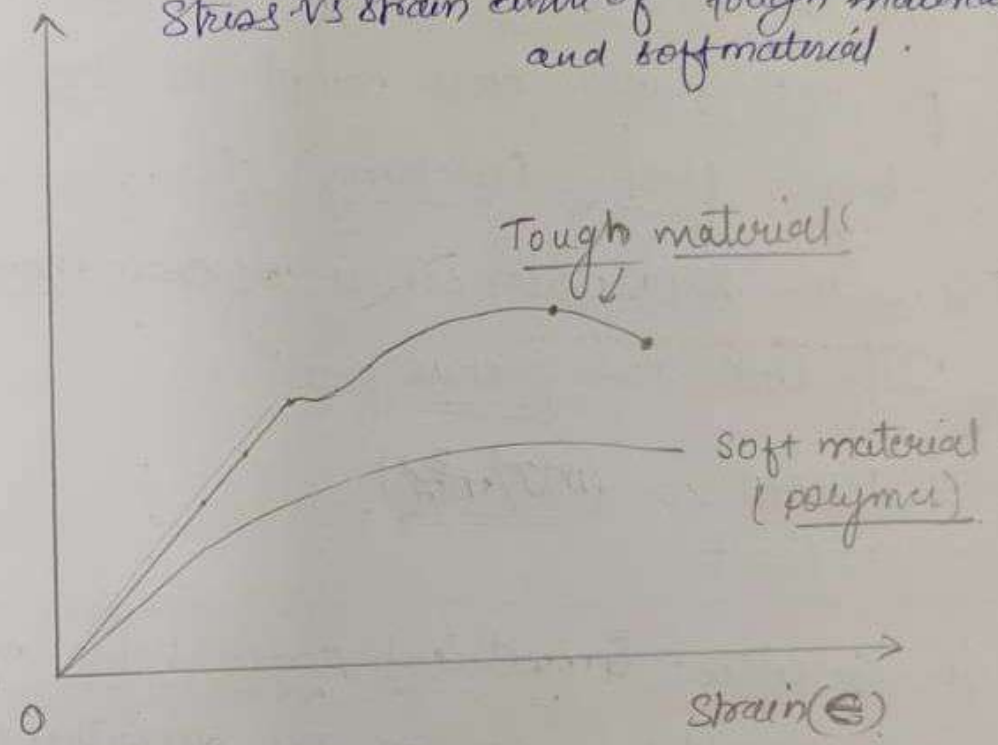
2) We can construct half geometrical sketch of a design and that other half can be mirrored by using mirroring tool.

3) It saves time and gives dimensionally accurate design and geometry

4) fully defined geometry is formed

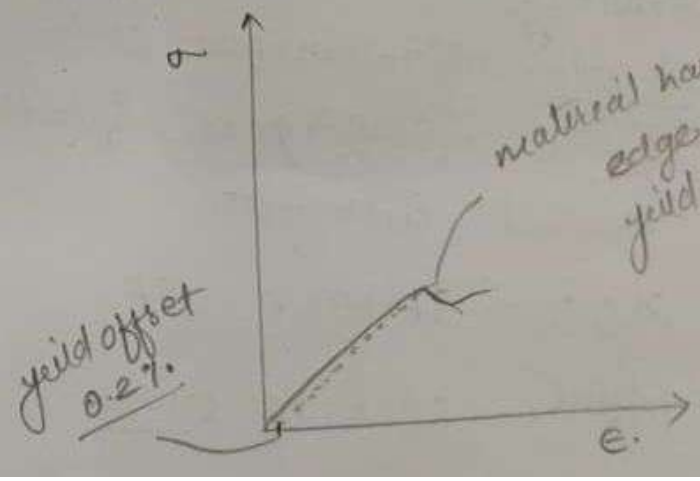
Ans f) clrspace. command clears all variables from workspace.
and
clc,val in command window

Ans g) Stress Vs Strain curve of tough material and soft material.



Ans(h) ① 0.2% offset yeild method determines the yeild point of the material which do not posses the sharp yeild point or having edge like yeild point.

② for such material 0.2% offset yeild method is considered for taking the line.



Ans i) (1) Toughness is defined as the ability of the material to withstand the applied ~~resistin~~ force per unit volume.

(2) It is the amount of energy absorbed by the material per unit volume ~~and~~ upto the stress-strain curve before fracture (necking) etc.

(3) It is the Area under curve of stress strain curve upto the fracture point

(4) Its unit is (MJ/m^3).

Ans j) In G codes - Geometrical codes : The machines or tool assembly works on the geometry codes of the design for positioning, start point.

G(X, Y) - rapid positioning : It deals with the geometry of the part to be desired.

G01 } arc of the design
G02 }

Similarly

M-code - Miscellaneous codes deals with the tooling system controlling ie Spindle ON and OFF, coolent control, cutting etc.

M03 - SPINDLE OFF

M05 - SPINDLE ONN

Ans R) CNC - Computer Numerical Control programming.
It is a programmed machine used for the manufacturing of the part of desired design. works on Numerical codes
Eg lath machine, drilling machine etc.

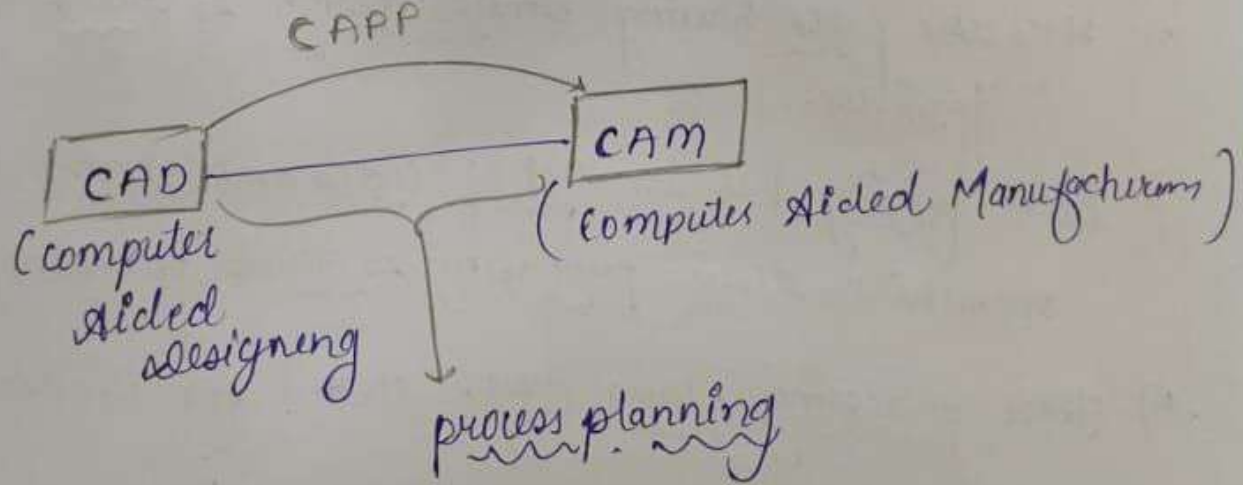
Ans 2 1D elements such as ~~lines and~~ & triangle and quadrilateral for modelling of thin structure in FEA:

Que 9

Ans 3:) CAPP stands for computer Aided parts programming. in which with the help of computer programming technology (assist) in the manufacturing of parts or families using the CAD and CAM ..

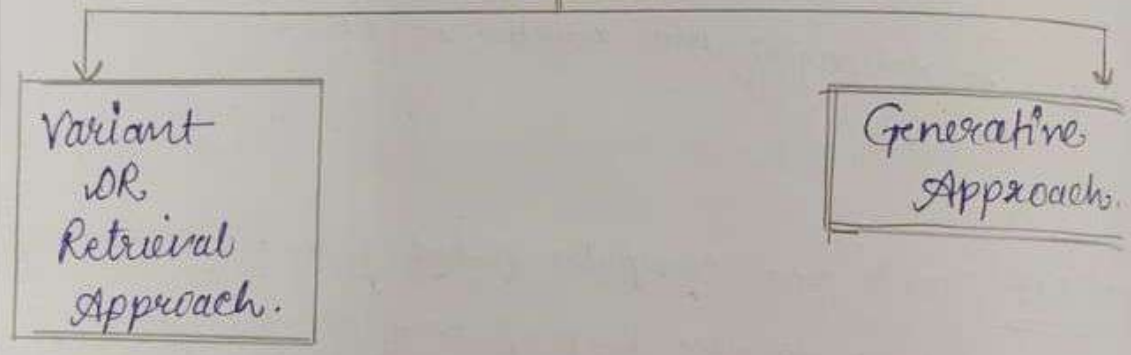
2) By using computer Aided Designing (CAD) and computer Aided manufacturing by optimising, and Automating the process.

3)



4) process planning is an act of planning of a process using the CAD and CAM modelling system. which converts the raw material to final product with the aid of computer technology.

5) for such there are 2 Approaches of CAPP



A) Variant OR Retrieval Approach :- It

~~In this the part~~

1) It is based on the grouping technology of the simi parts ~~and this~~ into the families and manufacturing team.

2) Here the parts having similar design is grouped into families.

3) Each family has its set of codes and algorithm ba on which their processing is done (processing plans

4) These processing plans are stored for similar famil and retrieved and modified as per the required

5. Steps in the variant approach

1) part (or part design)
2) differentiated into similar parts → families
3) The groups of families assigned with processing plans
4) Retrieval of the data for family (P.P).
5) changes if required is done to process the part fully.

Advantages :- 1) parts having similar design grouped easily.
2) Already stored processing plans saves in time and cost reduction
3) Increase the flexibility of operations
4) Limited risk lead time risk etc.
5) Storage of new plans/modified plan to software.

limitations : 1) The part having new design cannot be done by CAPP.
2) Standardized process plan is not available for each families.
3) Retrieval of information from Database is not possible always as they get overwrite.
4) Depend on property of material also.

Generative CAPP : In this approach the process plan is done with the helps of AI, algorithm or set of expression coded in system.

2) It generative every family has different process plan
3) It is suitable for Automated and Autofining m/c plan operations.
4) with the help of machine learing and Artificial Intelig complex array of process plan can be assayed.

Advantage : 1) less time consuming process.
2) more output can be gained.
3) Seperate process plans can be generated for each families.
4) Reduce manufacturing cost.
5) fully Automated machine.

Disadvantage : 1) The nature of material may vary so it always necessary to generate new plans.
2) The critical attributes should be known.
3) Mis Mistake in any printing or processing parameter can ~~lost of~~ lead to loss of batch of product.
4) It is costly and Time consuming process for complex process planning.

Q4

Ans 4 Complete workflow of CAD - CAM - CNC in part programming.

In computer Numerical control programming the: part is ~~optimized~~ manufactured by the machinability tools and along with various Standard Data basis which is important to produce accurate part.

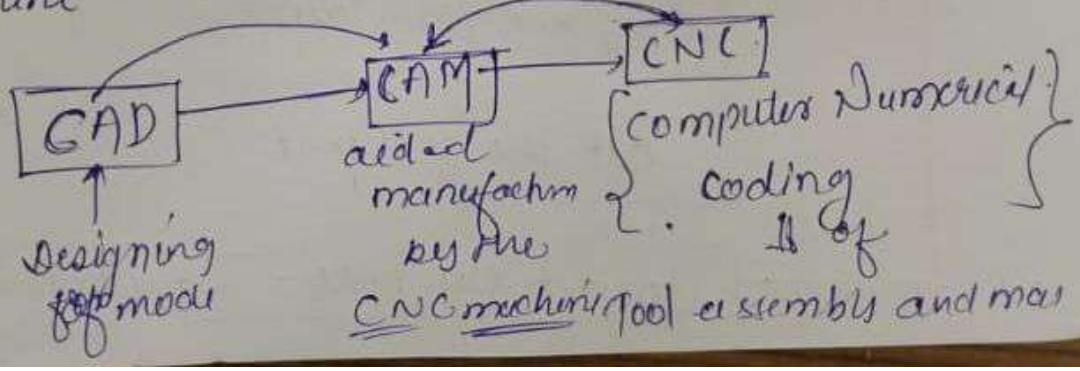
It works by the set of codes which control machine drilling milling. such ~~code~~ language is called Codes.

Codes

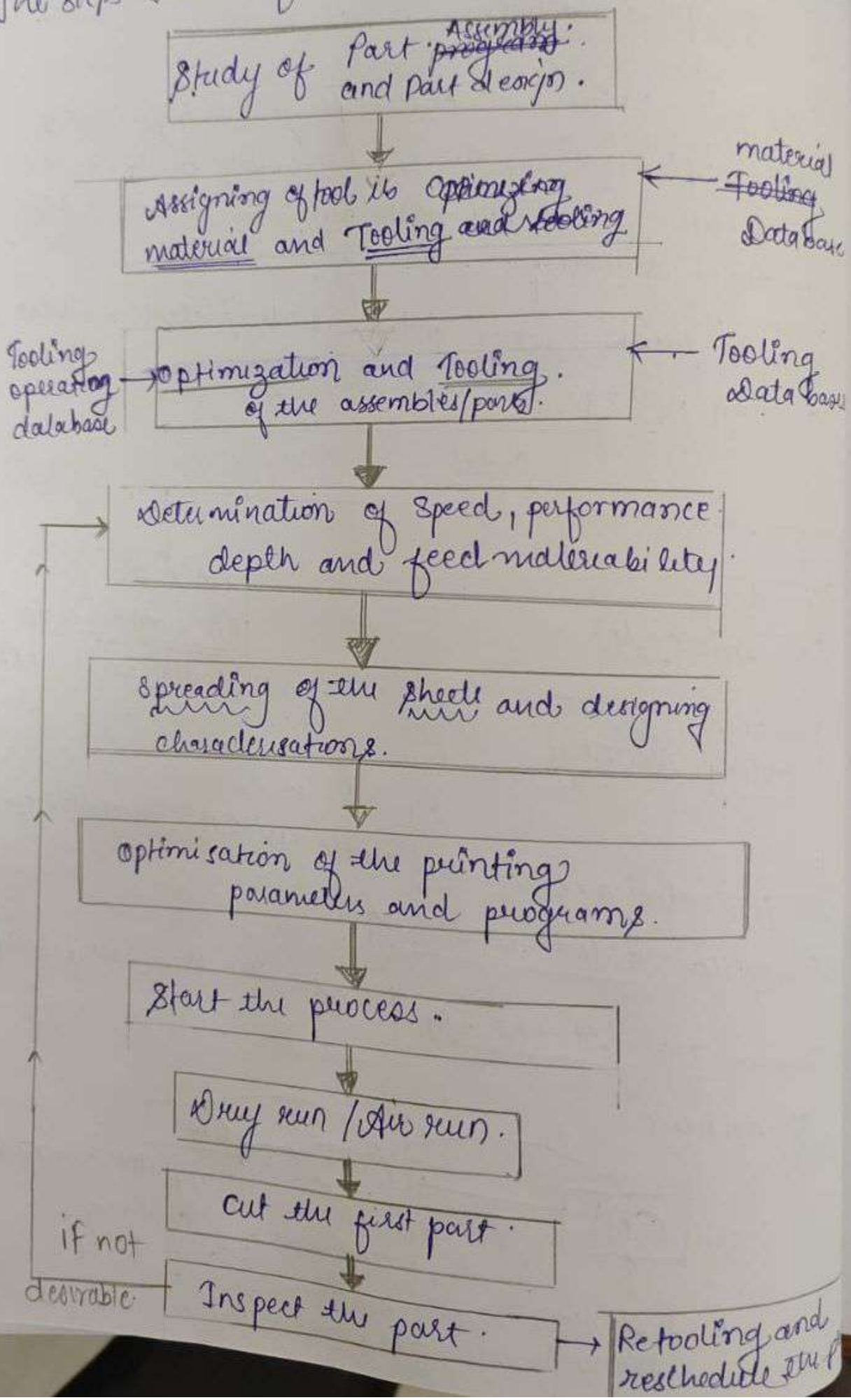
- G codes (geometric code) — positioning of the tooling Assembly
- M code — Miscellaneous code for spindle on and OFF

1) The part design is created with the CAD modelling (computer Aided modelling).

2) Save in the .stl or .obj file as the compatibility of machine



The steps are as follows.



Here fu

(1) The CA for th where

(2) Assign Stand can be

(3) Deter speed

(4) Then sp the

(5) Select first p inspec Lead

In gen part

Here from the flow diagram.

(1) The CAD modelling transferred to specific CNC machine for the CAM (manufacturing).
where the part is studies for which suitability of material is selected

(2) Assigning of material and Tooling properties with its standard Database of the software. The modification can be done there if required.

(3) Determination of suitable parameter such as- speed, performance, depth and feed material characteristics.

(4) Then Speeding of sheet on the machine and the select the variables manually.

(5) Select for the processing firstly Dry run / Air run then. first part is cut with knives and sent for the inspection ~~is~~ where our inspection will lead the fail of the part design.

In such a way CAD - CAM - CNC works in part programming.

Q5

Ans5 (1) Finite element analysis is a computer based analysis technique in which the part or design is divided into small region on which the real world forces are applied (force, compression, temperature) and their effect is studied.

(2) Instead of performing various operation on whole it is done on small region.

(3) There is no needle to solve the complex equation for analysis of various test instead computer will carry out this function on single element and add up all.

Application

Eg (1) Characterisation of Insulin needle pen (microneedle).

(2) Bone deformities.

(3) characterization of Implants and dental cones etc.

In FEA small whole region is considered of a large region and their characteristic is studied.

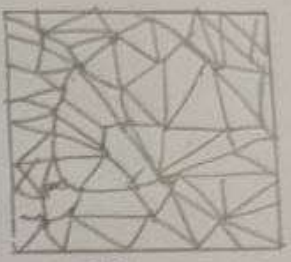
The FEA has following step as follows.

1) Designing :- The model is created with CAD. software and file is store in .stl file format

2) Meshing: After loading of file the operation of meshing is done in which the larger region is divided into small small region based on surface morphology

Each region is connected at common point called as node.

The Equation is calculated at this node only.

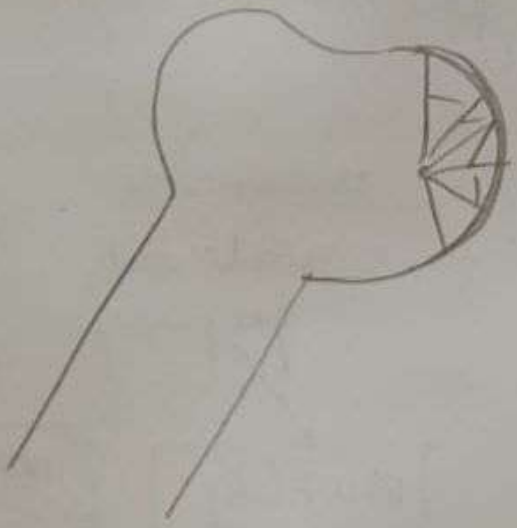


messhing.

The accuracy of meshing = Number of meshed triangle.

The accuracy can be increased by

- Order of meshing
- Increasing Number of meshing transregions



To calculate the curvature of the Bone or the optimization is done on it by meshing K/A Converging.

Types of element in meshing

Element	Shape	Characteristics	Eg.
1D	lines, offsets	for the beams and planes modelling	Stent
2D.	Triangles Δ quadrilaterals ▭	For the modelling of thin structure,	transdermal patch Values
3D.	Tetrahedral and Hexagonal Shapes	For the modelling of the structure (solid) along with Volumes.	Bone, Tooth, Implants etc.

After the meshing step.

3) Assigning of material parameters : After meshing the design from the standard Database library assign and give material characteristics to it.

If rod - stainless steel.
mild steel

Composition can also be varied

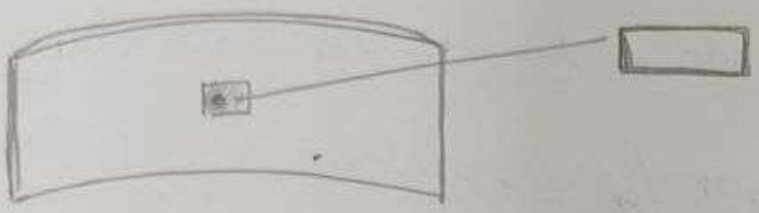
along with material property

Ductility

malleability etc

and proportion

4) Optimization and processing and appln weight/Boundary Conditioning
Select the one element from the design.

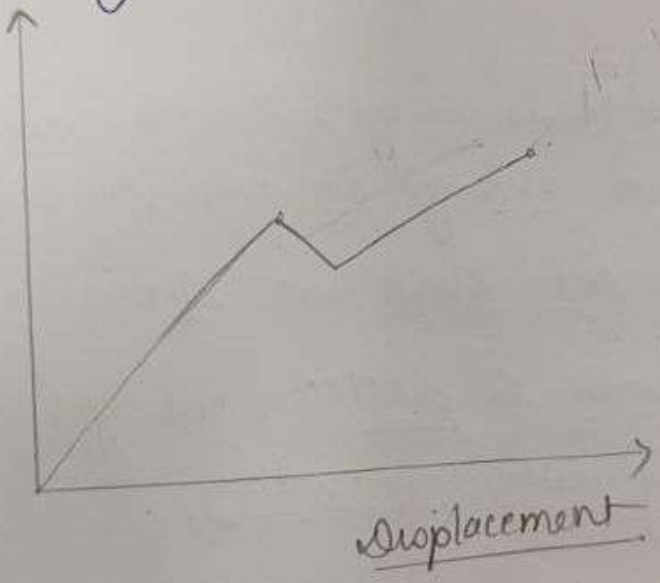


← various stress strain.
← Temperature
← Compressibility is tested.

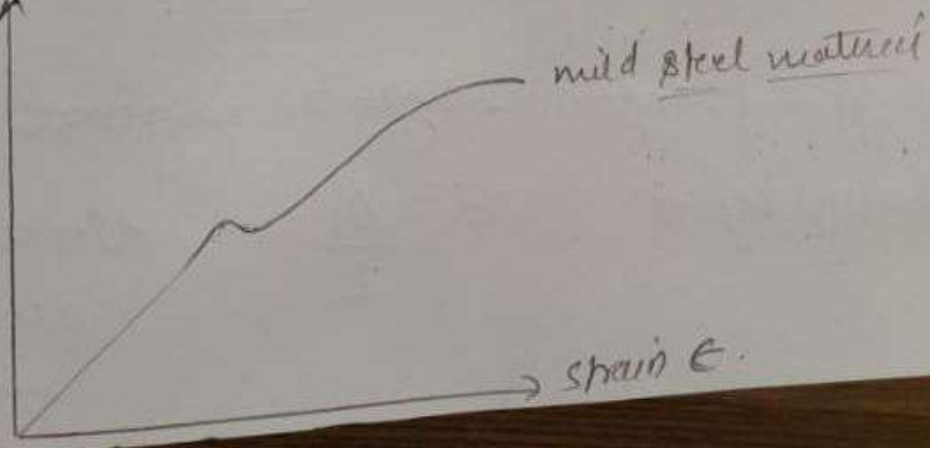
After all these test the data is collected and stored in softwares.

we can check

① force vs displacement ratio in case of microneedle penetrating stratum corneum



② Stress strain analysis of ~~not~~ design without pressing in the practical lab.



After all these steps finally we do

(5) Evaluation: ~~and Results~~:

The interpretation of the test are formatted and check with standard limits in such way finite element analysis is done.

Advantages of FEA 1) Automization of process

2) low risk 3) cost effectiveness.

4) consistency. 5) knowledge optimized etc

Que 6

Ans 6 (i) When the mild steel is subject to the any shear force. there is a change in the various parameters mainly parameters are stress and strain.

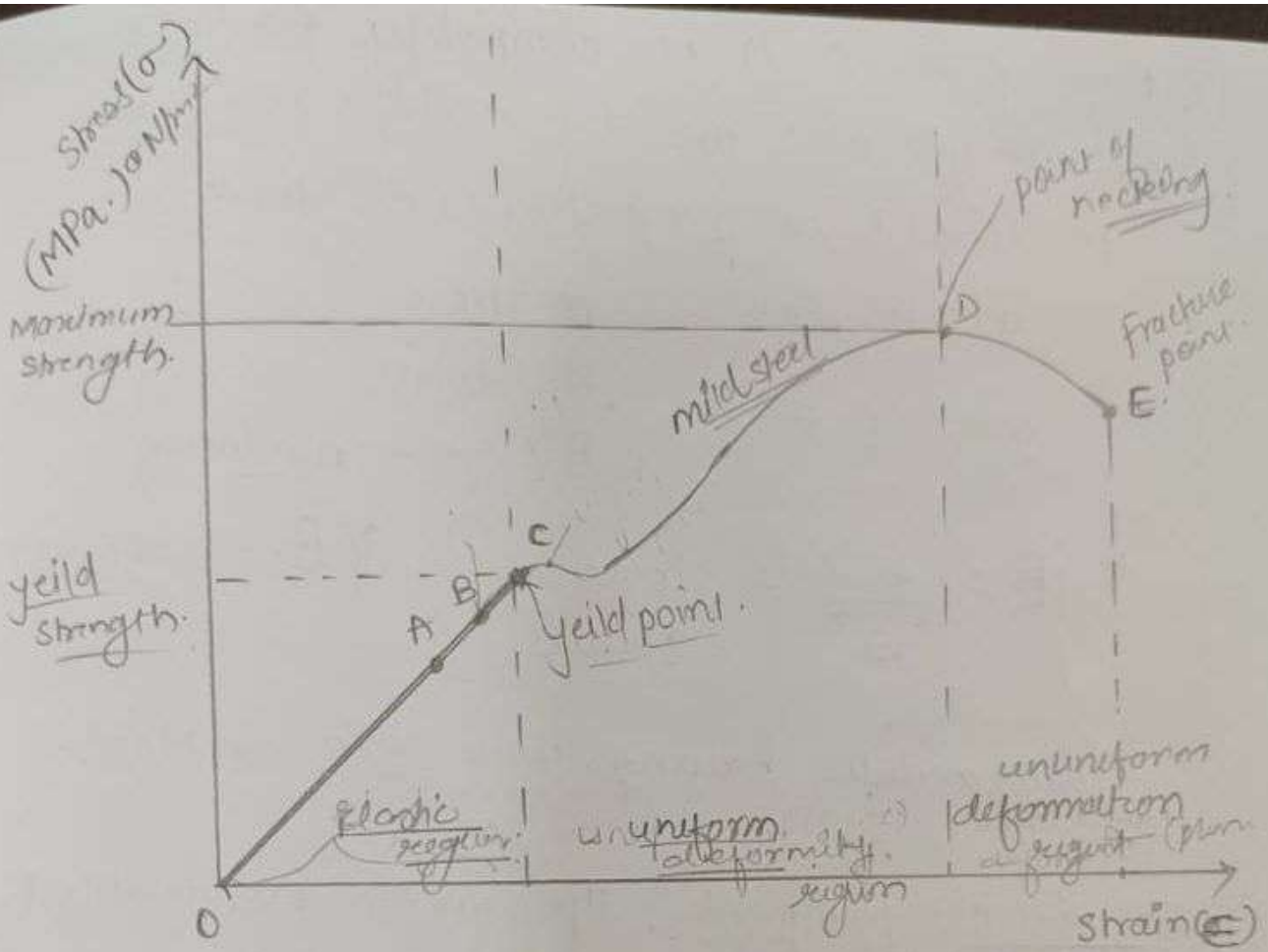
when stress v/s strain is plotted. we get Stress Strain curve along with deformation.

Stress: (σ) force acting per unit Area. also internal resisting force per unit Area

o has unit N/m^2. or MPa.

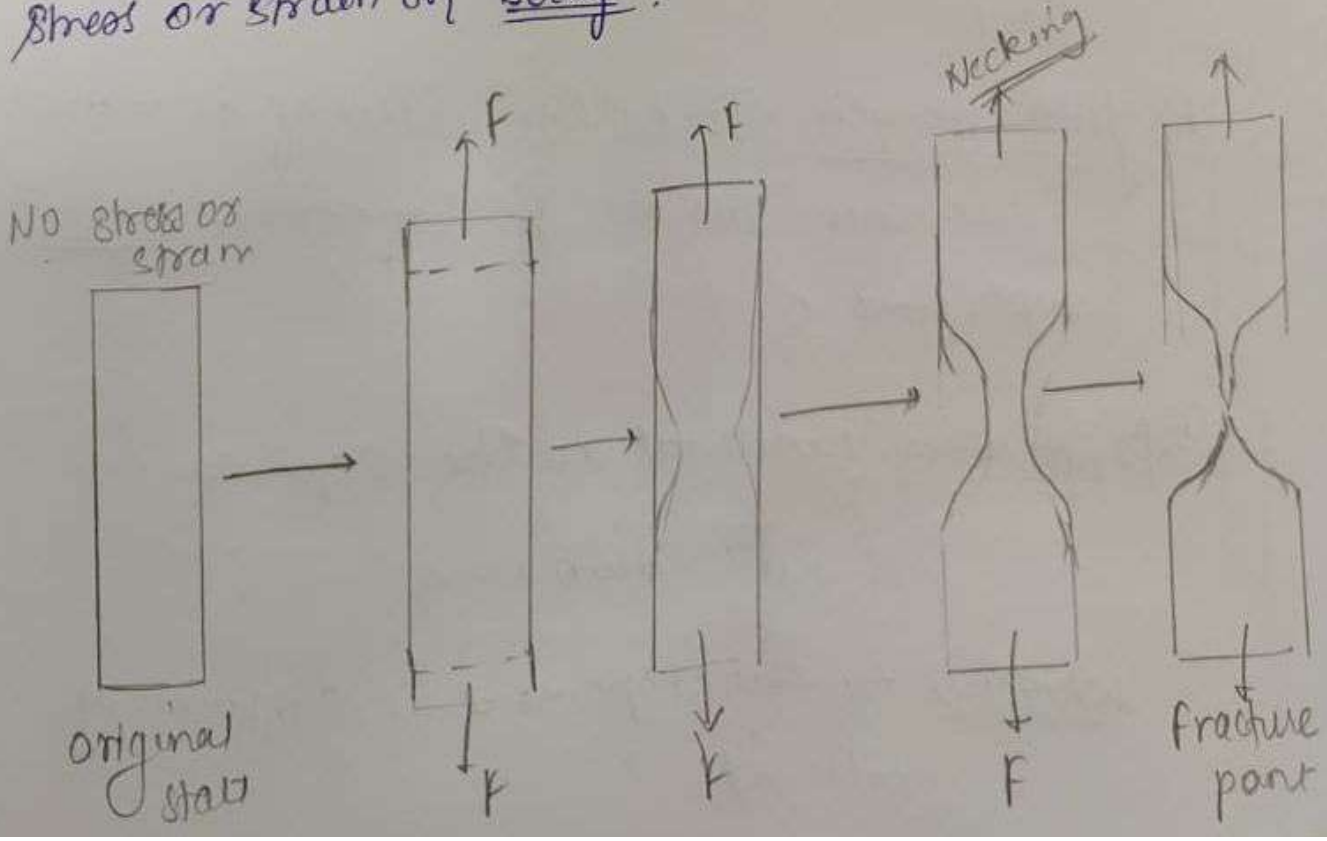
Strain: It is change in length to original length.

denoted by ϵ $\epsilon = \frac{\Delta L}{L}$ dimensionless always expressed in ratio



When stress and strain is applied over a mild steel.

It starts from origin O - when there is no stress or strain on body.



i) Region from O-A is completely plastic region where there is no deformation takes place ie stress, is proportional to strain

$\sigma \propto \epsilon$. σ stress, ϵ strain

$\sigma = E\epsilon$. E = Young modulus

ie $\boxed{E = \frac{\sigma}{\epsilon} = \frac{\text{Stress}}{\text{strain}}.}$

$E_{S.S} = 200\,GPa$

Young modulus having unit MPa or N/m^2.

(ii) At point C : yeild point : Upto which the material can regain its original shape and size if we the region before the plastic deformation start.

(A) Yeild strength : It is the value of area under the curve where ~~if shape can be regain~~ upto point C.

(B) Stiffness of material is the slope of Stress and strain curve

whatever be the slope is the stiffness of material.

(iii) After point C The material enter the plastic deformation area where we can find material property such as

material

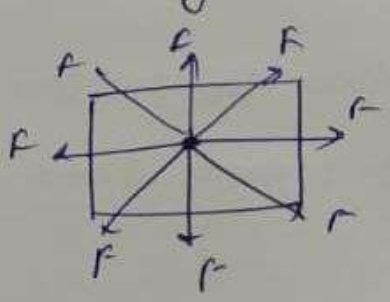
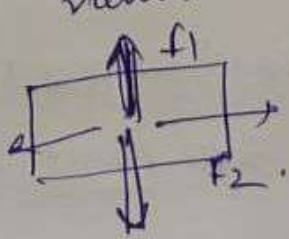
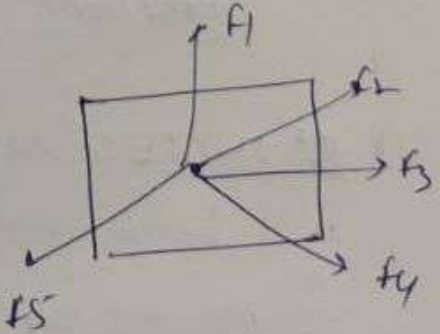
malleability. Ductility.

Some material are soft : which having large

A) uniformly deform curve,
Break with cup and cone fracture.
Eg mild steel.

B) Some material are hard : less or no elastic limit.
Less or brittle Eg plywood, plys.

C) Based on stiffness of material.

Isometric	multi metric	Anisometric.
Same stress all over the body	Two different direction different value.	Different direction of differ stress value
		

As the stress increases it comes to the point D where is called Necking region/Breaking. Here is narrowing of the body and Cross sectional Area

(IV) Necking region is important to determine the type of fracture

(D) Toughness: It is the energy absorb by the material per unit ~~At volume of~~ area is called Toughness

or the value of Area under the curve of stress strain curve.

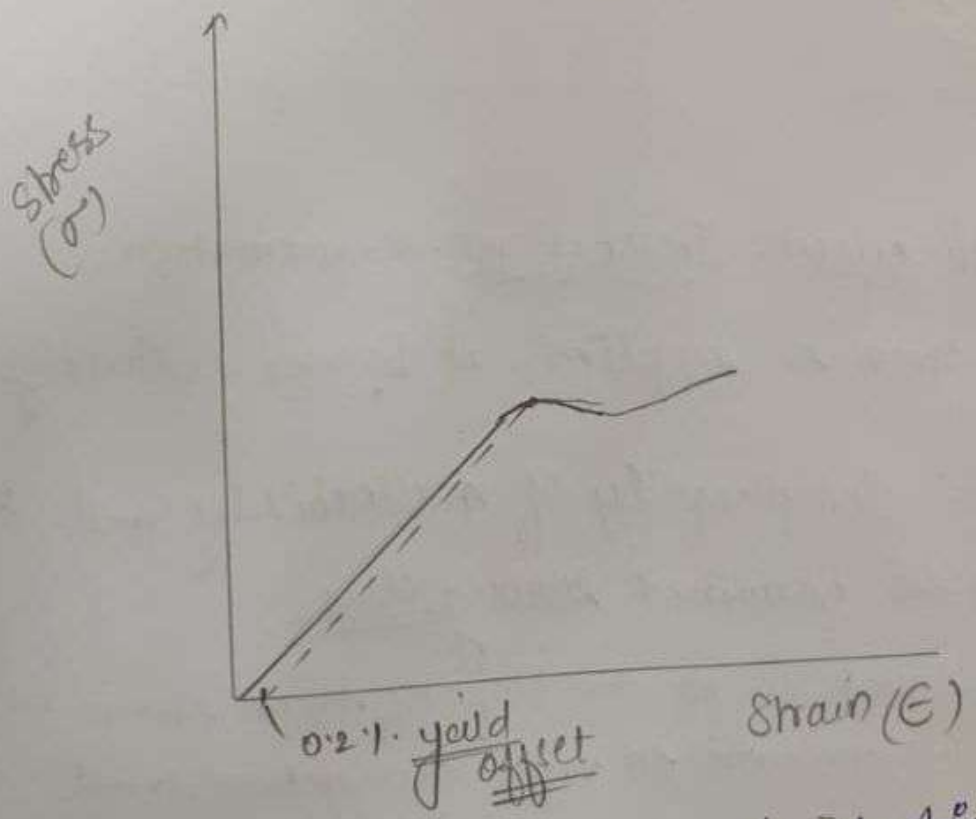
At point D: - maximum strength: It is upto point where the body can withstand maximum load

(V) At point E: The fracture point: where the material breaks into two part. after which there is no curve

from the stress strain analysis we can determine properties of material such as toughness, Hardness stiffness. and various of yeild strength and maximum strength

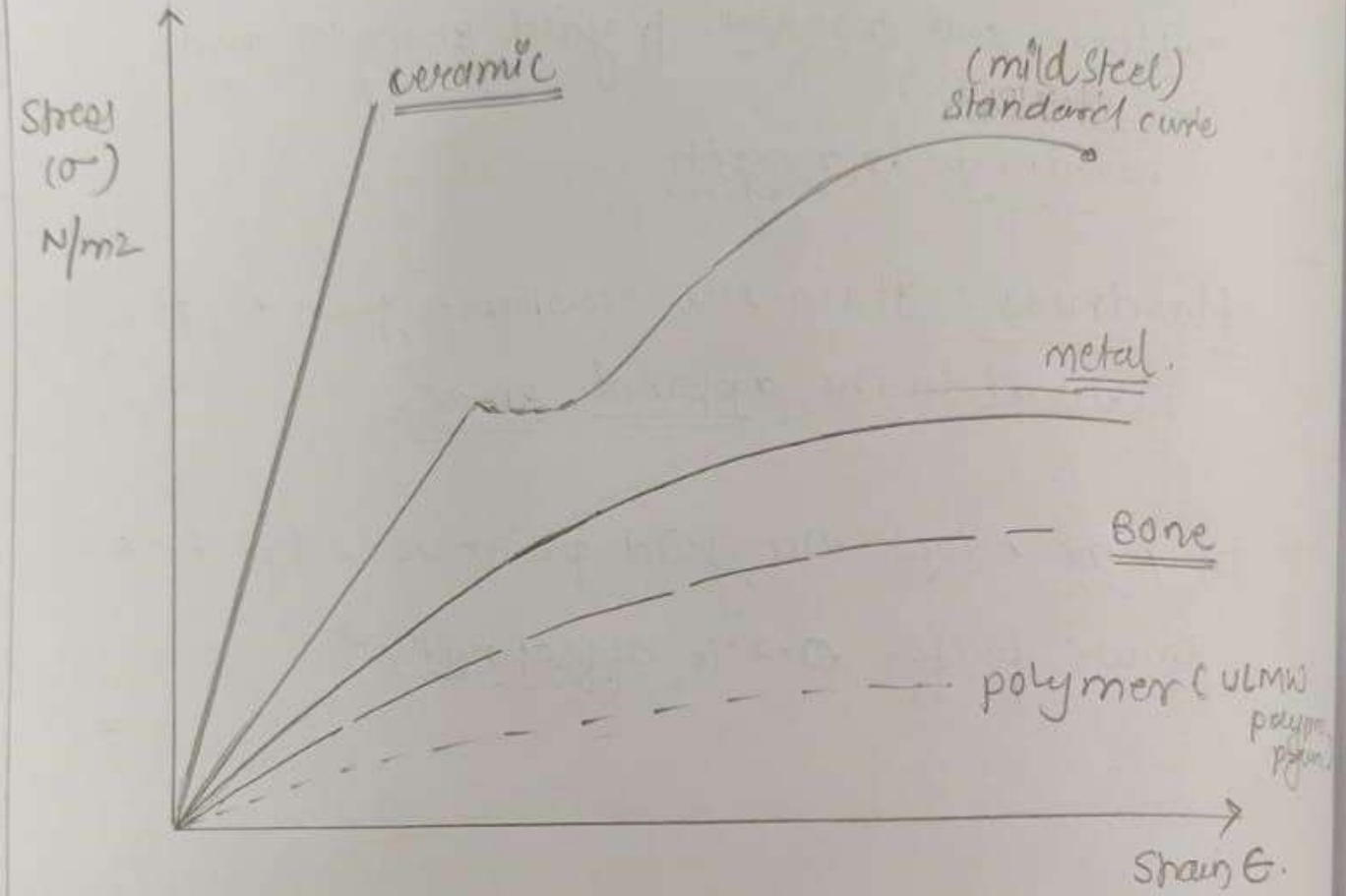
Hardness: It is the resistance given by the material to the applied stress.

In some cases the yeild point is edge like. so we prefer 0.2% offset method



Before point C: The region is elastic region.
After point E: The region is deformation region.

(iii) Stress strain curve of ceramic, polymer, bone and metal.



a) In ceramic curve: There is no deformation.
As the stress is applied, it breaks instantly.

b) In metal: The property of malleability and ductility can be examined through this.
The stiffness is ~~to~~ ~~can~~. slope of stress strain curve and in medium so more elongation, and curve more towards strain.

c) Bone: It has having curve with no yield point as such and fracture can ~~to~~ be sharp.