Assignment No-2.

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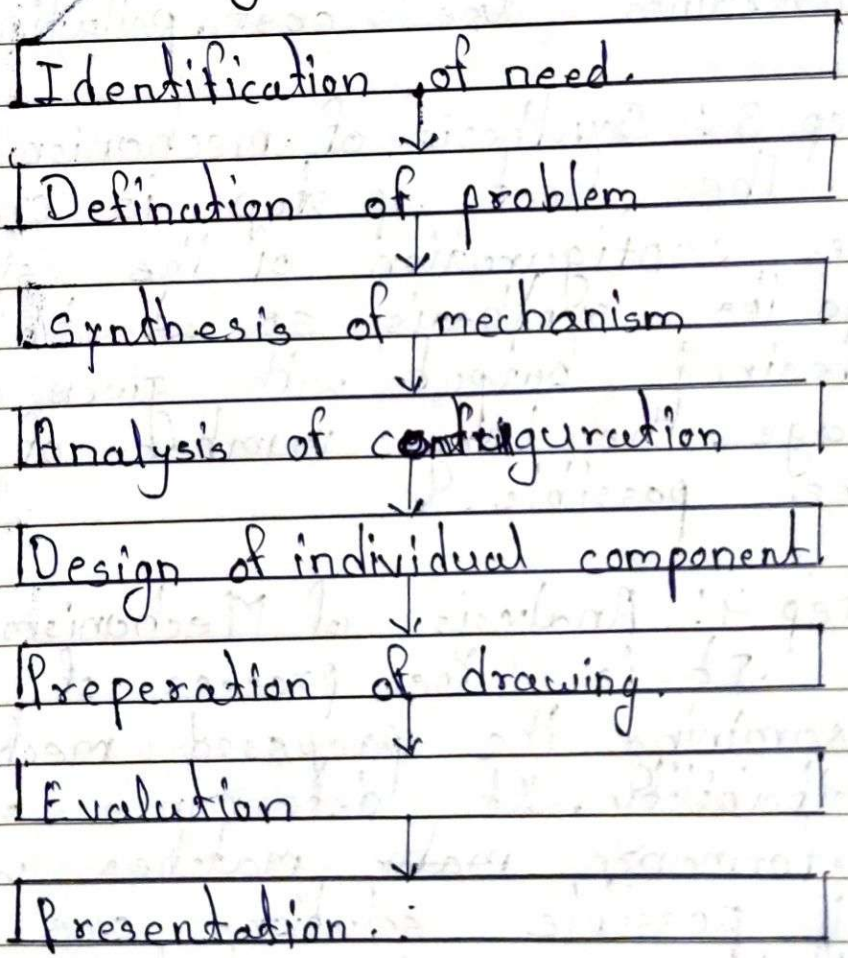
Subject :- Basic Mechanical Engineering.

Q.1. Explain design process in details :-

→ Generally design of many mechanical components or system or mechanism is done by following. The procedure which is compatible for manufacturing



Step I :- Identification of need :-

Every design process starts with the identification of need. It is the outcome of either the requirement of any problem with the existing system. for. e.g :- A car is the outcome

of the need of travelling at higher spe
with comfort.

Step 2:- Defination of Problem:-
Define the problem giving all the input pa
meters, output parameter and constraints.
For e.g:- In design of car, the input paran
is source of energy (petrol, diesel, elect
The output parameters are maximum spee
fuel economy, space occupied etc. The
constraints are cost, pollution norms etc.

Step 3: Synthesis of mechanism:-
The next step is creating and sele
the configuration of the system (mechanis
and its synthesis so as to get the
desired output with given input. At this
stage, the large number of alternative
are possible.

Step 4: Analysis of Mechanism:-
It is the process of critically
examining the proposed mechanism for th
suitability. It determines whether the
performance matches with requiremer
All possible solutions are analysed f
suitable one is selected.

Step 5: Design of Individual components:-
It consist of determination of forc
acting on each component, selection of
suitable material for each component f

determination of each component.

Step 6: Preperation of drawing:-
In this step the design of component is drafted. The drawing of individual components and the assembly drawing are prepared.

Step 7: Evalution:-
Evolution involves the testing of prototype in the laboratory or creating the model on computer. If this testing shows failure of components, the process is repeated from step 3.

Step 8: Presentation:-
Communicating or presenting the design to others is the final step in the design process

Q.2. Explain.

a] Stress:
The resisting force developed in the body per unit area is known as stress. It is denoted by σ.

$$\sigma = \frac{P}{A} \text{ in } N/m^2.$$

where, P = force in N.
A = Area in m^2

b] Strain :-

When a system of force or load act a body, it undergoes some deformation. deformation per unit length is called a strain. It is denoted by 'ε'

$$\text{Strain}(\varepsilon) = \frac{\text{change in length}}{\text{original length}}$$

strain has no unit.

c] Factor of safety :-

While designing a component, it necessary to provide sufficient reserve strength in case of an accident. This is achieved by ~~taking~~ taking a suitable factor of safety. (fs)

$$f(s) = \frac{\text{failure stress}}{\text{allowable stress}} \quad \left(\frac{\text{maximum stress}}{\text{working}}\right).$$

The allowable stress or working stress is the stress value, which is used in design to determine the dimensions of the component. It is considered as a stress, which the designer expects will not be exceeded under normal operating conditions.

d] Machine :-

A machine is a mechanism or a collection of mechanism which transmits force from the source of power to the resistance (load) to be overcome, and thus

performs useful mechanical work.

A system can be defined as a mechanism of a machine on the basis of its primary objective. When the objective is only to transfer and transform the motion (without consideration of the forces involved), the system is said to be a mechanism. On the other hand if the system is used with the objective of transfering mechanical energy, then it is called a machine.

As mechanical work is always associated with movement, every machine has to transmit motion. Therefore, every machine is a mechanism but not vice versa.

f] Machining :-

Machining also known as subtractive manufacturing, is a prototyping and manufacturing process that creates the desired shape by removing unwanted material from a larger piece of material.

E.g.- Cutting, milling, drilling, grinding, boring & turning

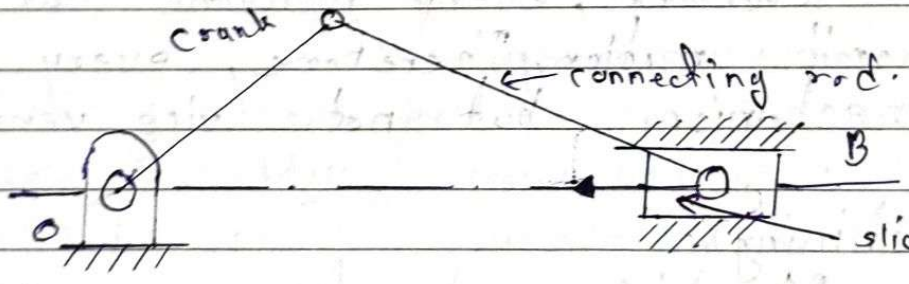
g] Machinability :-

Machinability can be defined as the ease with which the material is machined in terms of specific energy, specific horsepower, or shear stress.

In general, the larger the shear stress or specific power values, the more difficult the material is to machine and form, requiring greater forces and lower speed.

c] Mechanism :-

A mechanism is a combination of rigid or restraining bodies so shaped and connected th they move upon each other with definite relative motion. A simple example is the slid crank mechanism as shown in figure, used internal-combustion engine or reciprocating ai compressor, where the rotary movement of the is converted through the connecting rod into reciprocating motion of the slider.



Q.3. Explain construction and working of centre lathe :-

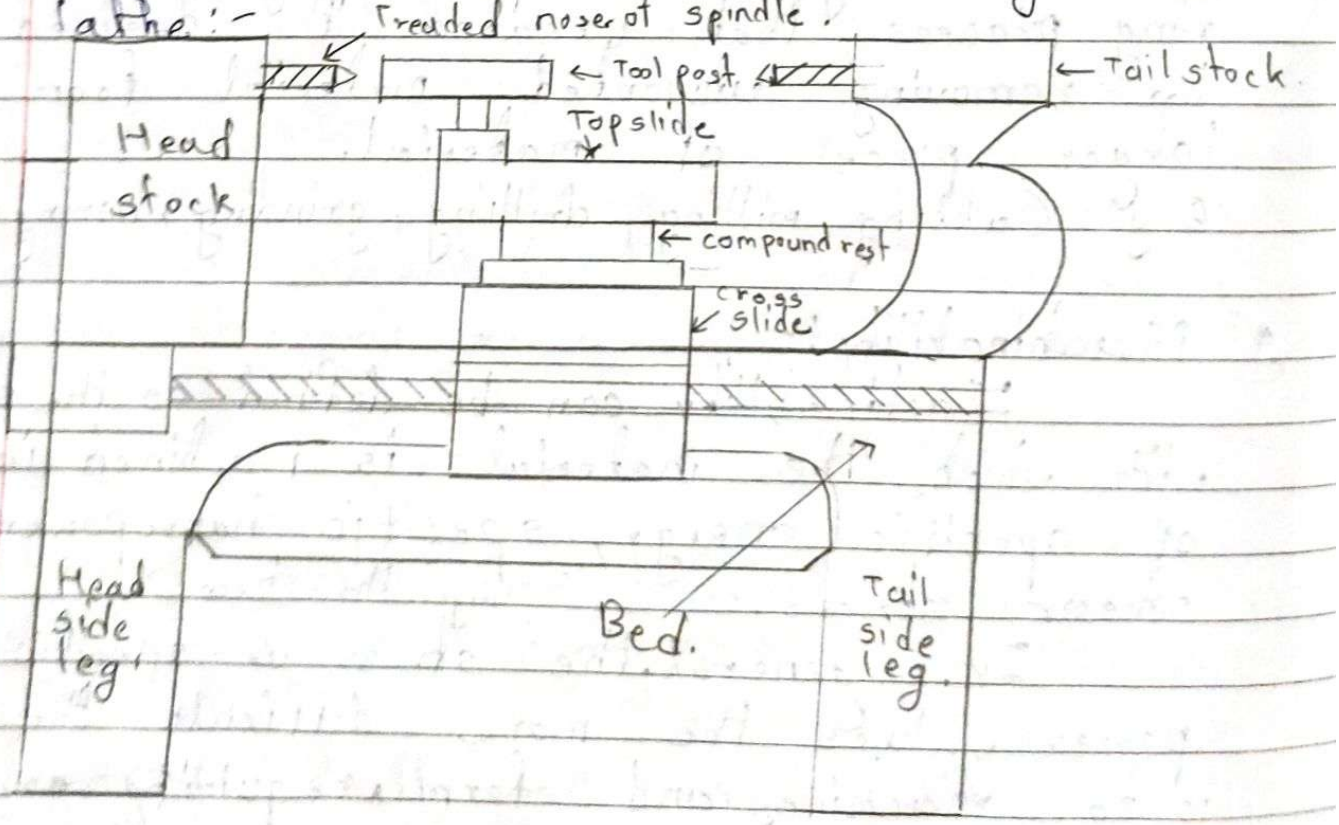


fig:- Centre lathe.

Construction :- It consist of -

1] Bed :- The bed of the lathe form the base of machine.

2] Head stock :- It is for supporting & rotating the spindle

3] Tail stock :- It is ~~required~~ the counterpart of head stock fitted at right hand side of the bed.

4] Carriage assembly :- It comprises of a number of components which support, move & control the tool.

5] Feed mechanism :- It is ~~automated~~ automatic feed mechanism, it recieves power from head stock.

6] End gear trail :- Power is transmitted from it.

7] Apex mechanism :- It transforms the rotary motion of the lead screw into linear motion of the tool for feeding.

8] ~~It~~ split nut mechanism :- It is used to engage or disangage the carriage with the lead screw for threading.

* Working :-

1] Power to the lathe spindle given with a captive motor with either a one pulley drive or geared head stock mechanism.

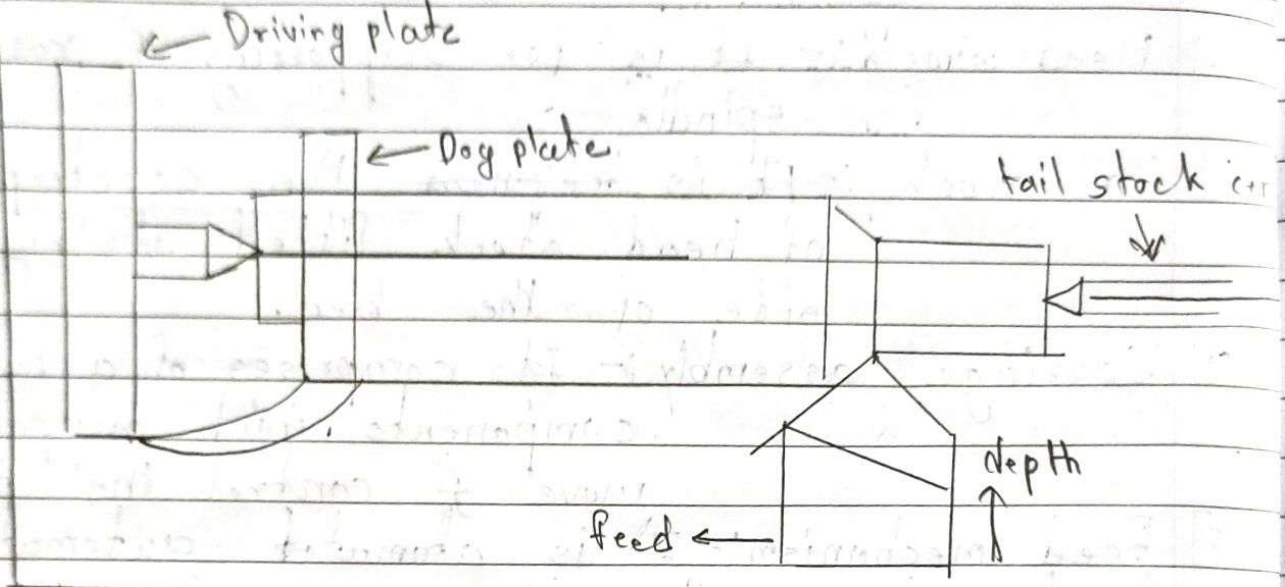
2] Work piece supported between centre in a chuck on a face plate.

3] Tools are held generally in the tool post on the carriage between tool post ~~between~~ in the tail stock.

4] Feed bore may be provided on the stock to control the rate if feeding of the tool.

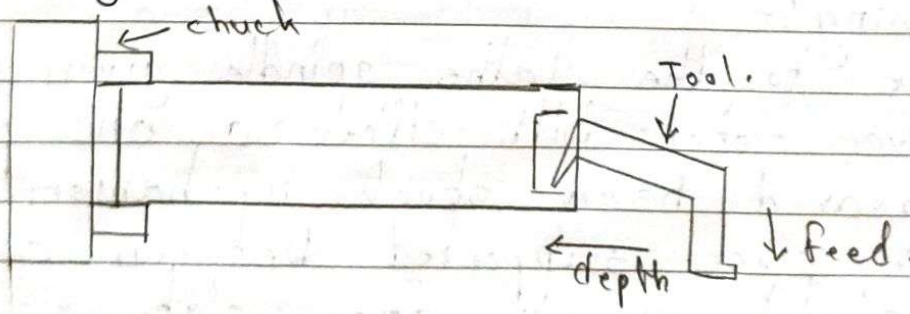
Q. 4. Explain different operations on lathe.

→ 1] Turning :-



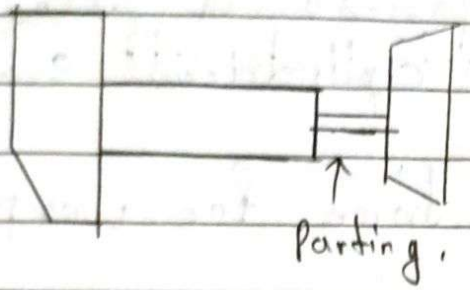
- Turning is the operation in which a cylindrical surface is produced by using tool.
- Workpiece is supported between holding device.
- Feed & depth is given to tool as per required.

2] Facing :-



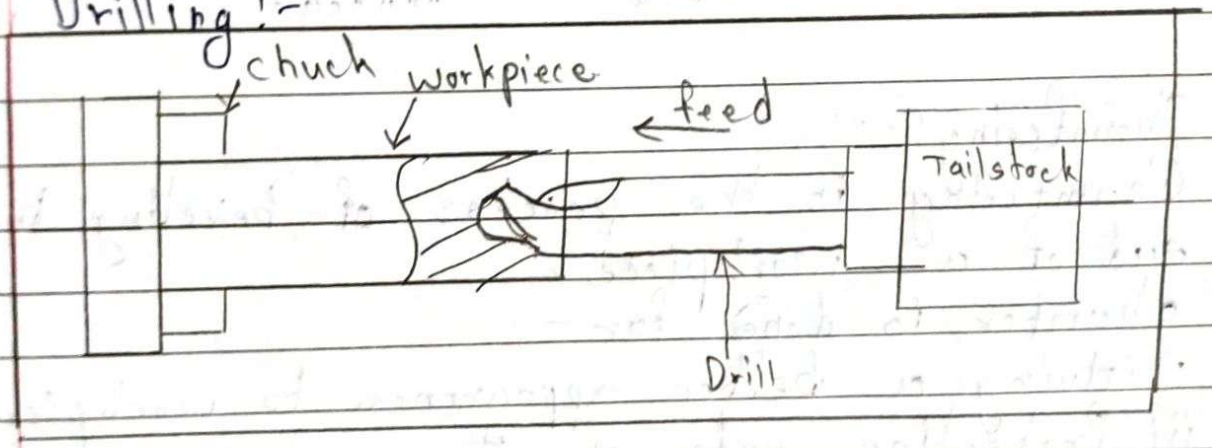
- Facing is an operation used to produce a flat surface at right angles to the rotational axis of the job.
- Feed & depth is given as per required.
- Workpiece is holded in the chuck.

3] Parting :-



- Parting or cutting off is the operation of severing or cutting away a desired length of bar.
- It is done with a narrow cutting tool.
- Cross feed is given to tool.
- Job is hold in chuck.

4] Drilling :-



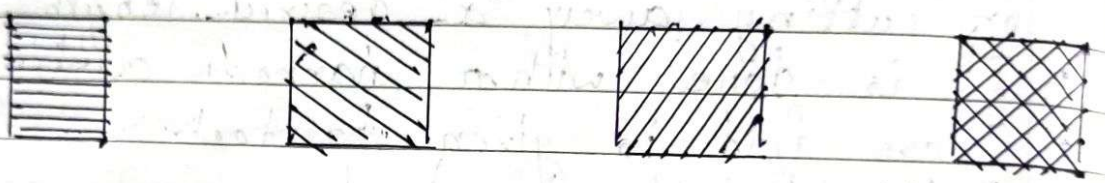
- Drilling operation is shown in fig.
- Workpiece is held in chuck & the drill is held in the tailstock.
- Feeding is done by movement of the tail stock

5] Boring :-

- Boring is the process of enlarging the hole produced by drilling, casting, etc. with the help of a single point tool.
- Job is held in the chuck or face & boring tool held on toolpost.

6] Knurling:-

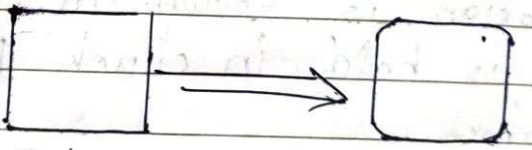
- Knurling is the process of providing rolled impression on the cylindrical surface of a workpiece.
- ~~Kn~~ Knurling is done for workpiece do not slip.
- Types:-



straight Left handed right handed diamond.

7] Chamfering:-

- Chamfering is the process of beveling the edge end of a workpiece.
- chamfer is done for -
  i] Giving a better appearence to workpiece.
  ii] Protecting ends of the workpiece.



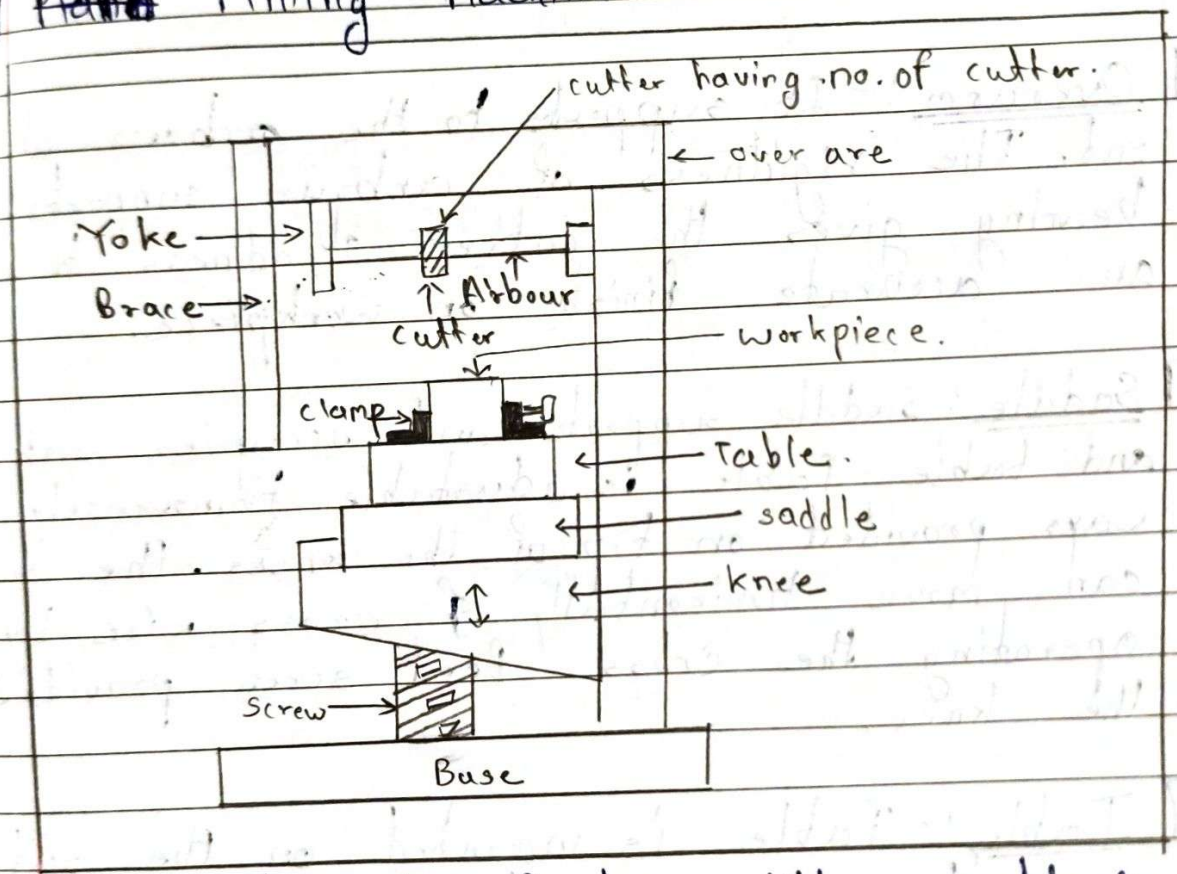
Job (before chamfering) Job (after chamfering).

8] Taper turning:-

- Taper turning is process of producing external & internal conical surfaces.
- Feed is the angular feed to tool.

g] Thread cutting:-
Thread are cut on lathe by rotary motion of job with circle motion of tool.

Q.5. Explain.
a] ~~Plain~~ Plain Milling machine:-



→ Important parts of plain milling machine:-
a] Base:- It act as a foundation for the machine All parts are mounted on it. It gives the machine rigidity and strength, usually is made of grey cast iron.

b] Column:- It houses the various parts like the main drive, spindle bearings, electrical components, etc. It supports and guides the knee, holds an overarm which extends outward at the front of the machine.

c] Knee :- It acts as a support for the saddle work table, indexing head, etc. knee slides up & down along the face of the column. knee also supported by the elevating screw. The top face of the knee provides slide ways for saddle to provide cross travel to the table.

d] Overarm :- It supports to the arbour at the end. The rigidness of arbour supports and bearing gives the cutter steadiness to obtain an accurate finish on workpiece.

e] Saddle : Saddle supports and occupies workpiece and table - Table is adustable transversely on ways provided on top of the knees. The saddle can move horizontally & cross wise by operating the cross feed screw provided on the knee.

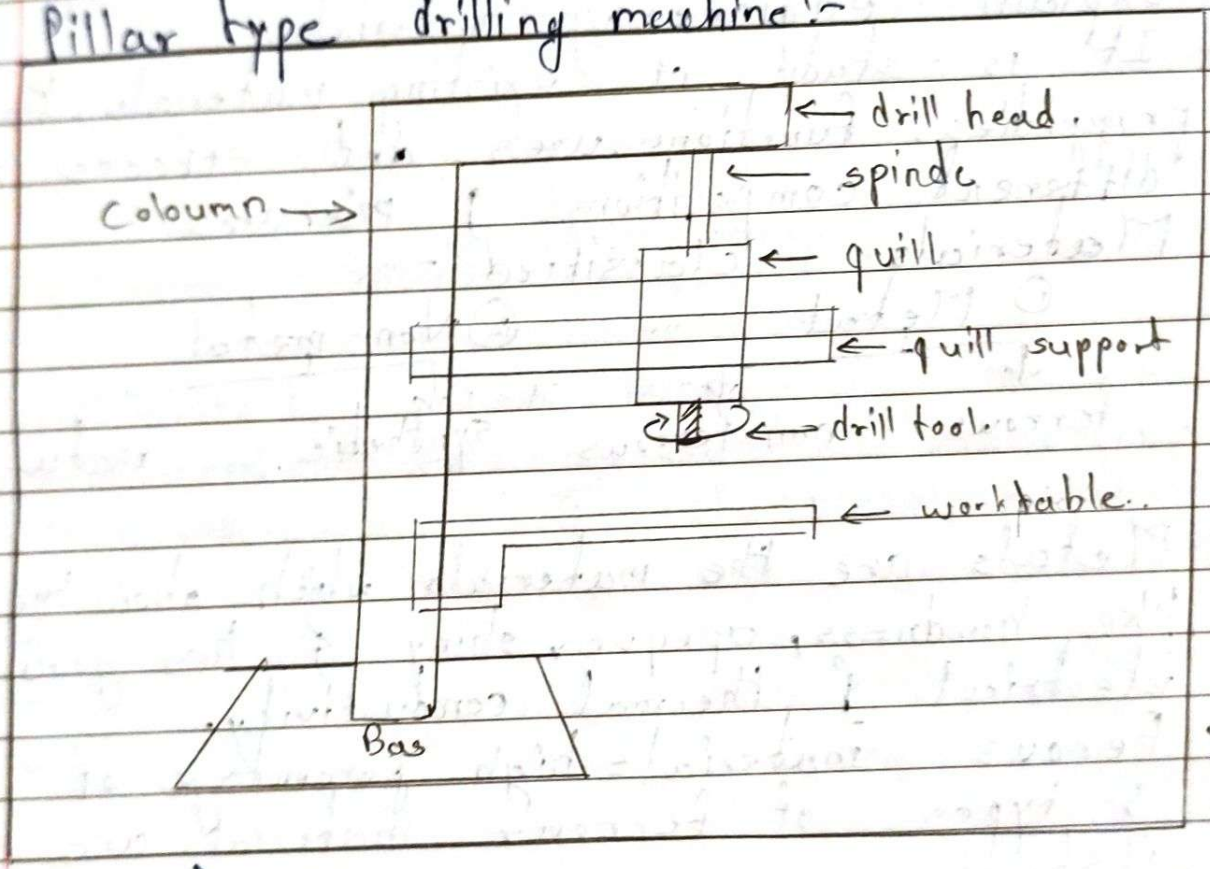
f] Table :- Table is mounted on the saddle on guide ways provided on it. The workpiece is mounted on the table with the help of clamps or T-slots.

g] Spindle : The spindle gets rotary motion from the motor through belts, gears, clyches and transmits the motion to an arbour. Arbour is fitted into the nose of the spindle which also holds the cutter. The accuracy in the machining of workpiece by cutter depends on accuracy

strength, and rigidity of the spindle.

h] Arbour :- It is an extension of the spindle on which the milling cutters are mounted. The cutter gets rotary motion from an arbour. The other end of the arbour is supported by an overarm.

6] Pillar type drilling machine :-



- Elements :-
1] drill head 2] spindle 3] Coloumn 4] quill
5] Worktable 6] Base 7] quill suport.

- Construction & working :-
1] Coloumn is round.
2] It provides support for a cork table & spindle head.
3] The work table supports the work piece.
4] It can be raised or lowered along pillar.

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* Applications:
1] It is used for the drilling various house hold equipments.
2] It is used for drilling automobile equipme
3] Used for the drilling of the various engineering components.
4] For the drilling of disc brake plates.

Q. 6. Explain engineering materials.
→ It is study of existing materials, their properties, functions, uses, and effects over different compositions & mixtures.
- Materials classified —

① Metal → ferrous, non-ferrous
② Non-metal → synthetic, natural.

- Metals are the materials which show the prop like hardness, opeque, shiny & has good electrical & thermal conductivity.
- Ferous material - high percentage of iron
- 3 types of ferrous material are
  1] Steel
  2] Cast iron
  3] Wrought iron.
- Steel — Alloy of iron & carbon + carbon less than 1.7%.
  - carbon present in form of iron carbo
  ∴ hardness & strength increases.

a] low carbon steel [mild steel] -
- carbon present 0.15% to 0.45% [Mn, Si, S]
Application:- Srew, bolt, nut, automobile body, building bars.

b] Medium carbon steel :-
- Carbon 0.45 to 0.8%
Applications :- Hooks, wire ropes, shaft, connecting rod, gears, turbine blades.

c] High Carbon steel -
- Carbon 0.8 to 1.7%
application :- Chisels, cutting tools, drill, saws.

Alloy steel :- other than carbon are added in sufficient quantity to implie desired properties such as wear resistance, corrosion resistance.
* Nickel - for strength & toughness.
* Chromium - hardness & strength.
* Tungstan - hardness at high temperature.
* Vanadium - for tensile strength.

Stainless steel :- Good corrosion resistance.
chromium & nickel - 18 & 8 %.
carbon - 0.15 %.