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Internal Assesment Test - I

Sub:	Machine Tools & Operations							Code:	17ME45B
Date:	07 / 03 / 2019	Duration:	90 mins	Max Marks:	50	Sem:	IV	Branch:	MECH (A & B)

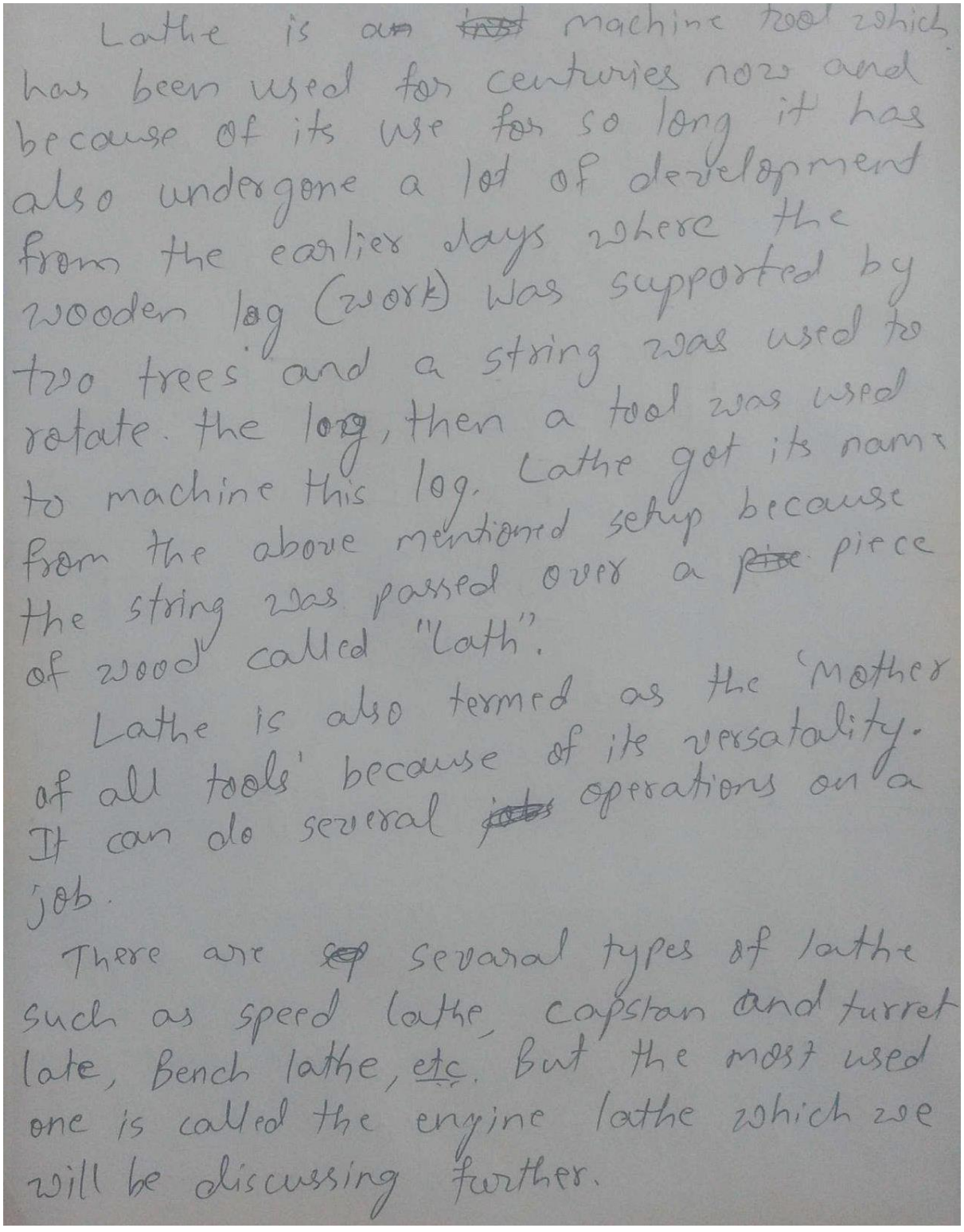
Answer ALL FIVE Questions

			Marks	OBE	
				CO	RBT
1		Explain with a neat sketch the construction and working of a lathe.	[10]	CO1	L2
2		Explain with a neat sketch construction and working of a radial drilling machine.	[10]	CO1	L2
3		Explain with a neat sketch construction & working of column & knee type vertical milling machine.	[10]	CO1	L2
4		Define machine tools. List the classification of machine tools. Draw the schematic representation of a broaching tool and explain as to why its designed in that way.	[1+4+5]	CO1	L1
5		Describe the specifications of lathe, milling and drilling machines.	[10]	CO1	L1

Machine Tools and Operations

Solution of IAT 1 (March 2019)

1.



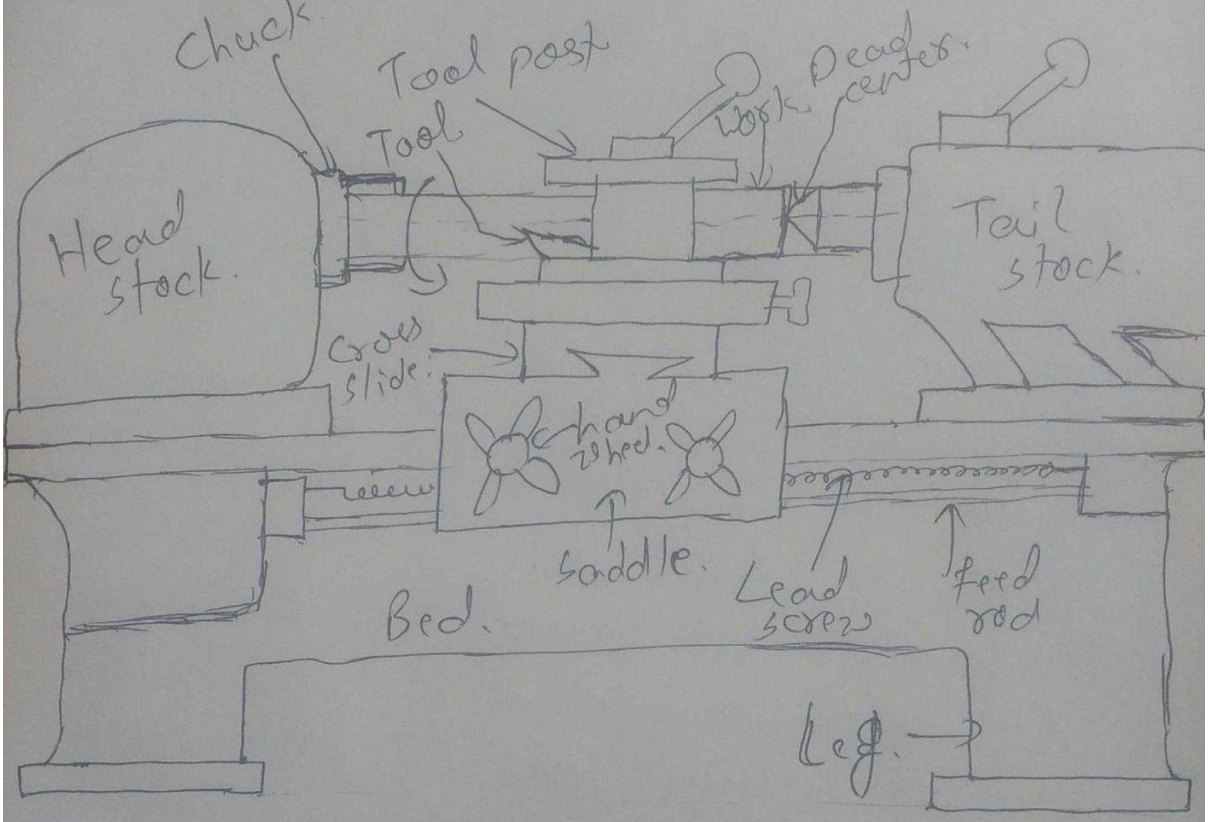
Lathe is a ~~n~~ ~~most~~ machine tool which has been used for centuries now and because of its use for so long it has also undergone a lot of development from the earlier days where the wooden log (work) was supported by two trees and a string was used to rotate the log, then a tool was used to machine this log. Lathe got its name from the above mentioned setup because the string was passed over a ~~pi~~ piece of wood called "Lath".

Lathe is also termed as the 'mother of all tools' because of its versatality. It can do several ~~jo~~ operations on a job.

There are ~~se~~ several types of lathe such as speed lathe, capstan and turret late, Bench lathe, etc. But the most used one is called the engine lathe which we will be discussing further.

Engine lathe got its name because in the earlier days, the tool on this lathe was powered by a steam engine.

Construction & Working of a Lathe



The schematic representation of the lathe is shown in the diagram above.

Bed is a cast part made from cast iron, it supports the entire weight of the machine. It has to be large to

be able to with stand the downward cutting forces generated during the operation. It has guide ways on the top of it to allow or guide the saddle and tailstock to slide on top of it. It also has a leadscrew and feed rod to move the saddle along the axis of the lathe.

The headstock houses the motor and also the gear drive system. The speed of the spindle can be varied to be able to machine different jobs and also for different operations. The head stock also has a chuck to hold the workpiece firmly.

The tailstock is on the other end of the bed. This tail stock can be moved parallel to the lathe axis. on the guideways of the bed. It can be fixed in place at any point. The main job of the tail stock is to support the free end of the work and also to hold tools like, drill bit, bore cutter, reamer, etc.

The carriage assembly is the one inbetween the headstock and tailstock. It also can move parallel to the lathe axis on the guideways provided on top of the bed. It has four main parts, saddle, compound rest, cross slide and tool post.

Saddle is the one in contact with the bed, it is moved parallel to the lathe axis using a hand wheel.

On top of the saddle sits the cross slide. This cross slide moves perpendicular to the lathe axis. On top of this sits the compound rest and tool post. Compound rest is termed so, because it can give the tool a combined motion, because it can be slightly tilted at an angle with respect to the lathe axis. The tool post, as the name suggests, holds the tool firmly during operation.

During working, the work (cylindrical) is held firmly by the chuck on the head stock, and if its too long, the free end

is supported by the dead center on the ~~tool post~~ tail stock. Then an appropriate speed is selected for the operation and the work piece is made to rotate. As the work rotates, the tool fixed to the tool post is brought in contact with the work ~~at~~ with a proper depth of cut and by moving the carriage and the cross slide, the material is removed to obtain the required work dimensions. The work should rotate in such a way that the material should be removed in the downward motion of the work.

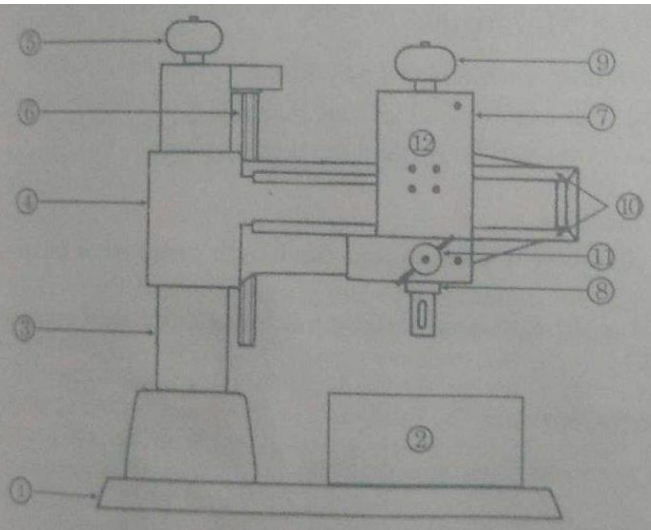
2.

It is a heavy duty precision machine, designed for universal movements of the arm with a tool head over a stationary work piece. Its arm will be automatically clamped on the vertical column when the elevating mechanism is stopped.

Construction

Fig 10.4 shows a Radial drilling machine. It consists of a large heavy **base (1)** with a stationary **working table (2)** A heavy cylindrical **column (3)** is mounted over it. It supports a heavy large **radial arm (4)** which can be raised, lowered or swung around its axis to any position and clamps automatically in that position. It receives power from a **motor (5)** which is mounted over it.

It can slide vertically over the **elevating screw (6)**. A **drill head (7)** contains the **sleeve and spindle unit (8)**. A gear box is housed inside the drill head to obtain required feed and speed. These receive power from another **motor (9)**, which is mounted over the head. The head can be moved horizontally over the arm on the **guide ways (10)** and clamped at any desired position. A **hand wheel (11)** helps in giving a manual or automatic down feed for the drill. The operative **switches (12)** are fixed over the head.



1. Base,
2. Working Table,
3. Column,
4. Radial Arm,
5. First Motor,
6. Elevating Screw,
7. Drill Head,
8. Sleeve and Spindle Unit,
9. Second Motor,
10. Guide ways,
11. Hand Wheel,
12. Switches

Fig 10.4 *Radial Drilling Machine*

Operation

After locating the hole positions, the work piece is mounted on the work table using suitable fixtures. Suitable drill and coolant are selected. The drill is fitted into the spindle. The tool head (drill) is brought over the work piece by swinging and moving the arm in the necessary up, down, left or right directions. The necessary feed and speed are calculated and set on the drill head drive mechanism. The machine is started and drilling may then be performed as usual.

3.

11.11 Plain Horizontal Milling Machine

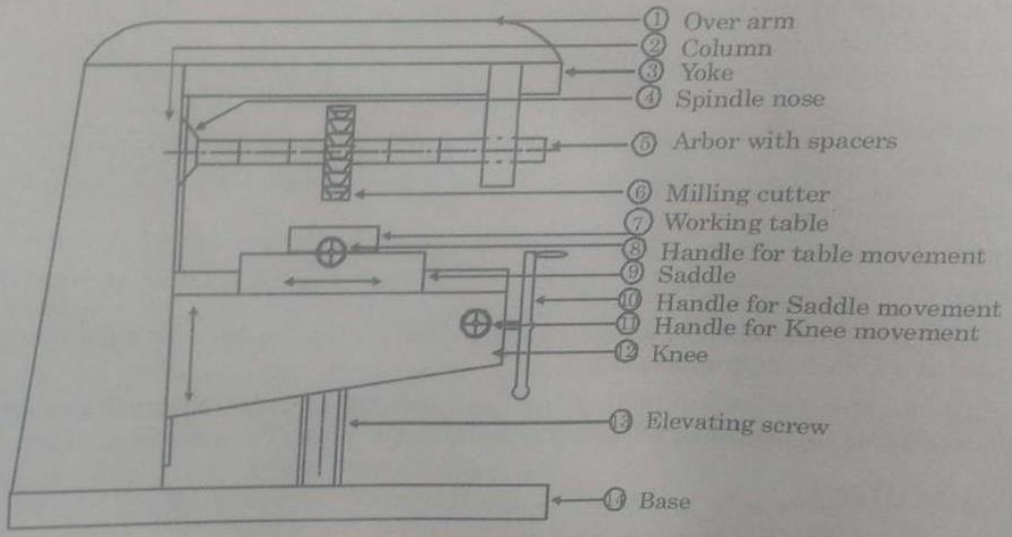


Fig 11.5 *Plain Horizontal Milling Machine*

Construction

Fig 11.5 shows a plain horizontal milling machine with its main parts. Its **base** serves a a foundation member. All the other parts rest upon it. It carries a column at its one end The **column** houses all driving mechanisms of **spindle** and table feed. The spindle receives power mainly from a motor. It supports an overarm at its top, the **spindle nose** and a

knee. The knee is supported on an elevating screw and on the guide ways on the column. It can be moved up and down with the help of the handle (Part No. 11). The knee supports the working table with the saddle and houses the feed mechanism for them. The table may be moved longitudinally using the handle (Part No. 8). The table is accurately finished with T-slots to clamp the work piece and other fixtures on it. Its circular base is graduated in degrees. The **saddle** may be moved horizontally using the hand wheel (Part No. 10) which

is engaged to a lead screw (not shown in the figure) below the table. An **arbor** (shaft) is supported between the **spindle** nose and the **yoke** of the **over arm** and receives power from the spindle. One end of the arbor is tapered so as to fit in the spindle nose. **The milling** cutter(s) mounted on the arbor. It is provided with spacers to facilitate the adjustment for cutter(s) position(s).

Operation

The work piece is mounted on the table with the help of suitable fixtures. The desired contour, feed and depth of cut for the job are noted down. A suitable milling cutter for the specified job is selected and mounted on the arbor. The knee is raised till the cutter just touches the work piece. The machine is started. By moving the table, saddle and the knee, for the specified feed and depth of cut, the desired job may be finished. The machine may then be switched off.

4.

Machine tool is defined as one which imparts relative motion between tool and workpiece by means of an external power source and thereby assist in metal removal in the form of chips to produce a finished product of required dimensions.

Classification of machine tools :-

a. Based on purpose:

- Single purpose m/c tool.
- Multi purpose m/c tool.
- Special purpose m/c tool.
- Numerical controlled m/c tool.

b. Based on chip size:

- Short chips
- Long chips

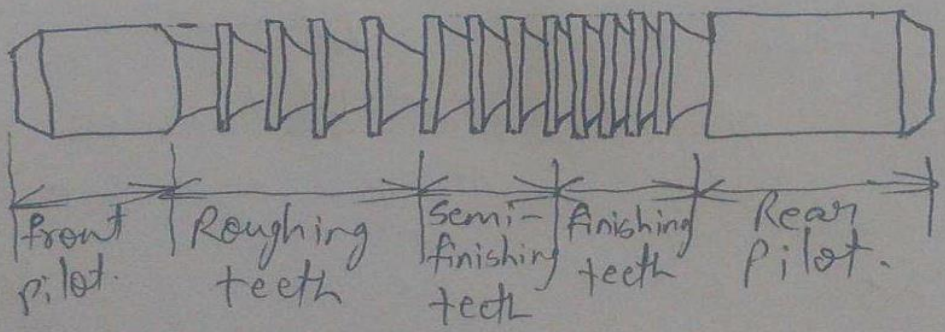
c. Based on type of surface produced:

- Plane surface
- Surface of revolution
- Teeth cutting
- Others

d. Based on the orientation of the axis:

- Horizontal axis m/c tool
- Vertical axis m/c tool
- Inclined axis m/c tool

Broaching Tool :-



The above diagram represents a typical Broaching tool. The front pilot is to guide the tool into the hole that has to be broached. Then the initial part of the teeth called the roughing teeth are very coarse and these teeth help in removal of maximum amount of material from the job (about 2-3 mm of stock material).

Then comes the semi-finish teeth that are finer than the roughing teeth, so these teeth usually remove lesser amount of material but they start smoothening out the surface (finishing). Then the last set of teeth is the finishing teeth which only remove a miniscule amount of material (less than 1mm) but give a good surface finish to the machined part of the job, this is because the teeth in this region are very fine.

5.

Specifications of a lathe :-

→ Max diameter and length of the work that can be accomodated.

→ Power of the main drive.

→ Range of spindle speeds

→ Range of feeds

→ ~~Floor~~ Floor space occupied by the machine.

10.9 Specifications of Drilling Machines

The general specifications of various drilling machines are as follows:

(i) The maximum diameter of drill that can be used in that machine

(ii) The maximum size of work piece that can be worked on that machine

(iii) Size of working table

(iv) Power (motor) capacity of the machine

(v) For Radial drilling machines, diameter of column and the length of the arm have to be specified.

(vi) For gang drilling machines and multi drill head drilling machines number of spindles with sizes have to be specified.

Milling machine (knee type and with arbour)

- Type; ordinary or swiveling bed type
- Size of the work table
- Range of travels of the table in X-Y-Z directions
- Arbour size (diameter)
- Power of the main drive
- Range of spindle speed
- Range of table feeds in X-Y-Z directions
- Floor space occupied.