Experiment No. 1

1.0 Title: Write a report on Industrial visit to observe at least electro discharge machining process.

2.0 Prior Concepts: Understand different Nontraditional machining processes, AJM, WJM, Electro Discharge Machining, Wire cut -EDM, - setup, working, process parameters, advantages, disadvantages and applications.

3.0 New Concepts:

Proposition1: Information collection during industrial visit.

Method of information collection during visit includes observations, documents, interviews and questionnaires. Information collected is used for writing report.

Concept structure:

Industrial Visit -1.Observations

2. Documents

3. Interviews

4. Questionnaire

4.0 Learning Objectives:

Intellectual skills:

- Understand the constructional details of various nontraditional manufacturing processes.
- Know the procedure for maintenance of different machining processes.
- Understand, visualize and correlate different subsystems of the plant under study.

Motor skills:

- Ability to collect the information of the plant.
- Ability to draw layout of the plant.
- Ability to write a report in the desired format.

5.0 Stepwise procedure:

1. Collect the information about the company before going for a visit form subject teacher or from the company website. (Date of visit, location, product)
2. List the question and doubt in the diary asked during the visit.
3. Proceed to visit on scheduled date.
4. Collect relevant information.

5. Clear the doubt from company representative during the visit.
6. Write a report on visit under the guidance of teacher.

6.0 Format of visit report:

1. Date and time of visit:_____
2. Details of location of the plant:_____

   _____
3. Name of company representative:_____

   _____
4. Layout of the plant (Block diagram with labels)

5. Name the different departments of the plant._____

_____

_____

_____

_____

6. General information of the plant:_____

7. Input raw material used for the production:_____

8. Products of the plant visited:_____

9. State production rate per shift of any one product of the plant visited._____

7.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 2

1.0 Title: Write a report on Industrial visit to observe electro chemical machining process.

2.0 Prior Concepts: Understand different Nontraditional machining process Electro chemical Machining - setup, working, process parameters, advantages, disadvantages and applications.

3.0 New Concepts:

Proposition1: Information collection during industrial visit.

Method of information collection during visit includes observations, documents, interviews and questionnaires. Information collected is used for writing report.

Concept structure:

Industrial Visit -1.Observations

2. Documents
3. Interviews
4. Questionnaire

4.0 Learning Objectives:

Intellectual skills:

- Understand the constructional details of various nontraditional manufacturing processes.
- Know the procedure for maintenance of different machining processes.
- Understand, visualize and correlate different subsystems of the plant under study.

Motor skills:

- Ability to collect the information of the plant.
- Ability to draw layout of the plant.
- Ability to write a report in the desired format.

5.0 Stepwise procedure:

7. Collect the information about the company before going for a visit form subject teacher or from the company website. (Date of visit, location, product)
8. List the question and doubt in the diary asked during the visit.
9. Proceed to visit on scheduled date.
10. Collect relevant information.

11. Clear the doubt from company representative during the visit.
12. Write a report on visit under the guidance of teacher.

6.0 Format of visit report:

10. Date and time of visit:_____
11. Details of location of the plant:_____

_____

12. Name of company representative:_____

_____

13. Layout of the plant (Block diagram with labels)

14. Name the different departments of the plant._____

_____

_____

_____

_____

15. General information of the plant:_____

16. Input raw material used for the production:_____

17. Products of the plant visited:_____

18. State production rate per shift of any one product of the plant visited._____

7.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 3

1.0 Title: One milling job on milling machine containing the operations like plain milling, slot milling by using end milling cutter.

2.0 Prior Concepts: Introduction, classification and basic parts of milling machine & their functions, operations like face milling, plain milling, slot milling, end milling, Cutting tool nomenclature and tool signature, cutting parameters.

3.0 Aim: To understand different operations carried out by the milling machine.

4.0 Material specification : ----------

5.0 Job Drawing:

6.0 Procedure: ----------

7.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 4

1.0 Title: One job of gear cutting (spur gear /helical gear) by using dividing head.

2.0 Prior Concepts: Understand the working of Milling & Gear Cutting machines, Introduction, gear manufacturing methods, universal dividing head & indexing methods, gear shaping & gear hobbing- setup, working, advantages, disadvantages, applications, gear finishing methods- grinding, shaving, burnishing.

2.1 Gear Cutting Processes: Gear cutting is any machining process for creating a gear. The most common gear-cutting processes include hobbing, broaching, milling, and grinding. Such cutting operations may occur either after or instead of forming processes such as forging, extruding, investment casting, or sand casting. Gears are commonly made from metal, plastic, and wood. Although gear cutting is a substantial industry, many metal and plastic gears are made without cutting, by processes such as die casting or injection molding. Some metal gears made with powder metallurgy require subsequent machining, whereas others are complete after sintering. Likewise, metal or plastic gears made with additive manufacturing may or may not require finishing by cutting, depending on application.

2.2 Broaching: For very large gears or splines, a vertical broach is used. It consists of a vertical rail that carries a single tooth cutter formed to create the tooth shape. A rotary table and a Y axis are the customary axes available. Some machines will cut to a depth on the Y axis and index the rotary table automatically. The largest gears are produced on these machines. Other operations such as broaching work particularly well for cutting teeth on the inside. The downside to this is that it is expensive and different broaches are required to make different sized gears. Therefore, it is mostly used in very high production runs.

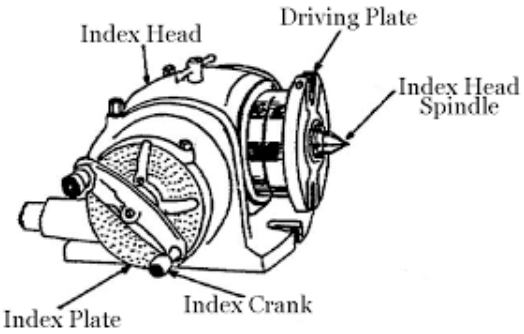
2.3 Hobbing: Hobbing is a method by which a *hob* is used to cut teeth into a blank. The cutter and gear blank are rotated at the same time to transfer the profile of the hob onto the gear blank. The hob must make one revolution to create each tooth of the gear. Used very often for all sizes of production runs, but works best for medium to high.

2.4 Milling/Grinding: Spur may be cut or ground on a milling machine or jig grinder utilizing a numbered gear cutter, and any indexing head or rotary table. The number of the gear cutter is determined by the tooth count of the gear to be cut.

To machine a helical gear on a manual machine, a true indexing fixture must be used. Indexing fixtures can disengage the drive worm, and be attached via an external gear train to the machine table's handle (like a power feed). It then operates similarly to a carriage on a lathe. As the table moves on the X axis, the fixture will rotate in a fixed ratio with the table. The indexing fixture itself receives its name from the original purpose of the tool: moving the table in precise, fixed increments. If the indexing worm is not disengaged from the table, one can move the table in a highly controlled fashion via the indexing plate to produce linear movement of great precision (such as a Vernier scale).There are a few different types of cutters used when creating gears. One is a rack shaper. These are straight and move in a direction tangent to the gear, while the gear is fixed. They have six to twelve teeth and eventually have to be moved back to the starting point to begin another cut. A popular way to build gears is by form cutting. This is done by taking a blank gear and rotating a cutter, with the desired tooth pattern, around its periphery. This ensures that the gear will fit when the operation is finished.

2.5 Shaping: The old method of gear cutting is mounting a gear blank in a shaper and using a tool shaped in the profile of the tooth to be cut. This method also works for cutting internal splines. Another is a pinion-shaped cutter that is used in a gear shaper machine. It is basically when a cutter that looks similar to a gear cuts a gear blank. The cutter and the blank must have a rotating axis parallel to each other. This process works well for low and high production runs.

3.0 Simple Indexing:



An **indexing head**, also known as a **dividing head** or **spiral head**, is a specialized tool that allows a workpiece to be circularly indexed; that is, easily and precisely rotated to preset angles or circular divisions. Indexing heads are usually used on the tables of milling machines, but may be used on many other machine tools including drill presses, grinders, and boring machines. Common jobs for a dividing head include machining the flutes of a milling cutter, cutting the teeth of a gear, milling curved slots, or drilling a bolt hole circle around the circumference of a part. The tool is similar to a rotary table except that it is designed to be tilted as well as rotated and often allows positive locking at finer gradations of rotation, including through differential indexing. Most adjustable designs allow the head to be tilted from 10° below horizontal to 90° vertical, at which point the head is parallel with the machine table.

The workpiece is held in the indexing head in the same manner as a metalworking lathe. This is most commonly a chuck but can include a collet fitted directly into the spindle on the indexing head, faceplate, or between centers. If the part is long then it may be supported with the help of an accompanying tailstock.

3.1 Manual indexing head: Indexing is an operation of dividing a periphery of a cylindrical workpiece into equal number of divisions by the help of index crank and index plate. A manual indexing head includes a hand crank. Rotating the hand crank in turn rotates the spindle and therefore the workpiece. The hand crank uses a worm gear drive to provide precise control of the rotation of the work. The work may be rotated and then locked into place before the cutter is applied, or it may be rotated during cutting depending on the type of machining being done. Most dividing heads operate at a 40:1 ratio; that is 40 turns of the hand crank generates 1 revolution of the spindle or workpiece. In other words, 1 turn of the hand crank rotates the spindle by 9 degrees. Because the operator of the machine may want to rotate the part to an arbitrary angle indexing plates are used to ensure the part is accurately positioned. Direct indexing plate: Most dividing heads have an indexing plate permanently attached to the spindle. This plate is located at the end of the spindle, very close to where the work would be mounted. It is fixed to the spindle and rotates with it. This plate is usually equipped with a series of holes that enables rapid indexing to common angles, such as 30, 45, or 90 degrees. A pin in the base of the

dividing head can be extended into the direct indexing plate to lock the head quickly into one of these angles. The advantage of the direct indexing plate is that it is fast and simple and no calculations are required to use it. The disadvantage is that it can only be used for a limited number of angles. Interchangeable indexing plates are used when the work must be rotated to an angle not available on the direct indexing plate. Because the hand crank is fixed to the spindle at a known ratio (commonly 40:1) the dividing plates mounted at the hand wheel can be used to create finer divisions for precise orientation at arbitrary angles. These dividing plates are provided in sets of several plates. Each plate has rings of holes with different divisions. For example, an indexing plate might have three rows of holes with 24, 30, and 36 holes in each row. A pin on the hand crank engages these holes. Index plates with up to 400 holes are available. Only one such plate can be mounted to the dividing head at a time. The plate is selected by the machinist based on exactly what angle he wishes to index to. For example, if a machinist wanted to index (rotate) his workpiece by 22.5 degrees then he would turn the hand crank two full revolutions plus one-half of a turn. Since each full revolution is 9 degrees and a half-revolution is 4.5 degrees, the total is 22.5 (9 + 9 + 4.5 = 22.5). The one-half turn can easily be done precisely using any indexing plate with an even number of holes and rotating to the halfway point (Hole #8 on the 16-hole ring).Brown and Sharpe indexing heads include a set of 3 indexing plates. The plates are marked #1, #2 and #3, or "A", "B" and "C". Each plate contains 6 rows of holes. Plate #1 or "A" has 15, 16, 17, 18, 19, and 20 holes. Plate #2 or "B" has 21, 23, 27, 29, 31, and 33 holes. Plate #3 or "C" has 37, 39, 41, 43, 47, and 49 holes. Universal Dividing heads: some manual indexing heads are equipped with a power drive provision. This allows the rotation of the dividing head to be connected to the table feed of the milling machine instead of using a hand crank. A set of change gears is provided to select the ratio between the table feed and rotation. This setup allows the machining of spiral or helical features such as spiral gears, worms, or screw type parts because the part is simultaneously rotated at the same time it is moved in the horizontal direction. This setup is called a "PTO dividing head".

3.0 Material Specification: _____

_____

_____

_____

4.0 Job Drawing:

5.0 Procedure for Gear Cutting on Milling Machine (with Pitch Calculations): _____

Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 5

1.0 Title: Prepare assembly job of gear and shaft which involves operations like end mill, turning, grinding operations.

2.0 Prior Concepts: Introduction of gear manufacturing, advantages, male part, female part, tolerance, types of tolerance, steps involved in the gear manufacturing, turning operations, grinding operations, milling operations etc

3.0 Aim: To prepare assembly job of gear and shaft

4.0 Material Specification:_____

4.0 Job Drawing:

5.0 Procedure: _____

Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 6

1.0 Title: One simple dry run job on CNC Lathe Machine and Verification on simulation software.

2.0 Prior Concepts: Introduction, advantages of CNC, open loop and closed loop control, axis identification, absolute & incremental coordinate system- G codes and M codes

3.0 Aim: To write the CNC program for the Component using part programming

4.0 Part Drawing:

4.1Tool Path: (Redraw part drawing and show tool path)

4.2 Co-ordinate Axis:

Position of tool	**X**	**Y**	**Z**

4.3 Program: _____

5.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 7

1.0 Title: One simple part on CNC Lathe Machine and Verification on simulation software.

2.0 Prior Concepts: Introduction, advantages of CNC, open loop and closed loop control, axis identification, absolute & incremental coordinate system- G codes and M codes

3.0 Aim: To write the CNC program for the Component using part programming

4.0 Part Drawing:

4.1Tool Path: (Redraw part drawing and show tool path)

4.2 Co-ordinate Axis:

Position of tool	**X**	**Y**	**Z**

4.3 Program: _____

5.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 8

1.0 Title: **One simple dry run Job on CNC Milling Machine and Verification on simulation software.**

2.0 Prior Concepts: axis identification, absolute & incremental coordinate system- G codes and M codes, simple lathe and milling programme , Dry run, Jog Mode, Block by Block execution etc.

3.0 Aim: To write the CNC program for the Component using part programming

4.0 Part Drawing:

4.1 Tool Path: (Redraw part drawing and show tool path)

4.2 Co-ordinate Axis:

Position of tool	X	Y	Z

4.3 Program: _____

5.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No.9

1.0 Title: One **simple part on CNC Milling Machine and Verification on simulation software**.

2.0 Prior Concepts: axis identification, absolute & incremental coordinate system- G codes and M codes, lathe and milling programme , Dry run, Jog Mode, Block by Block execution etc.

3.0 Aim: To write the CNC program for the Component using part programming

4.0 Part Drawing:

4.1 Tool Path: (Redraw part drawing and show tool path)

4.2 Co-ordinate Axis:

Position of tool	X	Y	Z

4.3 Program: _____

5.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	

Experiment No. 10

1.0 Title: Write a report on Industrial visit to observe robotic system in the industry.

2.0 Prior Concepts: Introduction, classification of robotic arm, basic parts of arm & their functions, applications, advantages and limitations,– types, tools and operations etc.

3.0 New Concepts:

Proposition1: Information collection during industrial visit.

Method of information collection during visit includes observations, documents, interviews and questionnaires. Information collected is used for writing report.

Concept structure:

Industrial visit-1. Observations

2. Documents

3. Interviews

4. Questionnaire

4.0 Learning Objectives:

Intellectual skills:

- Understand the constructional details of Broaching machines, Boring Machines, Planer machine**.**
- Know the procedure for maintenance of different machining processes.
- Understand, visualize and correlate different subsystems of the plant under study.

Motor skills:

- Ability to collect the information of the plant.
- Ability to draw layout of the plant.
- Ability to write a report in the desired format.

5.0 Stepwise procedure:

1. Collect the information about the company before going for a visit form subject teacher or from the company website. (Date of visit, location, product)
2. List the question and doubt in the diary asked during the visit.
3. Proceed to visit on scheduled date.
4. Collect relevant information.

5. Clear the doubt from company representative during the visit.
6. Write a report on visit under the guidance of teacher.

6.0 Format of visit report:

1. Date and time of visit:_____
2. Details of location of the plant:_____

   _____

   _____
3. Name of company representative:_____

   _____
4. Layout of the plant (Block diagram with labels)

5. Name the different departments of the plant._____

_____

6. General information of the plant:

7. Observations:

8. Types of robotic arm/system the plant visited:

9. Functions of the robotic arm/system:_____

10. Capacity of robotic arms/ system which have seen:_____

7.0 Conclusion: _____

Marks			Dated signature of teacher
Process related (10)	Product related (15)	Total (25)	