POORNIMA
COLLEGE OF ENGINEERING

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Machine Drawing Practice Lab Manual

(Lab Code: 3ME4-21)

2nd Year, 3rd Semester

Department of Mechanical Engineering

Session: 2023-24

TABLE OF CONTENT

VISION & MISSION

INSTITUTE VISION & MISSION

VISION

- To create knowledge based society with scientific temper, team spirit and dignity of labor to face the global competitive challenges

MISSION

- To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication & commitment to excellence in all spheres of life

DEPARTMENT VISION & MISSION

VISION

- To be recognized for quality education in the field of Mechanical Engineering and identified for its innovation & excellence

MISSION

- To provide education that transforms students through rigorous teaching and thought process to fulfill the needs of the society and industry
- To collaborate with leading industry partners and other academic & research institutes around the world to strengthen the education and research ecosystem.
- To prepare students with life-long learning for their career by fostering in them the ethical & technical capabilities pertinent to mechanical & allied engineering.

RTU SYLLABUS AND MARKING SCHEME

3ME4-21: Machine Drawing Practice LAB	
Credit: NA	**Max. Marks: 75 (IA:45, ETE:30)**
0L+0T+2P	**End Term Exam: 2 Hours**

S. No.	**NAME OF EXPERIMENT**
1.	Mechanical Component drawing & Geometric symbol Drawing Sheet
2.	Detailed Part drawing (Machine Vice- Part-I) from assembly drawing.
3.	Detailed Part drawing (Machine Vice- Part-II) from assembly drawing.
4.	Assembly Drawing (Non Return Valve) with sectioning and bill of materials.
5.	Introduction AUTOCAD with Graphic User Interface (GUI)
6.	Draw 2D drawings of given drawing using AUTO CAD.
7.	Draw 2D drawings of given Orthographic View using AUTO CAD.
8.	Draw 2D drawings of given Isometric drawing using AUTO CAD.
9.	3-D Modeling of a given object drawing in AutoCAD
10.	3-D Modeling with Annotation & Drafting of a given object drawing in AutoCAD
11.	Surface modelling Modeling in AutoCAD
12.	Assembly modelling by using AutoCAD

EVALUATION SCHEME

I+II Mid Term Examination			**Attendance and performance**			**End Term Examination**			**Total Marks**
Experiment	**Viva**	**Total**	**Attendance**	**Performance**	**Total**	**Experiment**	**Viva**	**Total**	
30	10	40	08	22	30	30	10	40	100

DISTRIBUTION OF MARKS FOR EACH EXPERIMENT

Attendance	**Record**	**Performance**	**Total**
2	3	5	10

LAB OUTCOME AND ITS MAPPING WITH PO & PSO

LAB OUTCOMES

After completion of this course, students will be able to –

3ME4-21.1	Draw & Illustrate simple mechanical parts & their assembly using fundamental Engineering Drawing Standards by using conventional method of Drawing Sheet.
3ME4-21.2	Apply the Geometrical Limits & tolerances using BIS Codes to Machine Parts drawings & their Assemblies.
3ME4-21.3	Analyze dimensioning, sectioning and development of views of complex feature components & improve their technical communication skill in the form of communicative drawings.
3ME4-21.4	Create 2D and 3D drafting of components using CAD software & explore the plotting techniques for standard presentation.

LO-PO-PSO MAPPING MATRIX OF COURSE

LO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
3ME4-21.1	2	-	-	-	-	-	-	-	-	-	-	-	3	2	2
3ME4-21.2	3	-	-	-	-	-	-	-	-	-	-	-	3	2	2
3ME4-21.3	-	-	-	-	-	-	-	-	-	2	-	-	3	2	2
3ME4-21.4	-	-	3	-	2	-	-	-	-	-	-	-	3	2	2

PROGRAM OUTCOMES (POs)

PO1	**Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and

	modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Design, analyze and innovate solutions to technical issues in Thermal, Production and Design Engineering.
PSO2	Exhibit the knowledge and skills in the field of Mechanical & Allied engineering concepts.
PSO3	Apply the knowledge of skills in HVAC&R and Automobile engineering.

RUBRICS FOR LAB

Laboratory Evaluation Rubrics:

S. No.	Criteria	Sub Criteria and Marks Distribution			Outstanding (>90%)	Admirable (70-90%)	Average (40-69%)	Inadequate (<40%)
		Mid-Term	End-Team	Continues Evaluation				
A	PERFORMANCE (PO1, PO8, PO9)	Procedure Followed M.M. 50 = 3 M.M. 75 = 4 M.M. 100 = 6	Procedure Followed M.M. 50 = 3 M.M. 75 = 4 M.M. 100 = 6	Procedure Followed M.M. 50 = 1 M.M. 75 = 2 M.M. 100 = 2	• All possible system and Input/ Output variables are taken into account • Performance measures are properly defined • Experimental scenarios are very well defined	•Most of the system and Input/ Output variables are taken into account • Most of the Performance measures are properly defined • Experimental scenarios are defined correctly	• Some of the system and Input/ Output variables are taken into account • Some of the Performance measures are properly defined • Experimental scenarios are defined but not sufficient	•System and Input/ Output variables are not defined • Performance measures are not properly defined • Experimental scenarios not defined
		Individual/Team Work M.M. 50 = 3 M.M. 75 =4 M.M. 100 = 6	Individual/Team Work M.M. 50 = 3 M.M. 75 =4 M.M. 100 = 6	Individual/Team Work M.M. 50 = 1 M.M. 75 = 2 M.M. 100 = 2	•Coordination among the group members in performing the experiment was excellent	•Coordination among the group members in performing the experiment was good	•Coordination among the group members in performing the experiment was average	•Coordination among the group members in performing the experiment was very poor
		Precision in data collection M.M. 50 = 3 M.M. 75 = 4 M.M. 100 = 6	Precision in data collection M.M. 50 = 3 M.M. 75 = 4 M.M. 100 = 6	Precision in data collection M.M. 50 = 2 M.M. 75 = 2 M.M. 100 = 4	•Data collected is correct in size and from the experiment performed	•Data collected is appropriate in size and but not from proper sources.	•Data collected is not so appropriate in size and but from proper sources.	ta collected is neither appropriate in size and norfrom proper sources
B	LAB RECORD/WRITTEN WORK (PO1, PO8, PO10)	NA	NA	Timing of Evaluation of Experiment M.M. 50 = 3 M.M. 75 = 4 M.M. 100 = 6	• On the Same Date of Performance	• On the Next Turn from Performance	• Before Dead Line	n the Dead Line
		Data Analysis M.M. 50 = 3 M.M. 75 =5 M.M. 100 = 6	Data Analysis M.M. 50 = 3 M.M. 75 =5 M.M. 100 = 6	Data Analysis M.M. 50 = 2 M.M. 75 = 3 M.M. 100 = 4	•Data collected is exhaustively analyzed & appropriate features are selected	•Data collected is analyzed & but appropriate features are not selected	•Data collected is not analyzed properly. •Features selected are not appropriate	ta collected is not analyzed & the features are not selected

		Results and Discussion M.M. 50 = 3 M.M. 75 =5 M.M. 100 = 6	Results and Discussion M.M. 50 = 3 M.M. 75 =5 M.M. 100 = 6	Results and Discussion M.M. 50 = 2 M.M. 75 = 3 M.M. 100 = 4	• All results are very well presented with all variables • Well prepared neat diagrams/plots/ tables for all performance measured • Discussed critically behavior of the system with reference to performance measures • Very well discussed pros n cons of outcome	• All results presented but not all variables mentioned • Prepared diagrams /plots/ tables for all performance measured but not so neat • Discussed behavior of the system with reference to performance measures but not critical • Discussed pros n cons of outcome in brief	• Partial results are included • Prepared diagrams /plots/ tables partially for the performance measures • Behavior of the system with reference to performance measures has been superficially presented • Discussed pros n cons of outcome but not so relevant	• Results are included but not as per experimental scenarios • No proper diagrams /plots/ tables are prepared • Behavior of the system with reference to performance measures has not been presented • Did not discuss pros n cons of outcome
C	**VIVA (PO1, PO10)**	Way of presentation M.M. 50 = 2.5 M.M. 75 = 4 M.M. 100 = 5	Way of presentation M.M. 50 = 2.5 M.M. 75 = 4 M.M. 100 = 5	Way of presentation M.M. 50 = 2 M.M. 75 = 3 M.M. 100 = 4	• Presentation was very good	• Presentation was good	• Presentation was satisfactory	• Presentation was poor
		Concept Explanation M.M. 50 = 2.5 M.M. 75 = 4 M.M. 100 = 5	Concept Explanation M.M. 50 = 2.5 M.M. 75 = 4 M.M. 100 = 5	Concept Explanation M.M. 50 = 2 M.M. 75 = 3 M.M. 100 = 4	• Conceptual explanation was excellent	• Conceptual explanation was good	• Conceptual explanation was somewhat good	• Conceptual explanation was Poor
D	**ATTENDANCE**	NA	NA	**A**ttendance M.M. 50 = 5 M.M. 75 =8 M.M. 100 =10	• Present more than 90% of lab sessions	• Present more than 75% of lab sessions	• Present more than 60% of lab sessions	• Present in less than 60% lab sessions

LAB CONDUCTION PLAN

Total number of Experiment – 12

Total number of turns required - 12

Number of turns required for:-

Experiment Number	Scheduled Week
Experiment -1	Week 1
Experiment -2	Week 2
Experiment -3	Week 3
Experiment -4	Week 4
Experiment -5	Week 5
Experiment -6	Week 6
Experiment-7	Week 7
I Mid Term	**Week 8**
Experiment -8	Week 9
Experiment-9	Week 10
Experiment-10	Week 11
Experiment-11	Week 12
Experiment-12	Week 13
II Mid Term	Week 14

DISTRIBUTION OF LAB HOURS

S. No.	Activity	Distribution of Lab Hours	
		Time (180 minute)	Time (120 minute)
1	Attendance	5	5
2	Explanation of Experiment & Logic	30	30
3	Performing the Experiment	60	30
4	File Checking	40	20
5	Viva/Quiz	30	20
6	Solving of Queries	15	15

GENERAL LAB INSTRUCTIONS

DO'S

1. Enter the lab on time and leave at proper time.
2. Feel that practical are essentials to lay the foundation for understanding the subject.
3. Have knowledge of the theoretical background of each experiment.
4. Handling every equipment carefully.
5. Consult your teacher, or your friend who had already done the experiment before entering the lab. This will help you to overcome difficulties while doing the experiments.
6. Turn off the machines before leaving the lab unless a member of lab staff has specifically told you not to do so.
7. Make as many observations/readings as possible. Large number of data will eliminate random errors and systematic errors.
8. Calculations must be done meticulously. For this, the knowledge of using calculators and mathematical tables is essential.
9. If you get wrong result others than the expected one, study your observation thoroughly and find out where you went wrong. Repeat the experiment until you get the correct observation, leading to the correct and expected result.
10. If you notice any problem with machine/ equipment/tool, then please report it to lab staff immediately. Do not attempt to fix the problem yourself.

DON'TS

1. Don't neglect the importance of practical.
2. Don't be lazy in making observation. Avoid copying someone else's observation.
3. There should not be any distraction. Don't play with your friend or the apparatus while doing the experiment.
4. Don't damage the equipment.
5. Don't touch the moving parts of the machine.
6. Don't play with electric instruments.
7. If you are going to be away from your machine for more than 10 or 15 minutes, switch off before leaving. This is for the security of your experiment and to ensure that others are able to use the lab resources while you are not.
8. No food or soft drink is allowed in the lab or near any of the equipment. Aside from the fact that it leaves a mess and attract pests. If you need to eat or drink, take a break and do so in the canteen.

9. Do not work in a laboratory wearing loose hair, loose clothing or dangling jewelry.
10. Don't wear rings, watches, bracelets or other jewelry that could get could get caught in moving machinery.
11. Do not eat food, drink beverages or chew gum in the laboratory.
12. Don't bring any external material in the lab, except your lab record, copy and books.

LAB SPECIFIC SAFETY RULES

FOR MANUAL DRAWING

1. Always bring drawing tools for manual drawing.
2. Always keep drawing sheet in sheet holder.
3. Keep the sheets safely after checking for final submission.

FOR CAD DRAWING

1. Always Login via students login.
2. Do not install anything on the system.
3. Do not delete anything from the system.
4. Take all your files to your pend rive or on your E-mail.
5. After the lab, shut down the system safely.

Experiment No.1- Mechanical Component & Geometric symbol Drawing Sheet

Objective: - To demonstrate the basic concepts of Machine component drawing by using manufacturing considerations. Student need to draw the drawings manually by using drawing tools with proper scale.

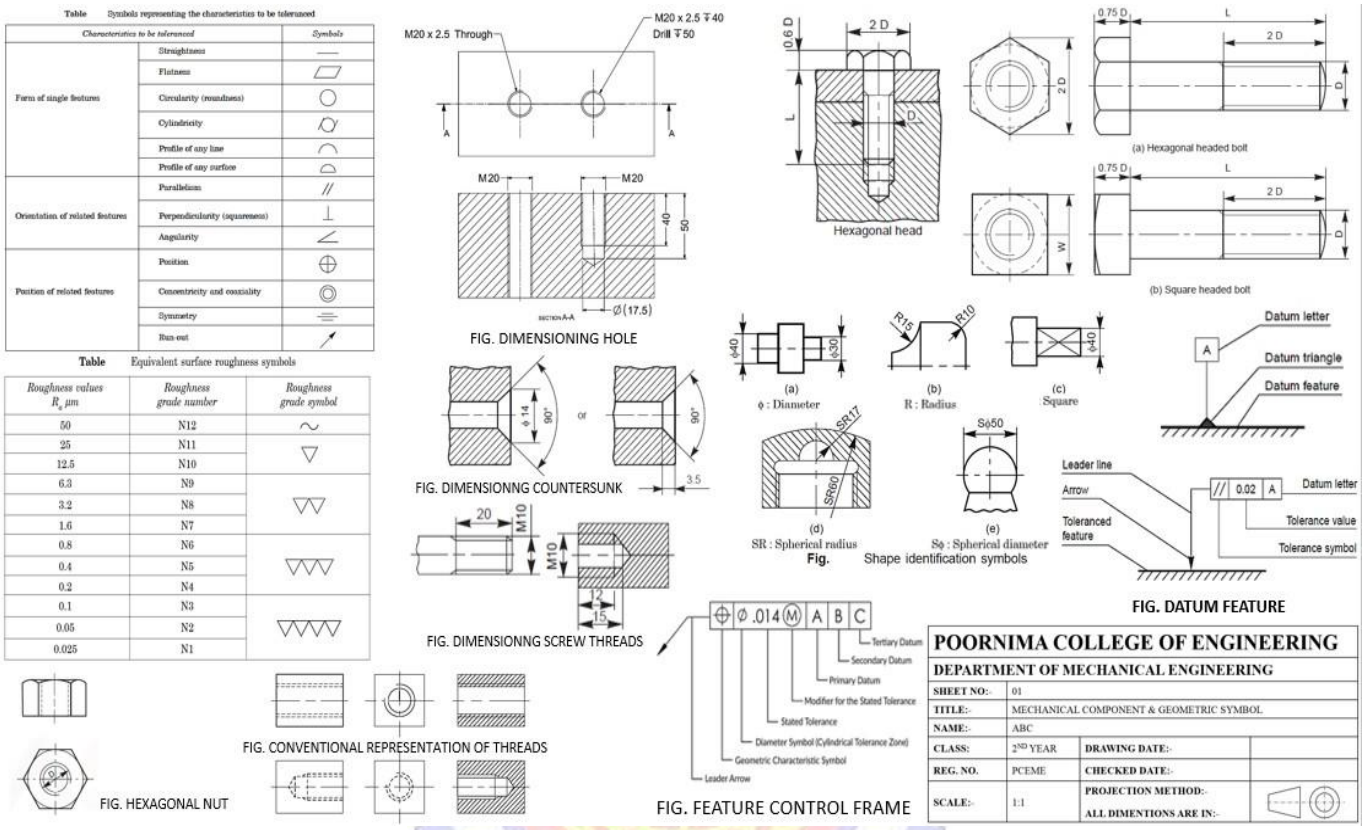


Fig. 1.0 Mechanical Component & Geometric symbol Drawing Sheet

Viva Questions

1. What are the basics things you need to consider while Manual drawing?
2. What are the size of Sheets?
3. What do you mean by Datum feature?
4. What is hatching line?
5. What do you mean by section?
6. What is projection Symbol? Why it is important
7. What are the positioning Symbols
8. How we represent Radius to an arc?
9. Explain Feature control frame?
10. Why Title box is important in a Drawing Sheet?
11. What M10 represents.
12. Represent a section line?

Experiment No.2- Detailed Part drawing (Machine Vice- Part-I) from assembly drawing

Objective: - To draw detailed Part drawing (Machine vice- Part-I) from assembly drawing. Student need to draw the drawings manually by using drawing tools with proper scale and dimension.

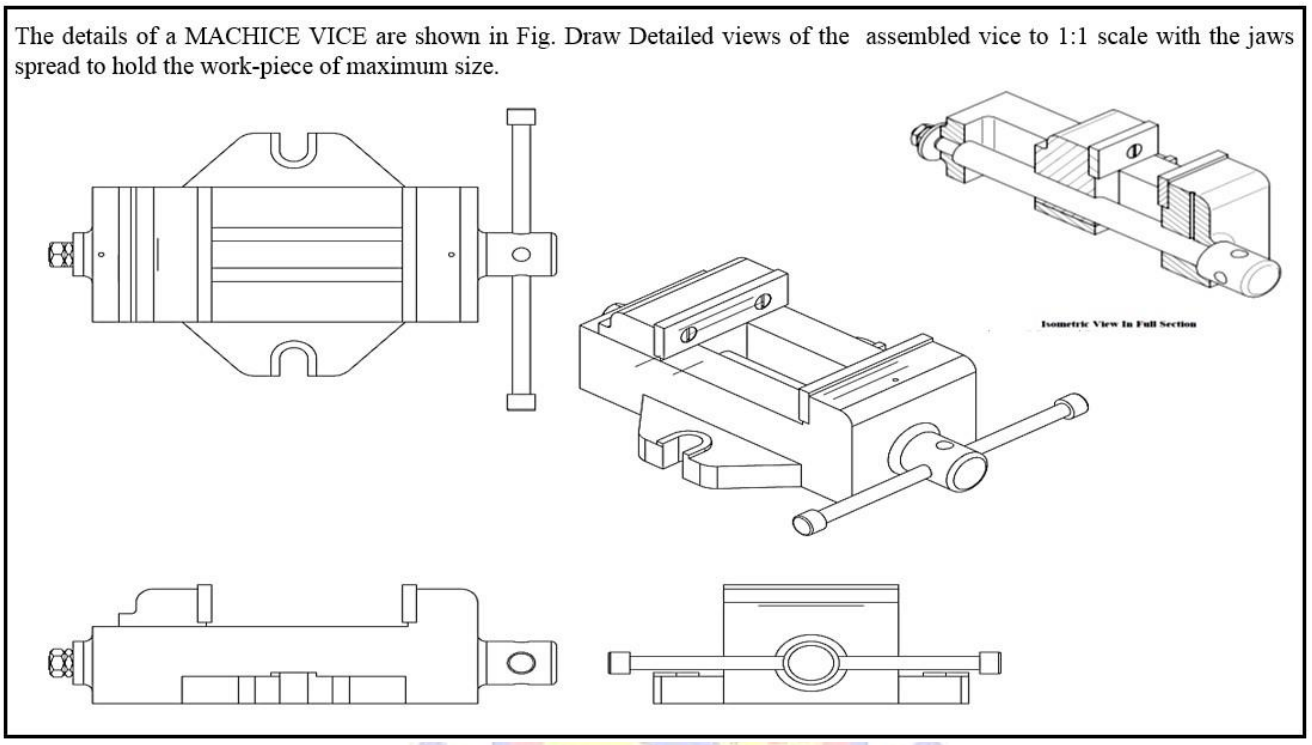


Fig. 2.0 Isometric view of Machine Vice for Reference

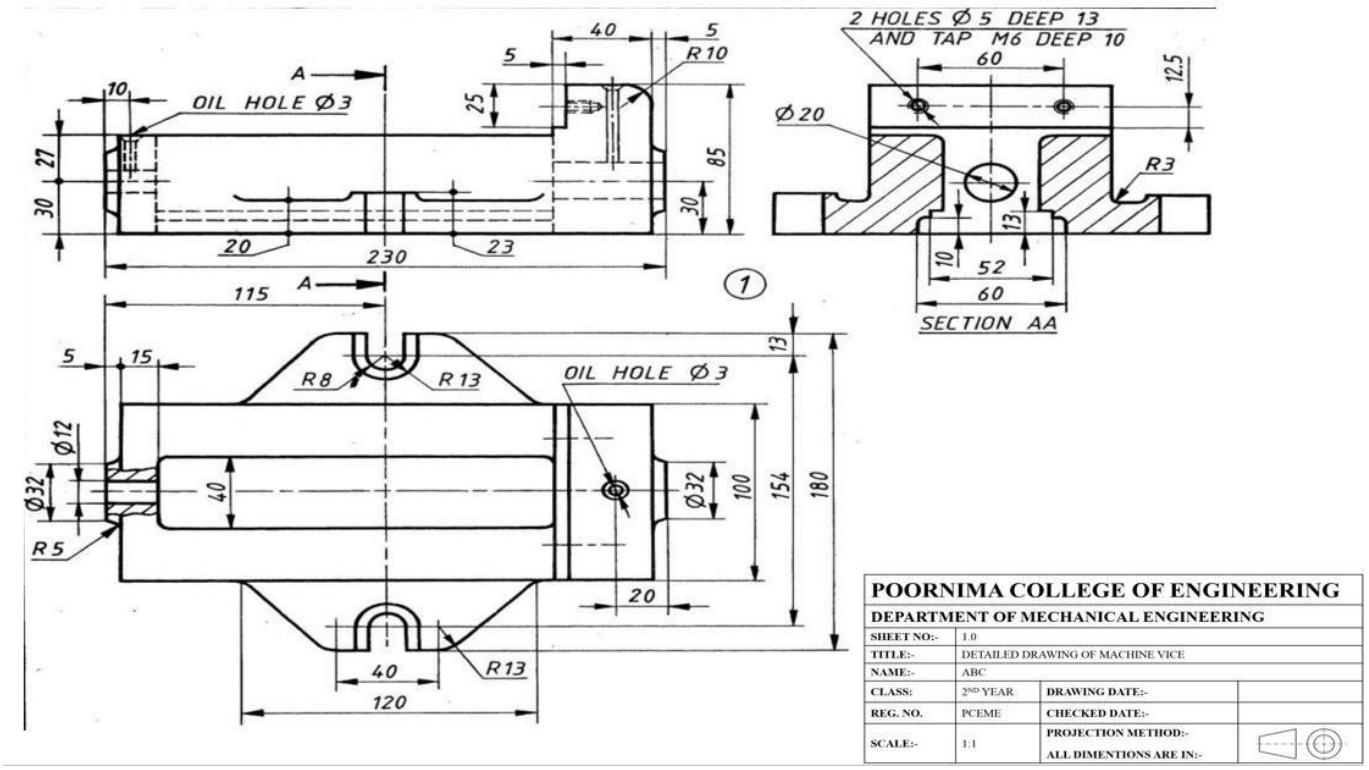


Fig. 2.1 Detailed Part drawing (Machine Vice- Part-I)

What is Vice?

Types of vices And Their Applications: - A vice is a mechanical apparatus that is used in securing an object to allow work to be performed on it i.e., to hold a work piece rigid at a stationary position. Vices consist of two corresponding jaws, one is static and the other can be moved in and out by a screw and a lever. It is used in multiple areas and fields such as a mechanical workshop, metalworking, woodworking etc.

The vice is attached to the bench, and therefore named as a **bench vice** or **workbench vice**. The bench vice are attached to a bench to give the operators comfort or ease while using the vice and to be easily accessible also.

If the working surface is stable a bench vice doesn't need to be attached to the workbench. It can be attached directly to the surface or the side. A vice is entirely made up of metal because of this reason, the linings in the jaws are made with wood or some similar kind of materials. This assists the integrity of the work piece. Jaws are replaceable if worn out over time.

Bench Vice

The complete construction of the bench Vice is made up of cast iron. Both of the jaws of this vice are made of tool steel and the spindle handle of the vice is made up of mild steel. This vice has wide range of applications in a workshop.

Bench Vice Parts and Function

The parts of the bench Vice are as follows:-

- Base
- Spindle
- Handle
- Fixed Jaw
- Movable Jaw
- Jaw Plate
-

Construction of Bench Vice

The fixed jaw of the bench vice is cast along with the vice and the movable jaw is fixed with it. In both types of jaws, the tool steel plate is attached with a plate screw, which has dents in it. These dents are the reason for the grip of the job being very strong. If the jaw plate gets damaged it can also be replaced.

Types of Vices and Their Applications

1. Pipe Vice:

The pipe vice is used in the plumbing work to hold the pipes in the vice to secure the tubing when cutting or threading is done. It is designed to hold the vice pipes which are as small as 3mm or as large as 200 mm. It may be fitted on a workbench or may be used with a mobile tripod stand. The mobile tripod stand

is usually used for projects to be performed outside the workshop, they are portable, and are easy to transport. We can combine two or more for longer pipes.

2. Machine Vice:

Types of Machine Vice

A) Plane Machine Vice

The plane machine Vice is used to fasten light jobs. It is also called the light-duty machine vice. Its fixed jaw is the one longer in the size. And the movable jaw moves ahead or backwards on revolving the spindle.

B) Flange Machine Vice

The flange machine vice is also known as the heavy-duty machine vice. For fastening the type of jobs that get frequent shocks at the moment of machining this type of machine vice is used. On one of the ends of the spindle, a square end is made which contains a box type handle fixed to it, to revolve it.

C) Universal Machine Vice

D) Vertical Machine Vice

E) Swivel Machine Vice

In construction and shape, the swivel machine vice is similar to a flange machine vice but it has a different kind of base, the vice can be revolved at any angle, with the help of this machine base. It has the quality which is that without separating the job from the vice straight or angular machining can be done.

3. Metalworking Vice:

4. Woodworking Vice

5. Heavy-Duty Vice

6. Medium Duty Bench Vice

7. Yoke Vice

8. Chain Vice

9. Leg Vice

10. Hand Vice

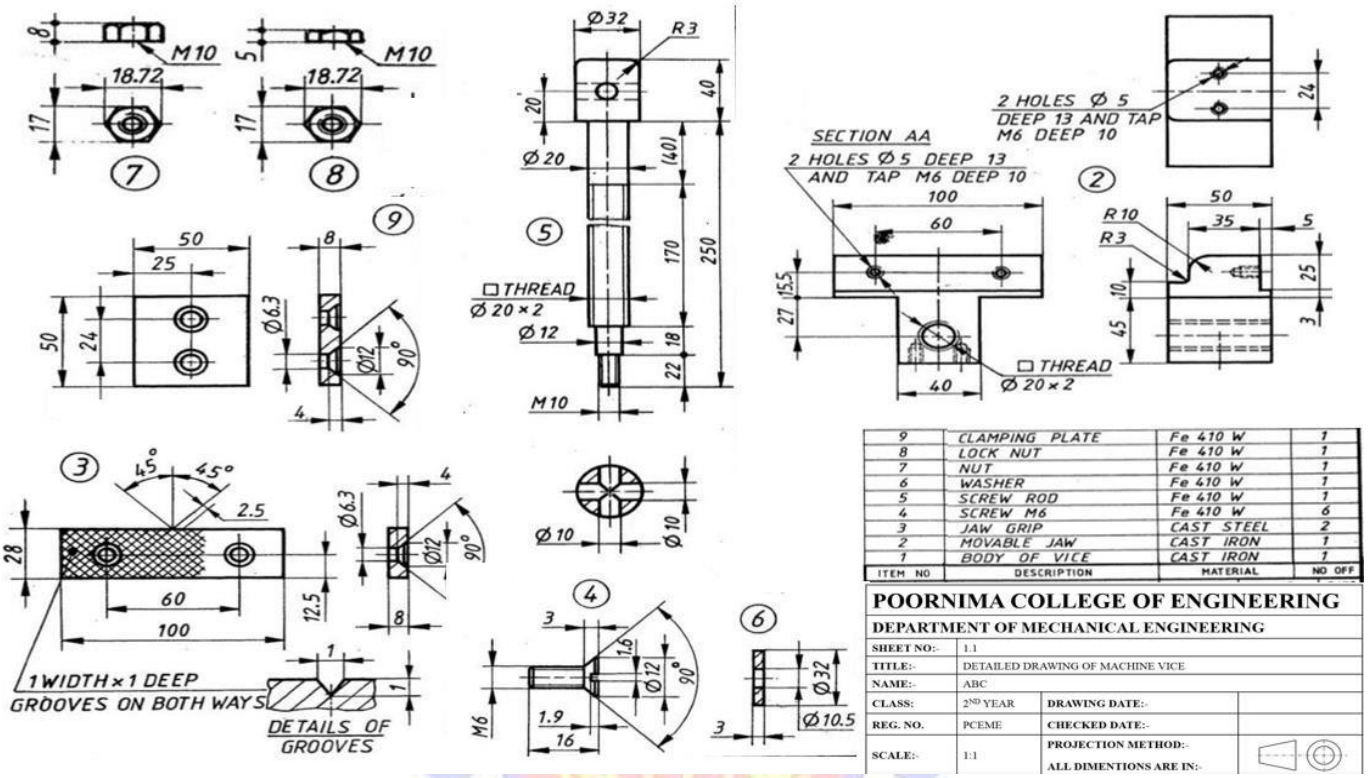
11. Combination Hand Vice

12. Tool Maker's Vice

13. Pin Vice

Experiment No.3- Detailed Part drawing (Machine Vice- Part-II) from assembly drawing

Objective: - To draw detailed Part drawing (Machine vice- Part-I) from assembly drawing with Bill of Material. Student need to draw the drawings manually by using drawing tools with proper scale and dimension.



ITEM NO	DESCRIPTION	MATERIAL	NO OFF
9	CLAMPING PLATE	Fe 410 W	1
8	LOCK NUT	Fe 410 W	1
7	NUT	Fe 410 W	1
6	WASHER	Fe 410 W	1
5	SCREW ROD	Fe 410 W	1
4	SCREW M6	Fe 410 W	6
3	JAW GRIP	CAST STEEL	2
2	MOVABLE JAW	CAST IRON	1
1	BODY OF VICE	CAST IRON	1

POORNIMA COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

SHEET NO:-	1:1		
TITLE:-	DETAILED DRAWING OF MACHINE VICE		
NAME:-	ABC		
CLASS:	2ND YEAR	DRAWING DATE:-	
REG. NO.	PCEME	CHECKED DATE:-	
SCALE:-	1:1	PROJECTION METHOD:- ALL DIMENTIONS ARE IN:-	

Fig. 3.0 Detailed Part drawing (Machine Vice- Part-II)

Viva Questions

1. What is machine vice?
2. What are the applications of Machine Vice
3. Why Drawings are important?
4. What are the types of Machine Vice?
5. What is Sectional View?
6. What is Bill of Material?
7. Why Sheet size is important for drawing?
8. Which are the things important, for manufacturing, as mentioned in the drawing.
9. Explain the process to draw Bill of Material.
10. Define Engineering Drawing. Why Drawing is called the Universal Language of Engineers?

Experiment No.4- Assembly Drawing (Non Return Valve) with sectioning and bill of materials.

Objective: - To draw Assembly Drawing (Non Return Valve) with sectioning and bill of materials. Student need to draw the drawings manually by using drawing tools with proper scale and dimension.

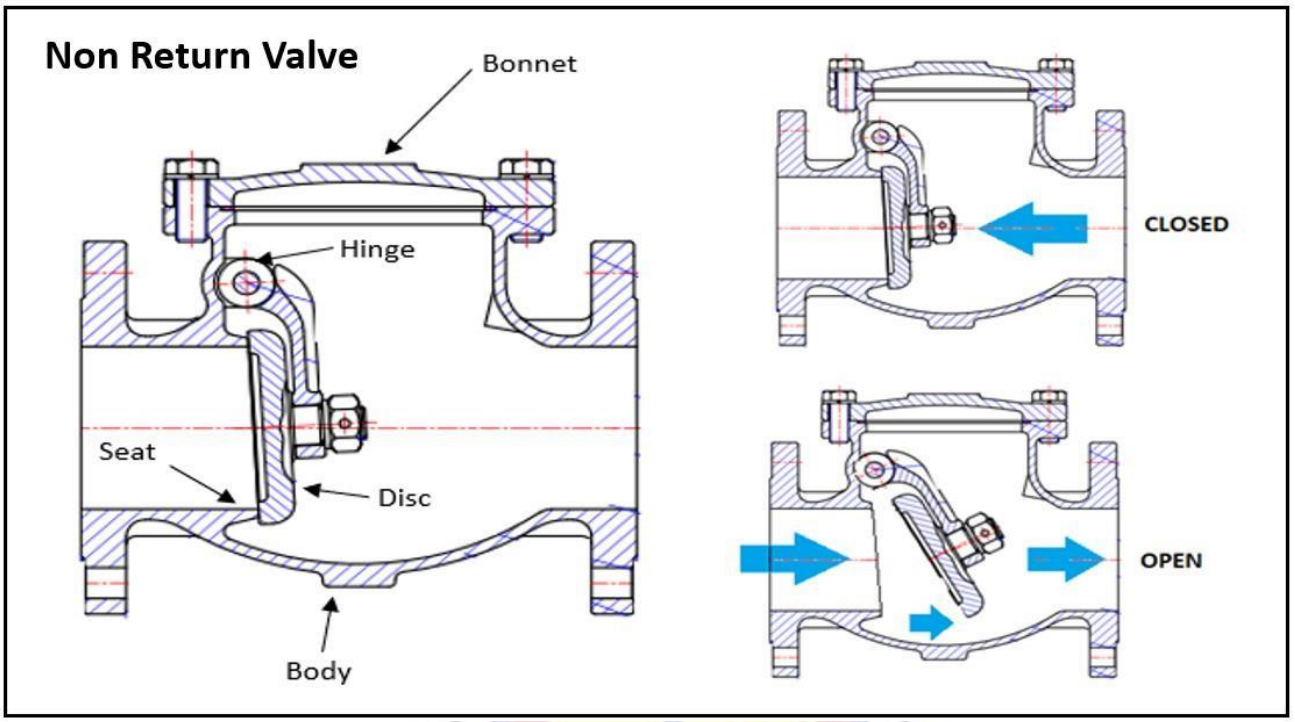


Fig. 4.0 Section View (Non Return Valve)

WHAT IS A NON-RETURN VALVE USED FOR?

A non-return valve, also known as a check valve, clack valve, one-way valve or retention valve, is designed to allow fluid to flow in one direction only, therefore preventing the liquid or gas from flowing back upstream of the valve. We take a look below at how a non-return valve operates, and what a non-return valve is used for, including some of the applications in which you might find one.

HOW DOES A NON-RETURN VALVE WORK?

A non-return valve usually only has two openings in the body, with a closing member situated between them. When the fluid enters the valve its pressure holds the closing mechanism open. If the fluid attempts to flow back through the valve in the wrong direction, the closing member is forced back over the entrance of the valve preventing any flow.

Non-return valves work automatically, which means that most are not controlled by a person or an external control but by the media flow itself. Depending on exactly what a non-return valve is used for, where it is used, the media flow and the budget available, there are a variety of different types of design

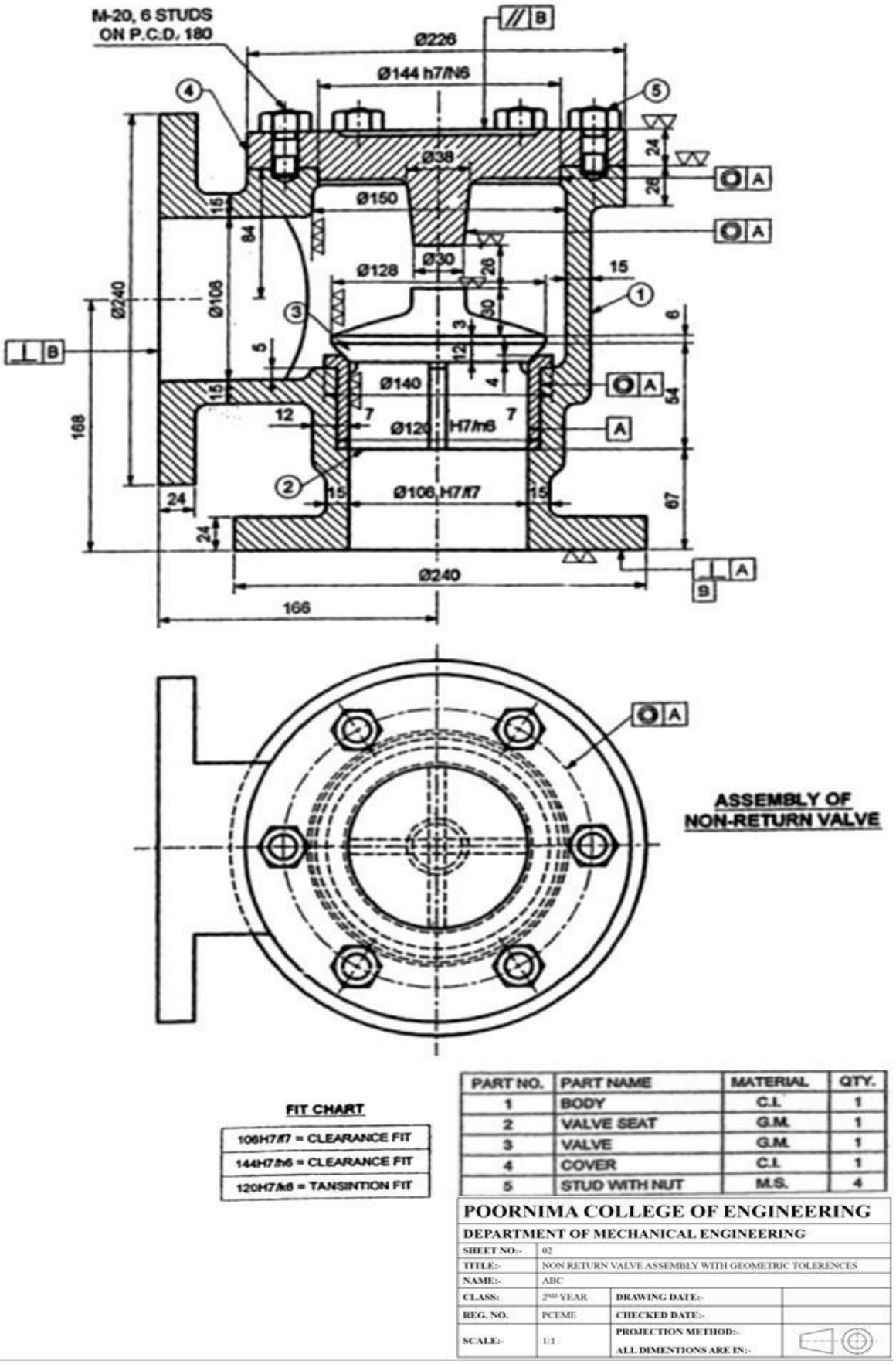
to select from according to the specific application. Types of non-return valve include those designed using a diaphragm, a swing or tilting disc, a stop, a lift, or a ball non-return valve.

WHICH APPLICATIONS IS A NON-RETURN VALVE USED FOR?

Pumps: Many pump applications include non-return valves to prevent backflow on the pump head on both the inlet and outlet lines. For example, the feed pumps for steam boilers would usually have a check valve fitted, as well as metering pumps, used to maintain a flow rate at a specific outlet pressure. They are also found in chromatography, which is a laboratory purification method for separating out components of a mixture.

Industrial processes: Fluid and processing systems, such as those found in power plants and pharmaceuticals, as well as fuel systems on transportation, commonly use non return valves within their pipeline systems. An example of what a non-return valve is used for in the nuclear industry could include within the dump lines, in the nitrogen feed system and in areas where water control systems are used. Non-return valves are used in fuel injection systems; the injectors are simply check valves which are designed to work with a high opening pressure and would be found in aircraft fuel systems as well as on spacecraft where the launch vehicle would use include them in the propulsion propellant control.

Domestic uses: Home heating systems, sprinkler systems and inflatable mattresses all use non-return valves. In some cases, the non-return valve can be a critical safety feature, for example to prevent contaminated, used water from re-entering a domestic water supply.



FIT CHART

106H7/f7 = CLEARANCE FIT
144H7/h6 = CLEARANCE FIT
120H7/k6 = TANSINTION FIT

PART NO.	PART NAME	MATERIAL	QTY.
1	BODY	C.I.	1
2	VALVE SEAT	G.M.	1
3	VALVE	G.M.	1
4	COVER	C.I.	1
5	STUD WITH NUT	M.S.	4

POORNIMA COLLEGE OF ENGINEERING			
DEPARTMENT OF MECHANICAL ENGINEERING			
SHEET NO:-	02		
TITLE:-	NON RETURN VALVE ASSEMBLY WITH GEOMETRIC TOLERENCES		
NAME:-	ABC		
CLASS:-	2ND YEAR	DRAWING DATE:-	
REG. NO.	PCEME	CHECKED DATE:-	
SCALE:-	1:1	PROJECTION METHOD:- ALL DIMENTIONS ARE IN:-	

Fig. 4.1 Assembly Drawing (Non Return Valve) with sectioning and bill of materials.

Viva Questions

1. What do you mean by Assembly drawing?
2. What is not return valve?
3. How does non-return valve works?
4. What do you mean by Fits?
5. Can we have section of assembled body?
6. What Do You Mean By Convention/ Code?
7. How assembly drawing is different from Part drawing?
8. What is the size of your drawing sheet?
9. Which positioning symbols are used in this drawing?
10. What do you mean by tolerance?

Experiment No.5- Introduction AUTOCAD with Graphic User Interface (GUI)

Objective: - To demonstrate the AUTOCAD Software with user interface and system settings. Students need to understand the basic commands & tools to operate the CAD software.

DESCRIPTION:

Computer Aided Drafting is a process of preparing a drawing of an object on the screen of a computer. There are various types of drawings in different fields of engineering and sciences. In the fields of mechanical or aeronautical engineering, the drawings of machine components and the layouts of them are prepared. In the field of civil engineering, plans and layouts of the buildings are prepared. In the field of electrical engineering, the layouts of power distribution system are prepared. In all fields of engineering use of computer is made for drawing and drafting.
The use of CAD process provides enhanced graphics capabilities which allows any designer to
Conceptualize his ideas Modify the design very easily Perform animation Make design calculations Use colours, fonts and other aesthetic features.

REASONS FOR IMPLEMENTING A CAD SYSTEM:

1. Increases the productivity of the designer: CAD improves the productivity of the designer to visualize the product and its component, parts and reduces the time required in synthesizing, analyzing and documenting the design
2. Improves the quality of the design: CAD system improves the quality of the design. A CAD system permits a more detailed engineering analysis and a larger number of design alternatives can be investigated. The design errors are also reduced because of the greater accuracy provided by the system.
3. Improves communication: It improves the communication in design. The use of a CAD system provides better engineering drawings, more standardization in the drawing, and better documentation of the design, few drawing errors and legibility.
4. Create data base for manufacturing: In the process of creating the documentation for these products, much of the required data base to manufacture the products is also created.
5. Improves the efficiency of the design: It improves the efficiency of the design process and the wastage at the design stage can be reduced.

APPLICATION OF CAD:

There are various processes which can be performed by use of computer in the drafting process.
1. Automated drafting: This involves the creation of hard copy engineering drawings directly from CAD data base. Drafting also includes features like automatic dimensioning, generation of cross – hatched areas, scaling of the drawing and the capability to develop sectional views and enlarged views in detail. It has ability to perform transformations of images and prepare 3D drawings like isometric views, perspective views etc.,
2. Geometric modeling: concerned with the computer compatible mathematical description of the geometry of an object. The mathematical description allows the image of an object to be displayed and manipulated on a graphics terminal through signals from the CPU of the CAD system. The software that provides geometric modeling capabilities must be designed for efficient use both by computer and the human designer.

BENEFITS OF CAD:

The implementation of the CAD system provides variety of benefits to the industries in design and production as given below:
1. Improved productivity in drafting
2. Shorter preparation time for drawing
3. Reduced man power requirement

4. Customer modifications in drawing are easier
5. More efficient operation in drafting
6. Low wastage in drafting
7. Minimized transcription errors in drawing
8. Improved accuracy of drawing
9. Assistance in preparation of documentation
10. Better designs can be evolved
11. Revisions are possible
12. Colors can be used to customize the product
13. Production of orthographic projections with dimensions and tolerances
14. Hatching of all sections with different filling patterns
15. Preparation of assembly or sub assembly drawings
. Preparation of part list
17. Machining and tolerance symbols at the required surfaces
18. Hydraulic and pneumatic circuit diagrams with symbols
19. Printing can be done to any scale

LIMITATIONS OF CAD:

1. 32 – bit word computer is necessary because of large amount of computer memory and time
2. The size of the software package is large
3. Skill and judgment are required to prepare the drawing
4. Huge investment

CAD SOFTWARES

The software is an interpreter or translator which allows the user to perform specific type of application or job related to CAD. The following softwares are available for drafting

1. AUTOCAD
2. Creo
3. CATIA
4. MS OFFICE
5. PAINT
6. ANSYS
7. MSc.NASTRAN
8. IDEAS 9. SOLIDWORKS
10. HYPERMESH 11. FLUENT –GAMBIT

INTRODUCTION TO AUTOCAD

AutoCAD is a CAD (Computer Aided Design or Computer Aided Drafting) software application for 2D and 3D design and drafting. It is developed and sold by Autodesk, Inc. First released in December 1982, AutoCAD was one of the first CAD programs to run on personal computers, notably the IBM PC. At that time, most other CAD programs ran on mainframe computers or mini-computers which were connected to a graphics computer terminal for each user. AutoCAD is used mainly by drafters, although engineers, surveyors and architects may need to use the software from time to time.

AUTOCAD AN OVERVVIEW

AutoCAD is a 2D and 3D computer-aided drafting software application used in architecture, construction and manufacturing to assist in the preparation of blueprints and other engineering plans. Professionals who use AutoCAD are often referred to as drafters. While drafters work in a number of

specialties, the six most common specialization areas are mechanical drafting, architectural drafting, civil drafting, electrical drafting, electronics drafting and aeronautical drafting.

AutoCAD software facilitates drafting in both 2D and 3D. AutoCAD performs 2D vector-based drafting and 3D solid modeling with easy rotations in three dimensions. This means that an object can be observed and analyzed from any angle, even from the inside. Through the 1980s, AutoCAD functioned mostly by using simple lines and circles, and text overlays, to set up custom objects. Beginning in the 1990s, AutoCAD began utilizing more robust custom object features, built with an Advanced Programming Interface using C++. And starting in 2007 AutoCAD has had much more advanced 3D tools that allow for greater 3D modeling and exploration of models, with high-quality, fast-moving rendering.

ADVANTAGES:-

1. AutoCAD allows its users to create 2D and 3D designs. Simple enough software with real user friendly interface.
2. AutoCAD detailing is one of the most prevalent forms of detailing due to AutoCAD's ease of use, realistic rendering, 3D navigation, flexibility and other features.
3. AutoCAD drawings save time, money, and labor by making it possible to order in bulk, well ahead of time and in the right dimensions.
4. AutoCAD have high level of customizability.
5. AutoCAD is also easily integrated with other applications to further expand its capabilities.
6. AutoCAD detailing to assist you in previewing your projects from details to the most complex.
7. AutoCAD software is most cost-efficient one and less time consuming.
8. AutoCAD performs 2D vector-based drafting and 3D solid modeling with easy rotations in three dimensions. This means that an object can be observed and analyzed from any angle, even from the inside.
9. AutoCAD drafting has become a routine today, delivering effective and accurate drawings for mechanical, architectural and structural projects.
10. Save time and money and reduce errors with the dynamic engineering model.

DISADVANTAGES:-

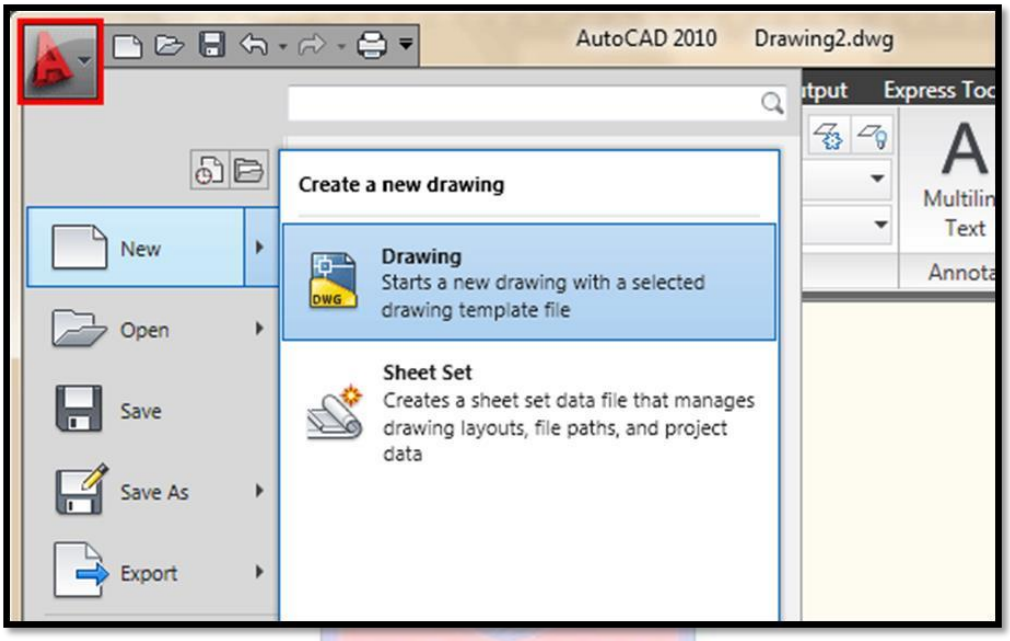
1. Is not suitable for data base.
2. it's case sensitive to error.
3. It is non parametric software.
4. Cannot handle complex designs.

OPENING AUTOCAD

Open up AutoCAD, you should be greeted with a screen asking if you want to open an existing drawing or start from scratch. (Dependent on your version of AutoCAD, the screen will be slightly different).

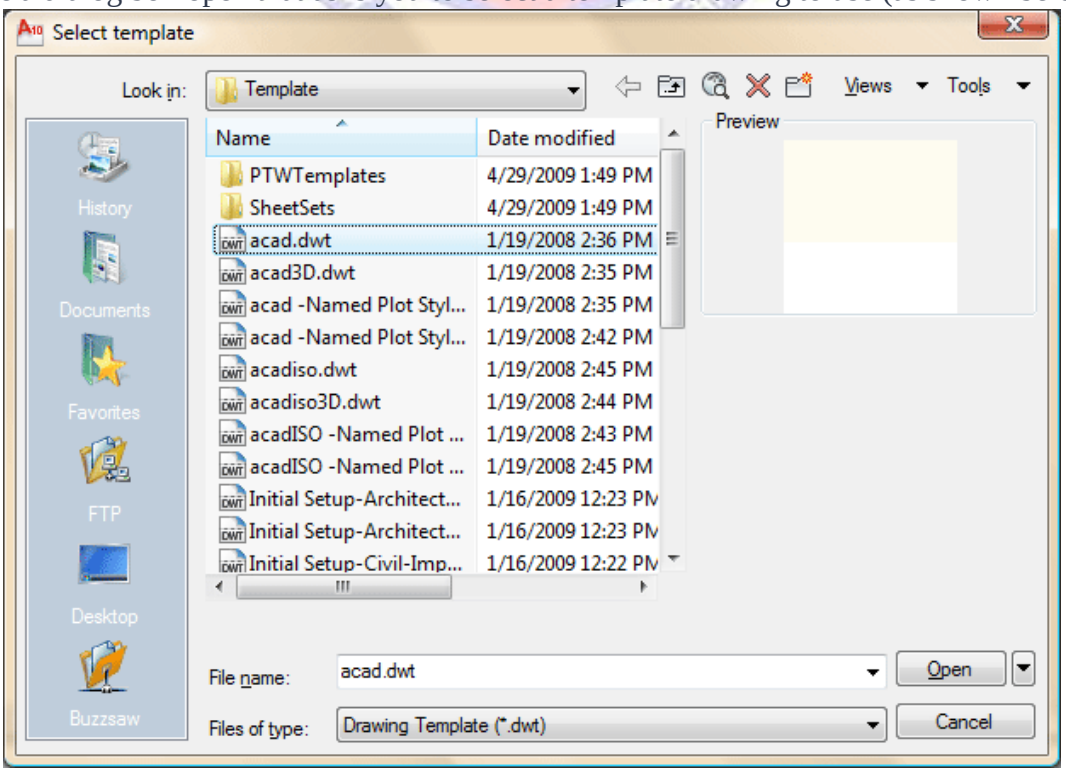
Start AutoCAD and a new drawing by pressing the Application Button (top left corner) and pressing the new button to reveal the fly out. Once you see the fly out, click on Drawing.

CREATES A NEW DRAWING FILE.



1. Choose File, New. **or**
2. **Press** CTRL + N or
3. Click the New icon. **or**
4. Type NEW at the Command prompt.
Command: **NEW**
5. **Choose** One of the options for creating a new drawing.
6. **Click** the OK button.
7. **Save** the drawing as another name.

You will see a dialog box open that asks you to select a template drawing to use (as shown below):



Select the "acad.dwt" template file and press the Open button to continue to the drawing screen. AutoCAD will now create a new drawing file named drawing1.dwg. AutoCAD will default to 'model space'. For now it is sufficient to say that model space is the blank space where all the drawing is carried out.

SAVING DRAWINGS

Saves the most recent changes to a drawing. The first time an unnamed drawing is saved the "Save As" dialog box appears. AutoCAD saves its drawings as files with extensions ending in .DWG.

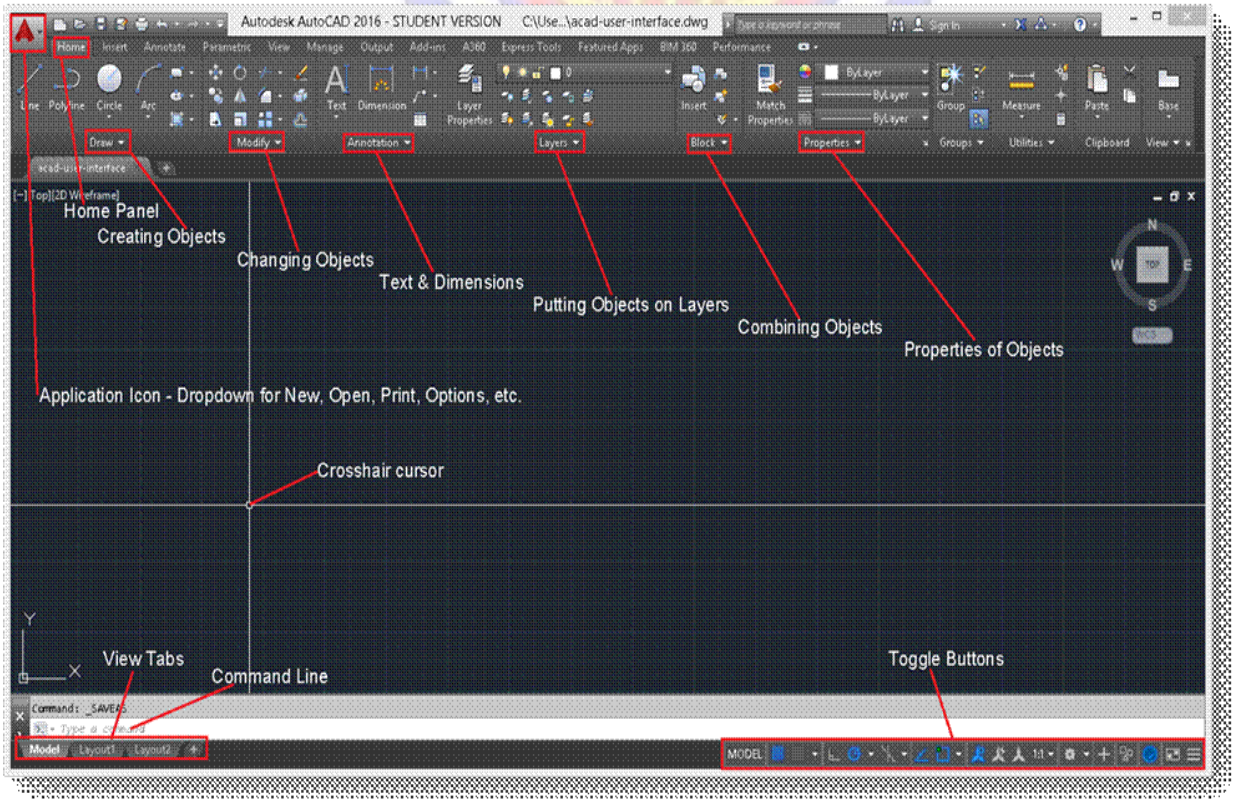
1. Choose File, Save or Save as. or
2. Type SAVE or SAVEAS at the command prompt. Command: **SAVE** or **SAVEAS**
3. Press ENTER
4. **Type** A new drawing name or keep the existing drawing name.
5. **Click** The OK button.

TOOLBARS

There are many toolbars available in AutoCAD. Go to **View > Toolbars** from the drop down menu to see them all. For now make sure that the following toolbars are checked:

Draw - Contains AutoCAD's most common drawing tools
Modify - Contains all of the common editing commands such as erase, copy etc.
Object Properties - Contains 'layer' information as well as object colors and line style options. (Covered Later).
Standard Toolbar - Contains open & save options as well as zoom & pan options.
Object Snap - AutoCAD's intelligent drawing aid - joins lines at specific points. (Covered later).

Arrange the icons to where is comfortable for you (A typical layout is shown below):

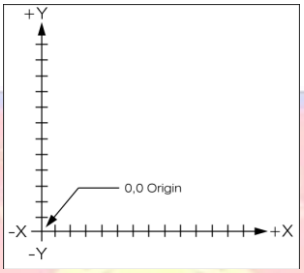


THE COMMAND LINE:-

The command line appears at the bottom of the AutoCAD screen (as shown above) and displays the commands entered. Commands can be entered into the command line in text format, or by using the icons or drop down menus. 'Old School' Cad users tend to type each command into the command line, as was required with older versions of AutoCAD. It is much quicker to familiarize yourself with the tool bars and drop down menus. There are times however when commands need to be typed into the command line, these will be covered later.

DRAWING TECHNIQUE - AUTOCAD'S CARTESIAN CO-ORDINATE SYSTEM

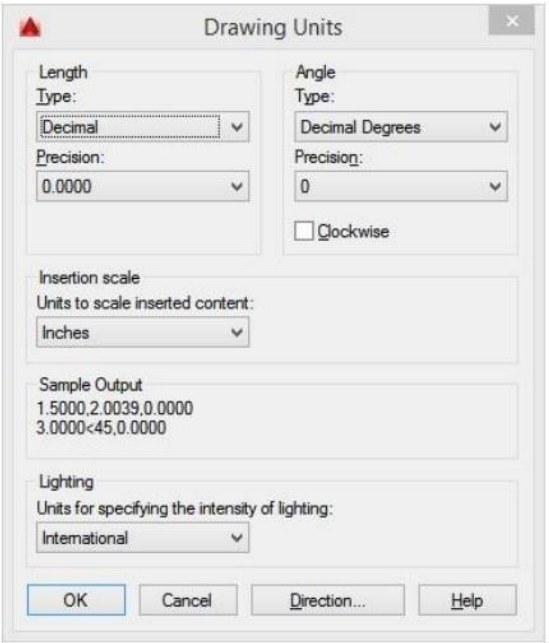
Just before we start drawing, one more important point. AutoCAD works on a co-ordinate system. When drawing, we can be very precise and specify an exact point in space where a line should begin or end. The 2D co-ordinates system is based on the horizontal and vertical axis named x and y. (This is shown in the bottom left of the AutoCAD drawing area, the X Y icon is called the UCS).



DRAWING UNITS SETUP:-

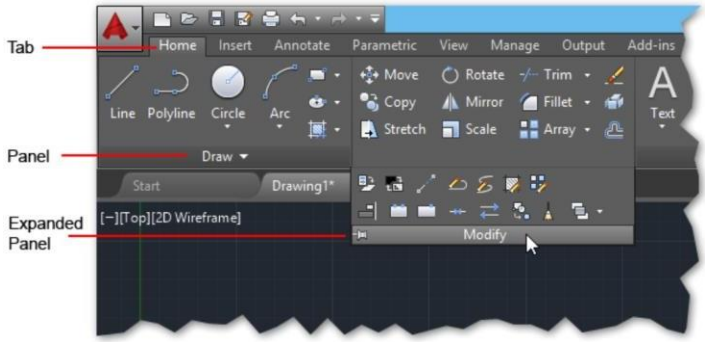
Every object we construct in a CAD system is measured in units. We should determine the value of the units within the CAD system before creating the first geometric entities.

1. In the pull-down menus, select: [Format] _ [Units]
2. In the Drawing Units dialog box, set the Length Type to Decimal. This will set the measurement to the default English units, inches.
3. Set the Precision to two digits after the decimal point as shown in the above figure.
4. Pick OK to exit the Drawing Units dialog box.



THE RIBBON

The ribbon is located, by default, docked across the top of the drawing area. It's composed of several tabs, which are composed of several panels, as shown in Figure 3. The ribbon can also be docked at the sides for floating (undocked) within the drawing area or on another monitor. Panels that have a small triangle pointing down are expandable panels, and you can expand those by a single click on the panel title.

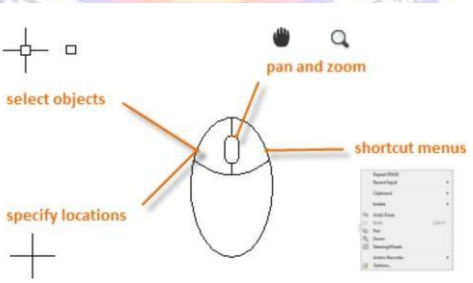


MOUSE

It's a good idea to have a mouse with left and right buttons and a wheel. A good mouse can save you a lot of time at the end of your project.

The following list describes how to use mouse keys:

- Left button: Used for entity selection as well as marking coordinate points.
- Right button: Opens the contextual menu matching the current selected entity, if any.
- Wheel:
    - Roll up: Zoom in
    - Roll down: Zoom out
    - Double-click: Zoom to the extension of your drawing
    - Press, hold, and drag: Pan the drawing



QUICK SAVE:-

1. Press CTRL + S. **or**
2. Click the Save icon. **Or**
3. Type QSAVE at the command prompt,
Command: **QSAVE**

EXITING AUTOCAD:-

1. Choose File, Exit. **Or**
2. Type QUIT at the command prompt.
Command: **QUIT**
3. **Press** ENTER
4. **Click** yes to save changes or No to discard changes.

BASIC AUTOCAD TERMINOLOGY

Here are some basic terms that you will want to review before using AutoCAD. Some terms have links to give you more information (but it is not necessary to memorize them all now).

Absolute co-ordinates	A way of inputting points based on AutoCAD's origin.
Acad.dwt	This is the default template that automatically loads whenever you start a drawing session. It can be customized to suit your needs.
Associated Dimensioning	Dimensions that are associated with specific points will update as that point is moved.
Backup file	AutoCAD can be set to automatically backup your drawing and save it. This is a safeguard in case your file gets corrupted. It is saved with a .BAK extension
Block	A pre-drawn image you can insert in your drawing to save time and make your file size smaller.
Clean Screen	A display setting that gives you maximum drawing space.
Crosshairs	This is your cursor when it is in the drawing space.
Cursor	Your cursor will change depending on what function it is performing in the program.
Database	An AutoCAD drawing file is actually one large database containing all the information needed to reproduce the objects when the file is opened. Info for layers and linetypes, etc are stored in this manner.
Dialog box	AutoCAD uses a large number of dialog boxes to get information from you. You must know how input the information that it asks for.
Drawing template file	This is a file that contains preset values for frequently used settings. AKA a prototype drawing. The file extension is DWT.
Extents	The outer boundaries of the objects you have drawn.
Grid	This is pattern of dots displayed on the screen to guide you. It can be toggled on and off by pressing the F7 key.
Grips	Small 'handles' on objects that allow for quick editing.
Layer	All objects are drawn on a layer. You can group objects (such as electrical) on a single layer and organize your drawing.
Layout Tabs	A space used for plotting your drawings (formerly called Paper Space).
Limits (Grid)	A setting to impose an 'artificial' boundary on your drawing that sets the area of the grid, and when turned on, limits you to drawing in the grid area.
Line type	All objects are drawn with a particular line type. Examples would be solid, center, dashed, etc.
Model space	The drawing space where you 'model' the objects.
Modify	A generic term used for changing your objects
Object	Any item that is in the AutoCAD database. Also known as an entity.
Origin	The (0,0) point of your current co-ordinate system.

Ortho mode	This is a drawing mode that allows you to draw only perpendicular lines. It is toggled on and off by pressing the F8 key.
Osnap - Object Snap	This is a method of 'snapping' to certain, precise points on an object.
Pan	To move around drawing by dragging the drawing area around your screen.
Panel	A grouping of commands on the ribbon
Path	The specific folder where AutoCAD looks for, or saves files.
Pick	To select an object by 'left-clicking' on it.
Plot	Also known as print. To make a hard copy of your drawing.
Polar co-ordinates	A way of inputting points based on distance and angle.
Property	Any specific characteristic of an object such as layer, scale, linetype, start point, etc.
Ribbon	The Ribbon runs across the top of the drawing space and contains panel - each panel has a group of associated tool. Switch to different panels by clicking on the tabs at the top of the ribbon.
Relative co-ordinates	A way of inputting points based on a starting point.
Selection set	The current group of objects selected for modifying.
Snap	This is a drawing mode that allows you to snap your cursor to precise points laid out in a grid pattern. Toggle with the F9 key.
Styles	Formatting that defines the look of text, dimensions, etc.
Units	The basic drawing unit set for you drawing. For example, you can use inches or millimeters depending on your needs. You can also set the precision you want displayed, such nearest 1/4", 1/2" 1/64", etc.
User co-ordinate system (UCS)	Modifications made to the World Co-ordinate System (WCS) results in a User Co-ordinate System (UCS)
View	A particular area of your drawing.
Viewport	A separate 'window' on your drawing. You may have more than one viewport visible to see different areas of your drawing at the same time.
Wizard	An easy step-by-step instruction set to help you set-up certain aspects of your drawing.
World Co-ordinate System (WCS)	This is the common X-Y co-ordinate system that is the default. If it is modified, it becomes a User co-ordinate System (UCS)
Zoom	To view either a smaller section of your drawing (zoom in) or a larger section (zoom out)

DRAW COMMANDS

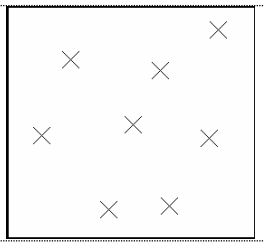
1. POINT:-

1. Choose Draw, Point, Single or Multiple Point. **or**

2. Click the Point icon.  **or**

3. Type POINT at the command prompt. Command : **POINT**

4. **Pick** A point on the drawing. Point (**point**)



2. LINE:-

Creates single straight line segments

1. Choose Draw, Line. **or**

2. Click the Line icon. **or** 

3. Type LINE from the command prompt ,Command: **LINE** or **L**

4. **Press** ENTER

5. **Pick** From point: (**point**)

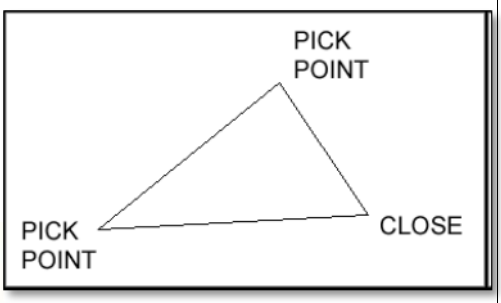
6. **Pick** Specify next point or [Close/Undo]:(**point**)

7. **Pick** Specify next point or [Close/Undo]:(**point**)

8. Press ENTER to end line sequence **or**

9. Type U to undo the last segment To point: **U** (undo) **or**

10. **Type** C to create a closed polygon To point : **C** (close)



3. RECTANGLE:-

1. Select the **Rectangle** symbol from the draw menu. 

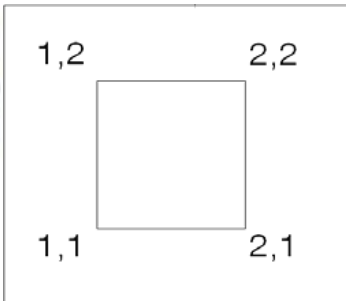
2. Specify on the screen the first corner for the rectangle you want to draw.

3. Type **D** to specify the dimension for the rectangle.

4. Input the length.

5. Input the width.

6. Click anywhere inside the rectangle area to get out of the command.



4. CIRCLE:-

1. Choose Draw, Circle. **or**

2. Click the Circle icon.  **or**

3. Type CIRCLE at the command prompt.

Command: **CIRCLE**

4. Type One of the following options: 3P/2P/TTR/<<center point>>: **or**

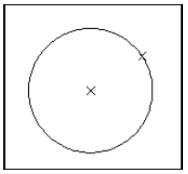
5. **Pick** A center point.

6. **Type** A radius or diameter. or

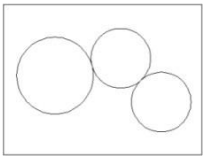
7. **Pick** A radius or diameter

Diameter/<<radius>>:

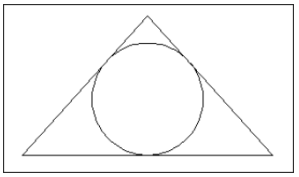
There are many types to draw a circle



Circle, Center Radius/Diameter



Circle, Tangent, Tangent Radius

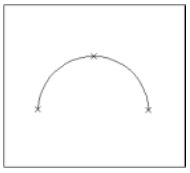


Circle, Tangent, Tangent, Tangent

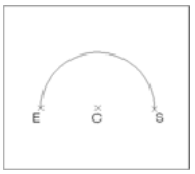
5. ARC COMMAND:-

1. **Choose** Draw, Arc. or 
2. **Click** the Arc icon. or
3.**Type** ARC at the command prompt
4. **Draw** One of the arcs.

Arc Example



3 point arc



start, center, end

6. ERASING OBJECTS:-

1. Choose Modify, Erase. **or**  **Click** the Erase icon. **or**

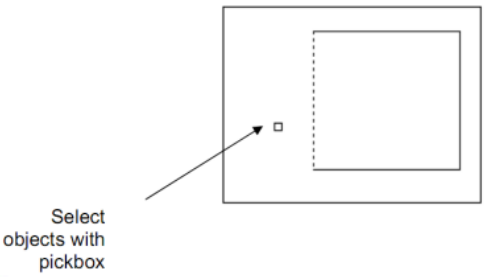
2. Type ERASE at the command prompt. Command : **ERASE** or **E**

3. **Pick** Object at the select object prompt.

Select objects: (**pick object**)

4. Press ENTER when you are done choosing objects.

Select objects: **ENTER**



7.PLINE:-

A polyline is a connected sequence of line segments created as a single object. You can create straight line segments, arc segments, or a combination of the two.

1. Choose Draw, Polyline. **or**

2. **Pick** the Pline icon. 

3. Type PLINE at the command prompt

Command : **PLINE** or **PL**

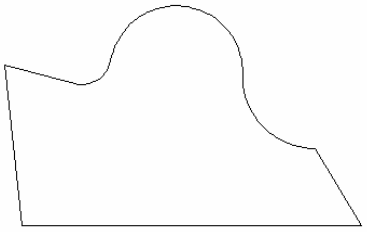
4. **Pick** A point on the drawing to start the polyline

From point:(**select**)

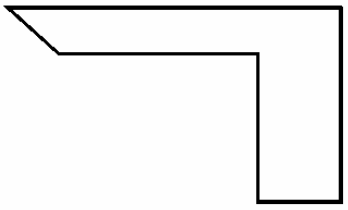
5. **Type** One of the following options Arc/Close/Half width/Length/Undo/Width/<endpoint of line>:

or

6. **Pick** A point to continue drawing Arc/Close/Half width/Length/Undo/Width/<endpoint of line>: (**pick point**)



Polyline with arcs



Polyline with width .125

8. EDITING POLYLINES:-

1. **Choose** Modify, Polyline.

or 

2. **Pick** the Pedit icon from the Modify II toolbar.

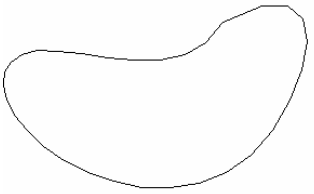
3. Type PEDIT at the command prompt

Command: **PEDIT**

4. **Pick** Pick a polyline to edit

Select Polyline:(**pick**)

5. **Type** One of the following options: Close/Join/ Width/Edit vertex/Fit Curve/Spline/Curve/ De curve/Undo/exit



Splined Polyline

9.POLYGON:-

1. Choose Draw, Polygon. **or**

2. **Click** the Polygon icon. 

or

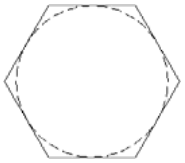
3. **Type** Polygon at the command prompt. Command: **POLYGON**

4. **Type** The number of sides for the polygon (3-1024)
Number of sides <default>: **number**

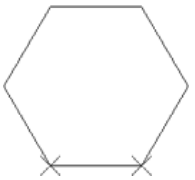
5. **Pick** The center of the polygon. Edge/<Center of polygon>: **Pick or**

6. **Type E** to define the polygon by two edges.

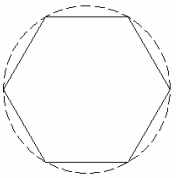
7. **Type I** or **C** to place the polygon inside or outside of an imaginary circle. Inscribed in circle/Circumscribed about circle (I/C):



Polygon Inscribed in an imaginary circle



Polygon drawn with Edge

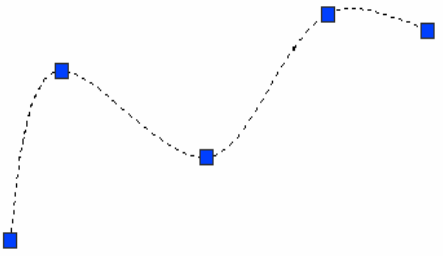


Polygon circumscribed around an imaginary circle

10. SPLINE:-

The SPLINE command creates a particular type of spline known as a non-uniform rational B-spline (NURBS) curve. A NURBS curve produces a smooth curve between control points.

1. **Choose** Draw, Spline. or
2. **Click** the Spline icon. or
3. **Type** SPLINE at the command prompt
Command: **SPLINE**
4. **Pick** A start point for the spline
Object / <Enter first point>: (**pick point**)
5. **Pick** Points until you are done drawing splines
Enter point:(**pick points**)
6. **Press** Enter or close to complete the spline



11. DONUT:-

Donuts are filled rings or solid-filled circles that actually are closed poly lines with width.

1. **Choose** Draw, Donut.

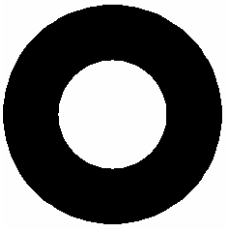
or

2. **Type** Donut at the command prompt. Command: **DONUT**

3. **Type** A value for the inside diameter. Inside diameter <last>: **.5**

4. **Type** A value for the outside diameter. Outside diameter <last>: **1**

5. **Pick** A point for the center of the donut. Center of doughnut: (**point**)

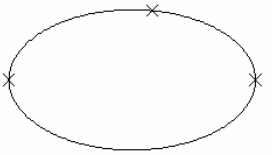


Donut

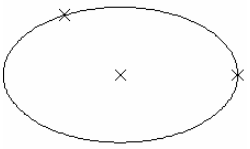
12. ELLIPSE:-

Creates an ellipse or an elliptical arc.
1. **Choose** Draw, Ellipse. or

2. **Choose** the Ellipse or Partial Ellipse icon.  or
3. Type ELLIPSE at the command prompt
Command: **ELLIPSE**
4. **Type** One of the following options: Arc/Center/ Iso-circle /<Axis endpoint 1>:
Choose the type, enter the values.



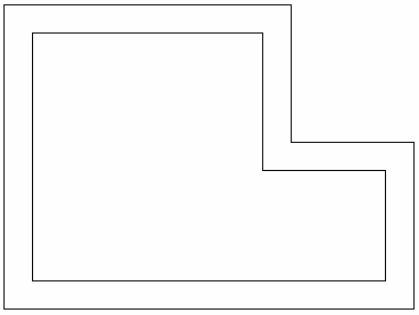
Axis Endpoint, Axis End point, Other Axis Distance



Center, Axis, Axis

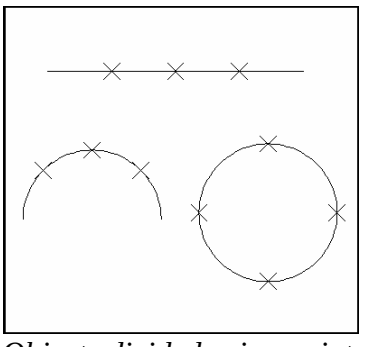
13. MULTILINES:-
MLINE Command

Creates multiple parallel lines.
1. **Choose** Draw, Multiline.
or
2. Type MLINE at the command prompt. Command: **MLINE**
3. **Pick** A point to start the multiline.
Justification/Scale/Style/<From point>: pick point
4. **Pick** A second point to continue the multiline.
<To point>: **pick point**
5. **Pick** The next point to continue drawing multi lines. Undo/<To point>: pick point
6. **Press** ENTER to end the multiline
Close/Undo/<To point>: press enter or
7. Type C to close the multiline back to the first point.
Close/Undo/<To point>:**c**



14. DIVIDE:-

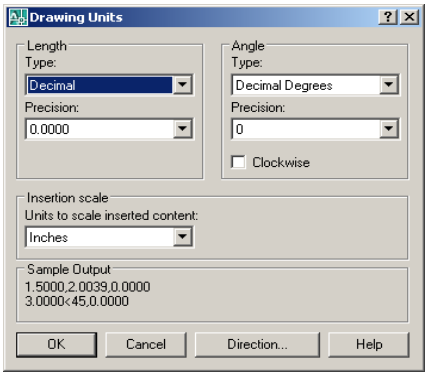
1. **Choose** Draw, Point, and Divide.
or
2. **Type** DIVIDE at the command prompt
Command: DIVIDE
3. **Pick** Object to divide
Select object to divide: (**pick one object**) You can select a single Line, Arc, Circle, or polyline.
If you enter a segment count between 2 and 32,767, Point entities will be placed along the object to divide it into that number of equal segments.
4. **Type** The number of equal segments to divide the object into<Number of segments>/Block:
(**number**)



Objects divided using points

BASIC DISPLAY AND DRAWING AID COMMANDS

15. UNITS COMMAND:-



1. **Choose Format**, Units... or
2. **Type** DDUNITS at the command prompt. Command: **DDUNITS or UN**
3. **Choose a** units and angle setting.
4. **Choose** a precision setting.

16. DRAWING LIMITS:-

The drawing limits are two-dimensional points in the World Coordinate System that represent a lower-left limit and an upper-right limit.

1.**Choose** Format, Drawing Limits.**or**
2.**Type** LIMITS at the command prompt
Command: **LIMITS**
3.**Type** One of the following options On/Off/Lower left corner <.000,0.000>: **0,0**
4.Type One of the following options for the upper right limit:
Upper right corner <12.0000,9.0000>:**36,24**
Drawing with lower left limit of 0,0 and upper right limit of 36,24
NOTE:- You can also pick points to define the limits.

17. REDRAW AND REGEN:-

Redraw refreshes the current view.
1. **Type** Redraw at the command prompt
Command: **Redraw** or **R** & Enter
REGEN regenerates the entire drawing and recomputes the screen Coordinates for all objects. It also re-indexes the drawing database for optimum display and object selection performance.

2. **Type** REGEN at the command prompt. 
Command: **REGEN or RE** & Enter

18. PAN AND ZOOM A DRAWING:-

You can shift the location of your view by using PAN or by using the window scroll bars. Using the PAN command does not change the location of your drawing; it only changes the view. You can zoom in on a rectangular area of your drawing by specifying two diagonal corners of the area you want to view larger.

To pan a drawing by dragging 
1. From the View menu, choose Pan Real-time.
2. When the hand cursor appears, drag the view by holding down the button as you move your mouse. If

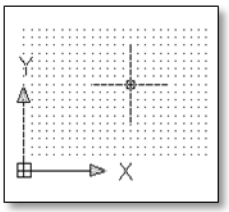
you are using a wheel mouse, hold down the wheel button and move the mouse.

To zoom by dragging

1. Choose Zoom from the view menu Real-time.
2. Hold down the button on your mouse and drag vertically to zoom in and out. 3. Press Enter, or ESC, or Right-click to exit.

19. SNAP COMMAND: - Enables to move on the specified point distances.

1. Choose Tools, Drafting Settings... **or**
2. Type SNAP at the command prompt.
Command: **SNAP or SN**
3. **Type** One of the following options: Snap spacing or [ON/OFF/Aspect/Style/Type]:



GRID

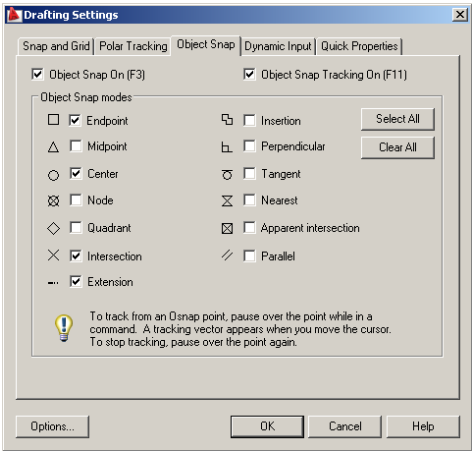
20. GRID COMMAND:-

1. Choose Tools, Drafting Settings... **or**
2. **Type** DSETTINGS at the command prompt. Command : DSETTINGS (DS) or
3. Type GRID at the command prompt. Command: **GRID**
4. **Type** One of the following options:
Grid spacing(X) or ON/OFF/Snap/Aspect <0000>:

21. OSNAP COMMAND:-

An object snap mode specifies a snap point at an exact location on an object. OSNAP specifies running object snap modes, which remain active until you turn them off.

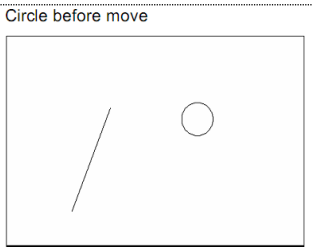
1. Choose Tools, Drafting Settings... **or**
2. **Type** DDOSNAP at the command prompt Command: **DDOSNAP or**
3. **Click** OSNAP on the Status Bar.
4. **Right Click** the Object Snap TAB.
5. **Choose** an object snap to turn ON/OFF from the dialog box.

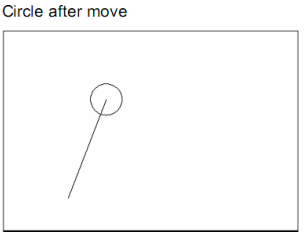


EDIT COMMANDS

22. MOVE:-

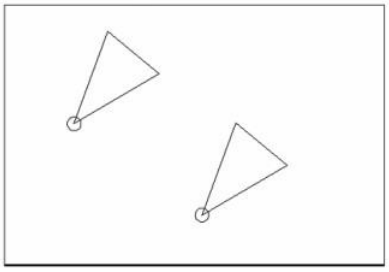
1. Choose Modify, Move. **or**  **Click** the Move icon. **or**
2. Type MOVE at the command prompt , Command: **MOVE or M**
3. **Pick** Objects to move , Select objects: (**select**)
4. **Pick A** point to move from Base point or displacement: (**pick point**)
5. **Pick A** point to move to Second point of displacement: (**pick point**)





23. COPY:-

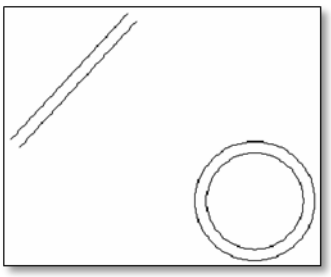
1. Choose Modify, Copy. **or**  **Click** the Copy icon. **or**
2. Type COPY at the command prompt. Command: **COPY or CP**
3. **Pick Objects** to copy. Select objects: (**select**)
4. **Pick A** point to move from. Base point or displacement/Multiple: (**pick point**).
5. **Pick A** point to copy to. Second point of displacement: (**pick point**)



24. OFFSET:-

Enable to copy the objects in multiple at a definite distance and scale.
To offset a specified distance:

1. Choose Modify, Offset.  **Or Choose** the Offset icon. **or**
2. Type OFFSET at the command prompt.
Command: **OFFSET or O**
3. **Type** The distance to offset. Offset distance or <Through point>: (**number**)
4. **Pick** The object to offset. Select object to offset: (**select object**)
5. **Pick** A side to offset object to. Side to offset: (**pick side**)
6. Pick Another object to offset Select object to offset: (**pick side**) **or**
7. **Press** Enter to end the command.



Offsetting objects by specifying a distance

25. EXTEND:-

1. Choose Modify, Extend. **or**

2. Click the Extend icon.  **or**

3. Type EXTEND at the command prompt
Command: **EXTEND**
Select boundary edge(s)...
4. **Pick** The BOUNDARY edge to extend to
Select objects: (**select**)
5. **Press** ENTER to accept the boundary edge
Select objects: (**press enter**)
6. **Pick** The objects to extend
<Select object to extend> / Project / Edge / Undo: Select an object, enter an option, or press enter : (**select**)
7.**Press** ENTER when you are done choosing objects

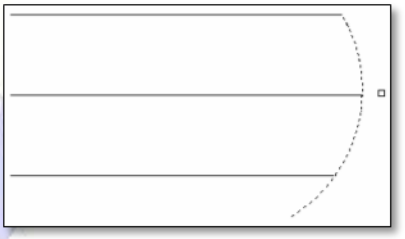
Lines Extended to an Arc
(Arc is boundary edge)

26. TRIM: - The TRIM command allows you to trim objects in a drawing so they end precisely at a cutting edge defined by one or more other objects in the drawing.

1. Choose Modify, Trim. **or**

2. **Click** the Trim icon. 

3. Type TRIM at the command prompt
Command: **TRIM**
Select cutting edge(s)...
4. **Pick** The CUTTING edge to extend to
Select objects: (**select**)
5. **Press** ENTER to accept the cutting edge
Select objects: (**press enter**)
6. **Pick** Objects to trim
<Select object to trim> / Project / Edge / Undo: Select an object, enter an option, or press enter
7. **Press** ENTER when you are done choosing objects
Select object to trim/Undo :(**press enter**)



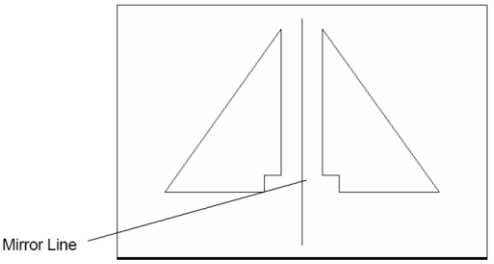
Lines Trimmed to an Arc
(Arc is cutting edge)

27. MIRROR:-

1. Choose Modify, Mirror. **or**

2. Click the Mirror icon.  **or**

3. **Type** MIRROR at the command prompt. Command: **MIRROR**
4. **Pick** Objects to mirror. Select objects:(**select**)
5. **Pick** First point of mirror line: (**point**)
6. **Pick** Second point: (**point**)
7. **Type** Yes to delete the original objects and No to keep them.
Delete old objects? **Y** or **N**



28. ROTATE:-

1. Choose Modify, Rotate. **or**

2. **Click** the Modify icon. 

or

3. Type ROTATE at the command prompt

Command : **ROTATE**

4. **Pick** Objects to rotate: Select objects:(**select**)

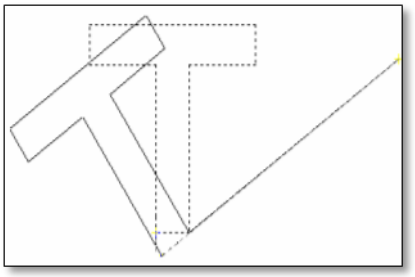
5. **Pick** A pivot point to rotate around

Base point: (**point**)

6. **Type** A rotation angle<Rotation angle>/Reference: (**number**)

or

7. **Pick** A rotation angle<Rotation angle>/Reference: (**point**)



29. SCALE COMMAND:-

1. Choose Modify, Scale. **or**

2. **Click** the Scale icon. 

or

3. Type SCALE at the command prompt

Command: **SCALE**

Select objects: (**select objects**)

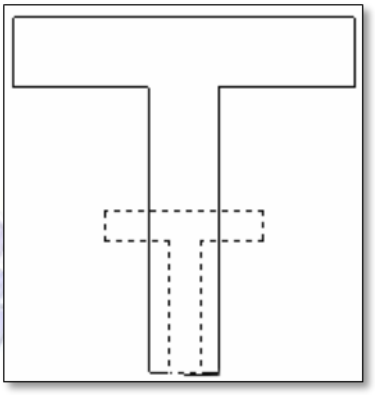
4. **Pick** A pivot point to scale about Base point: (**point**)

5. **Type** A rotation angle<Scale factor>/Reference:(**number**)

or

6. **Pick** A scale factor<Scale factor>/Reference: (**point**)

Scale factor/Reference:(**points**)



30. BREAK:-

1. **Choose** Modify, Break. or

2. **Click** the Break icon. or 

3. Type BREAK at the command prompt. Command: **BREAK**

4. **Pick** Object to break.

Select object: (**select one object**)

5. **Pick** A second break point.

Enter second point : (**point**) or

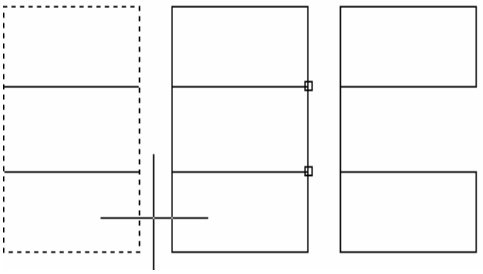
6. **Type F** to choose a different breakpoint

Enter second point (or F for first point):(**F**)

7. **Pick** The first break point on the object

Enter first point: (**point**)

8. **Pick** A second break point



31. FILLET :-

1. **Choose** Modify, Fillet. or

2. **Click** the Fillet icon  . or

3. Type FILLET at the command prompt. Command: **FILLET**

4. **Pick** First object to fillet. Polyline/Radius/Trim<Select two objects>: select first object.

5. **Pick** Second object to fillet.

Select second object: select second object. or

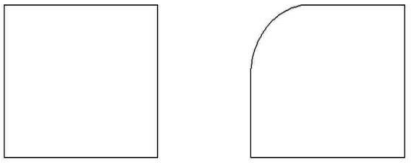
6. **Type** One of the following options:

P Fillets an entire Polyline.

R Sets the fillet radius.

T Sets the trim mode (trim cuts the fillet

Corner and no trim keeps the fillet corner).



Filleting

32. CHAMFER :-

1. **Choose** Modify, Chamfer. or

2. **Click** the Chamfer icon. 

or

3. **Type** CHAMFER at the command prompt. Command: **CHAMFER**

4. Pick First object to chamfer.

Polyline/Distance/Angle/Trim/Method<Select first line>: **select first object**

5. **Pick** Second object to chamfer.

Select second object: select second object. or

6. **Type** One of the following options:

P Chamfers entire Polyline.

D Sets chamfer distances.

A Uses a distance and angle method instead of two distances.

T Sets the trim mode

M Sets the method to distance or angle.

Chamfer with equal distances

Chamfer with different distances

33. ARRAY :-

Enables user to make definite pattern of a object

RECTANGULAR ARRAY

To draw rectangular array:

1. Choose Modify, Array. **or**

2. Click the Array icon. **or** 

3. Type *ARRAY at the command prompt.* Command : **ARRAY**

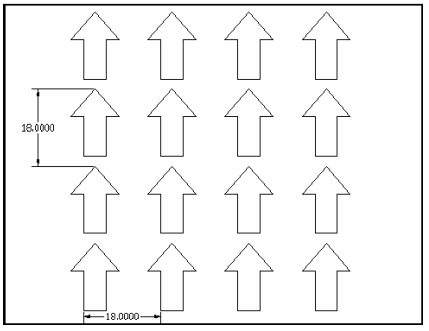
4. **Pick** Objects to array. Select objects : (**select**)

5. **Type** *The number of rows top to bottom.* Number of rows(---) <1>: (**number**)

6. **Type** The number of columns left to right. Number of columns (|||)<1>: (**number**)

7. **Type** The unit cell distance between items in each row.

Distance between rows: (**+ number=up, -number =down**)



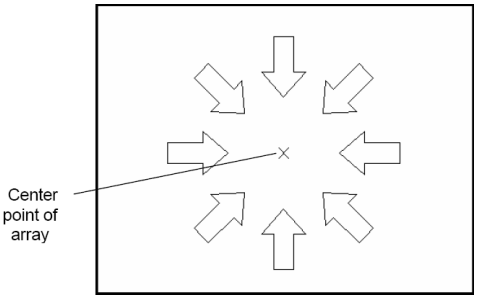
Unit Cell Distance Between Rows & Unit Cell Distance Between Columns

8. **Type** The unit cell distance between items in each column.
Distance between columns:(**+number=right, - number = left**)
9. ok

POLAR ARRAY

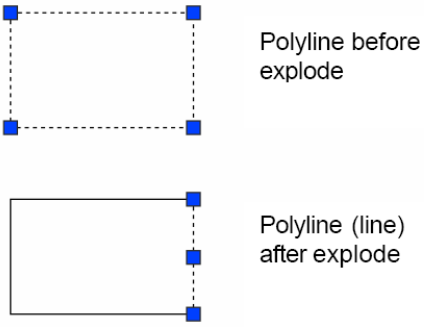
To draw a polar array:
1. Choose Modify, ARRAY. **or**

2. **Click** the Array icon. 
or
3. Type *ARRAY at the command prompt.* Command: **ARRAY**
4. **Pick** Objects to array. Select objects:(**select**)
5. Type P to draw a polar array. Rectangular or Polar array (R/P): **P**
6. Pick A center point for the array. Center point of array: **pick point**
7. Type The TOTAL number of items in the array. *Number of items*: **number**
8. Type The number of degrees to rotate the objects. Degrees to fill (+=CCW, -+CW)<360>: **number**
9. **Type** Yes or No to rotate objects.
Rotate objects as they are copied?<y> **Y** or **N**



34. EXPLODE:-

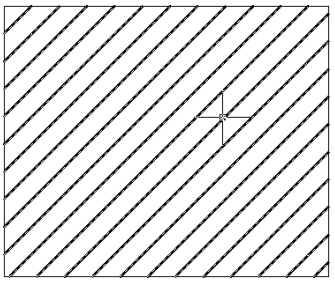
1. **Choose** *Modify, Explode.*
or
2. **Pick** the Explode icon. 
3. **Type** EXPLODE at the command prompt. Command: **EXPLODE**
or
4. **Pick** The object to explode .Select objects:(**pick**)



35. HATCH:-

1. Choose Draw, Hatch... **or**

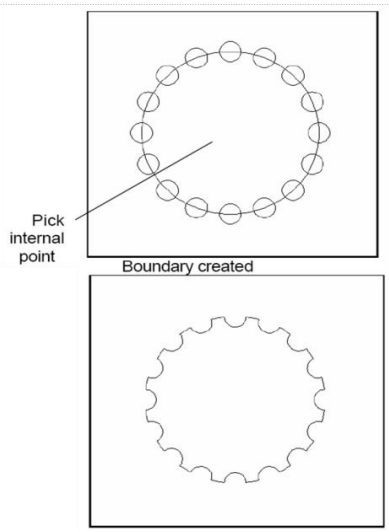
2. **Click** the Hatch icon. 
or
3. Type BHATCH at the command prompt
Command: **BHATCH**
4. **Choose** Inherit Properties.
5. **Pick** the cross hatch of an existing associative hatch to make the current Pattern Type and Pattern Properties options. Preview Hatch Displays the hatching before applying it.



36. BOUNDARY:-

Defines the object type, boundary set, and island detection method for defining boundaries from points you specify.

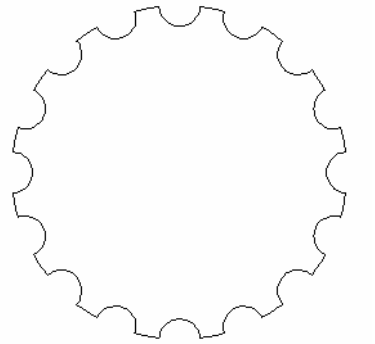
1. **Choose** Draw, Boundary
or
2. **Type** BOUNDARY at the command prompt. Command: **BOUNDARY**



37. REGION :-

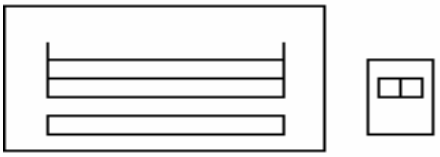
Regions are two-dimensional areas you create from closed shapes or loops. Closed polylines, lines, and curves are valid selections. Curves include circular arcs, circles, elliptical arcs, ellipses, and splines.

1. **Choose** Draw, Region
2. Type REGION at the command prompt. Command: **REGION**
Select objects: **(pick boundary)**
Select objects:1 found
1 loop extracted.
1 Region created.
Object created as a region



38. CREATING LOCAL BLOCKS(BMAKE)

To connect all the boundaries and to make it as single block
1. **Choose** Draw, Block, and Make.
or
2. **Click** the Make Block icon. 
or
3. **Type** BMAKE at the command prompt. Command: BMAKE or BLOCK
4. **Type** the name of the block.
5. **Pick** an insertion point.
6. **Select** objects to be included in the block definition.
7. **Click** OK.
Insertion point.



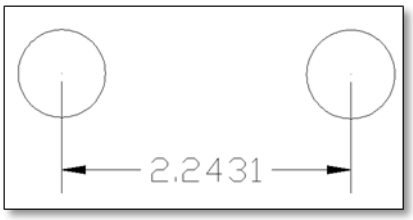
DIMENSIONING, MEASUREMENT AND TEXT

39. MEASURING DISTANCES:-

1. Choose Tools, Inquiry, and Distance. **or**

2. Click the Distance icon from the Inquiry Toolbar.  **or**

3. Type DIST at the command prompt
Command: **DIST**
4. Pick The first point to measure from
First point: **pick point**
5. Pick The second point to measure to
Second point: **pick point**
Distance Between Circle Centers

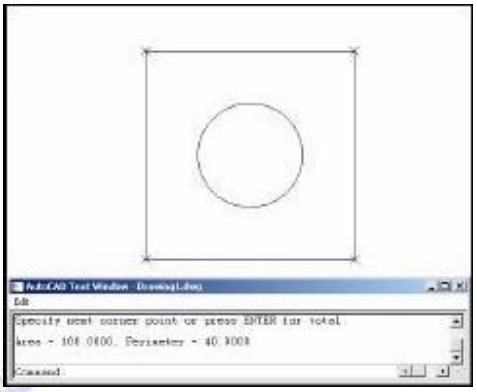


40. CALCULATING AREAS

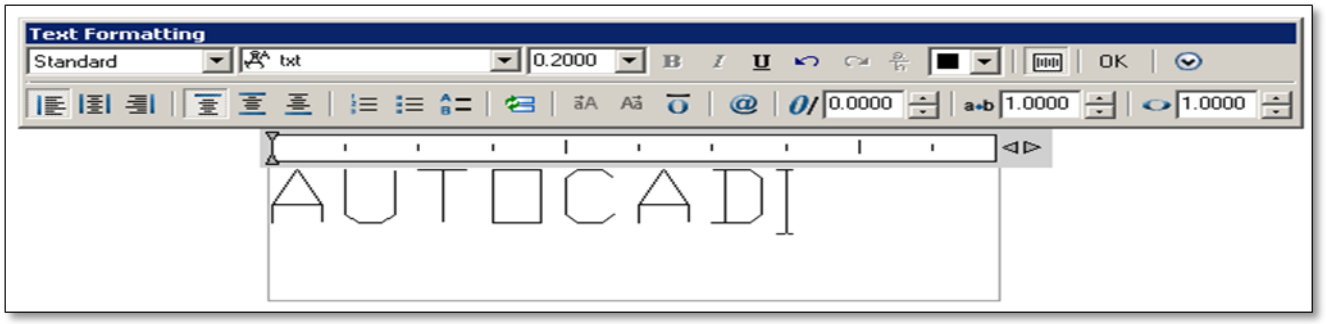
1. Choose Tools, Inquiry, and Area. **or**

2. Click the Area icon.  **or**
3. Type AREA at the command prompt
Command: **AREA**
4. **Pick** The first point for area calculation
<First point>/Object/Add/Subtract: **pick**
5. Pick Next point: **pick**
6. Pick Next point: **pick**
7. Press ENTER when you are finished choosing points. Area of Rectangle **Object**

Object Allows user to pick an object to calculate area (circle or polyline).
Add Adds separate areas for a total area calculation
Subtract Subtracts areas from each other.



41. TEXT COMMAND:-



Creates a single-line text object

1. **Type** TEXT at the command prompt

Command: **TEXT or**
2. **Pick** the Single Line Text icon from the Text Toolbar.
3. Pick A start point
Justify/Style/<Start Point>: (**point**) **or**

4. **Type** J to change the justification or S to change the text style.
5. **Type** A text height
Height <default>: (**type value or pick two points**)
6. **Type** A rotation angle
Rotation angle <default>: (**angle or point**)
7. **Type** A text string
Text: (**type text string**)
8. **Press** enter to exit the Text: prompt.

42. MTEXT COMMAND (MULTILINE TEXT):-

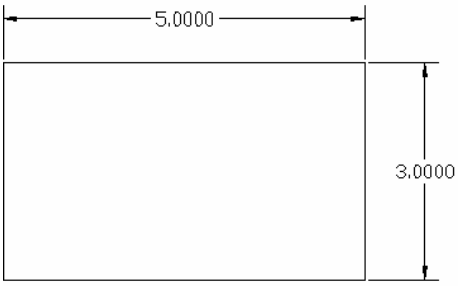
1. Choose Draw, Text, Multiline Text... **or**
2. **Pick** the Mtext icon.
or
3. Type MTEXT at the command prompt. Command: **MTEXT**
4. Type One of the following options
Height/Justify/Rotation/Style/Width:
or
5. **Pick** 2Pointstodefinethetextwindow.
6. **Type** text or change an MTEXT setting.

43. DDEDIT (EDITING TEXT)

1. Choose Modify, Text... **or**
2. Click the Edit Text icon from the Text toolbar. **or**
3. Type DDEDIT at the command prompt. Command: **DDEDIT** or **ED**
4. **Pick** The text to edit. Select objects:(pick text)
5. **Pick** Additional text or ENTER to end the command.
Select objects: ENTER

44. LINEAR DIMENSIONS:-

1. Choose Dimension, Linear. **or**
2. **Click** the Linear Dimension command from the toolbar.
or
3. Type DIM at the command prompt. Command: **DIM**
Dim :HOR or VER

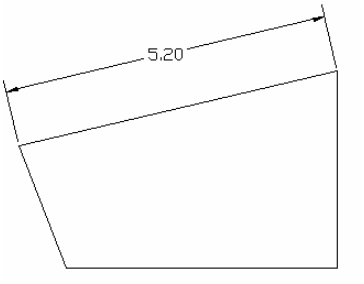


45. ALIGNED DIMENSINS:-

1. **Choose** Dimension, Aligned.

or

2. **Click** the Aligned Dimension command from the toolbar.
or
3. Type DIM at the command prompt. Command: **DIM**
Dim: **ALIGNED**

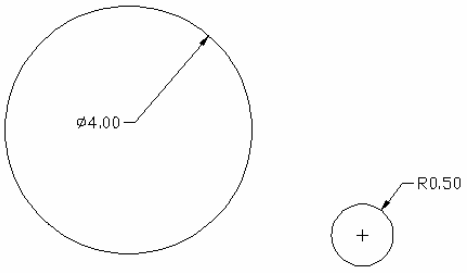


46. RADIAL DIMENSINS:-

1. **Choose** Dimension, Radius or Diameter.

or

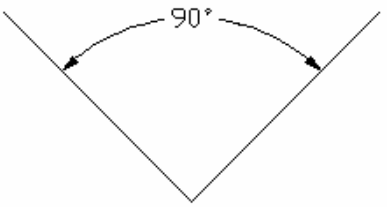
2. **Click** the Radial Dimensions command from the toolbar.
or
3. Type DIM at the command prompt. Command: **DIM**
Dim: **RADIUS or DIAMETER**



46. ANGULAR DIMENSIONS:-

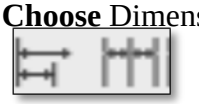
1. Choose Dimension, Angular. **or**

2. **Click** the Angular Dimensions command from the toolbar.
or
3. Type DIM at the command prompt. Command: **DIM**
Dim: **ANGULAR**



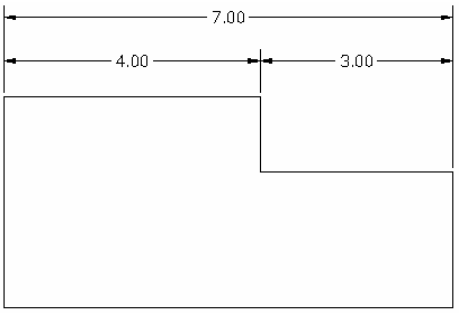
47. CONTINUED AND BASELINEDIMENSIONS:-

1. **Choose** Dimension, Continue or Baseline.



or

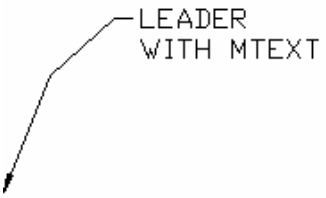
2. **Click** the Continue or Baseline Dimensions command from the toolbar.
or
3. Type DIM at the command prompt. Command: **DIM**
Dim: **CONTINUE or BASE LINE**



48.LEADERS:-

1. Choose Dimension, Leader... **or**

2. **Click** the Leader icon from the Dimension toolbar.
or
3. **Type** QLEADER at the command prompt. Command: **QLEADER.**



LAYERS, LINE TYPES, COLOURS & PLOT

49. CREATING LAYERS:-

Enables User to differentiate the object parts with changing their colors and properties. Makes a layer read only preventing entities from being edited but available visual reference and osnap functions.

1. Choose Format, Layer. **or**
2. Type LAYER at the command prompt. Command: **LAYER (or LA) or**
3. **Pick** the layers icon from the Layer Control box on the object properties toolbar.
Lists layers, with states, colors and line types.
Creates a new layer and makes it current.

LAYER STATES

1. **Choose** the layer icon.
2. **Select** various layers to be ON, OFF, FROZEN, LOCKED, etc.
3. **Choose** the Save State button.
4. **Choose** Restore State to restore the layer settings.

50.COLOR COMMAND

1. Choose Format, Color. **or**
2. **Type** DDCOLOR at the command prompt. Command: **DDCOLOR or COL or**
3. **Choose** Color on the Object Properties toolbar and then select a color from the list or select Other to display the Select Color dialog box.

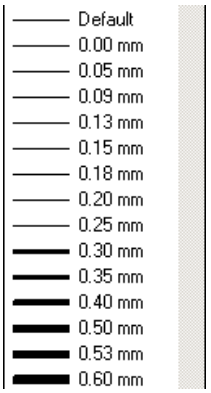
51.LOADING AND CHANGING LINETYPES:-

1. Choose Format, Line type... **or**
2. Type DDLTYPE at the command prompt. Command: **DDLTYPE or LT**
3. **Choose** Load...to see a list of available line types.
4. **Choose** the desired line type to assign.
5. **Click** OK.

Linetype	Description
ACAD_ISO02W100	ISO dash
ACAD_ISO03W100	ISO dash space
ACAD_ISO04W100	ISO long-dash dot
ACAD_ISO05W100	ISO long-dash double-dot
ACAD_ISO06W100	ISO long-dash triple-dot
ACAD_ISO07W100	ISO dot
ACAD_ISO08W100	ISO long-dash short-dash
ACAD_ISO09W100	ISO long-dash double-short-dash
ACAD_ISO10W100	ISO dash dot
ACAD_ISO11W100	ISO double-dash dot
ACAD_ISO12W100	ISO dash double-dot
ACAD_ISO13W100	ISO double-dash double-dot
ACAD_ISO14W100	ISO dash triple-dot

LOADING AND CHANGING LINE WEIGHTS:-

1. **Choose** Format, Line weight...
or
2. **Type** LINEWEIGHT at the command prompt. Command: **LINEWEIGHT or LWEIGHT or**
4. **Pick** a line weight to make current from the Object Properties menu.



52. PLOT COMMAND :-

1. Choose File, Plot. **or**
2. Click the Plotter icon. **or**
3. Type PLOT at the command prompt: **PLOT or PRINT or**
4. **Press** CTRL+P

PLOT SETTINGS:-

1. **Choose** the Plot Settings tab.
2. **Choose** the appropriate paper size based on the chosen plotter.
3. **Choose** the paper units (inches or mm).
4. **Choose** the drawing orientation (Portrait, Landscape, and Upside down).
5. **Choose** the plotting area.
6. **Choose** the plot scale.
7. **Choose** plot to center or specify an x or y offset.
8. **Click** OK.

-*-*-*-*-*-

Viva Questions

1. What is meant by AutoCAD?
2. What are the applications of CAD?
3. Give some example of latest CAD software.
4. What are the benefits of CAD?
5. Give any one limitation of CAD.
6. Name the file extensions used in AUTOCAD.
7. What is difference between design & drawing?
8. What do you mean by Ribbon in AUTOCAD?
9. Explain the modify commands used in AUTOCAD?
10. Explain the Draw commands?

Experiment No.6- Draw 2D drawings of given drawing using AUTO CAD.

Objective: - To Draw 2D drawings of given drawing using AUTO CAD. Students need to draw the following drawing with proper dimension by using basic commands & tools of AUTOCAD Software.

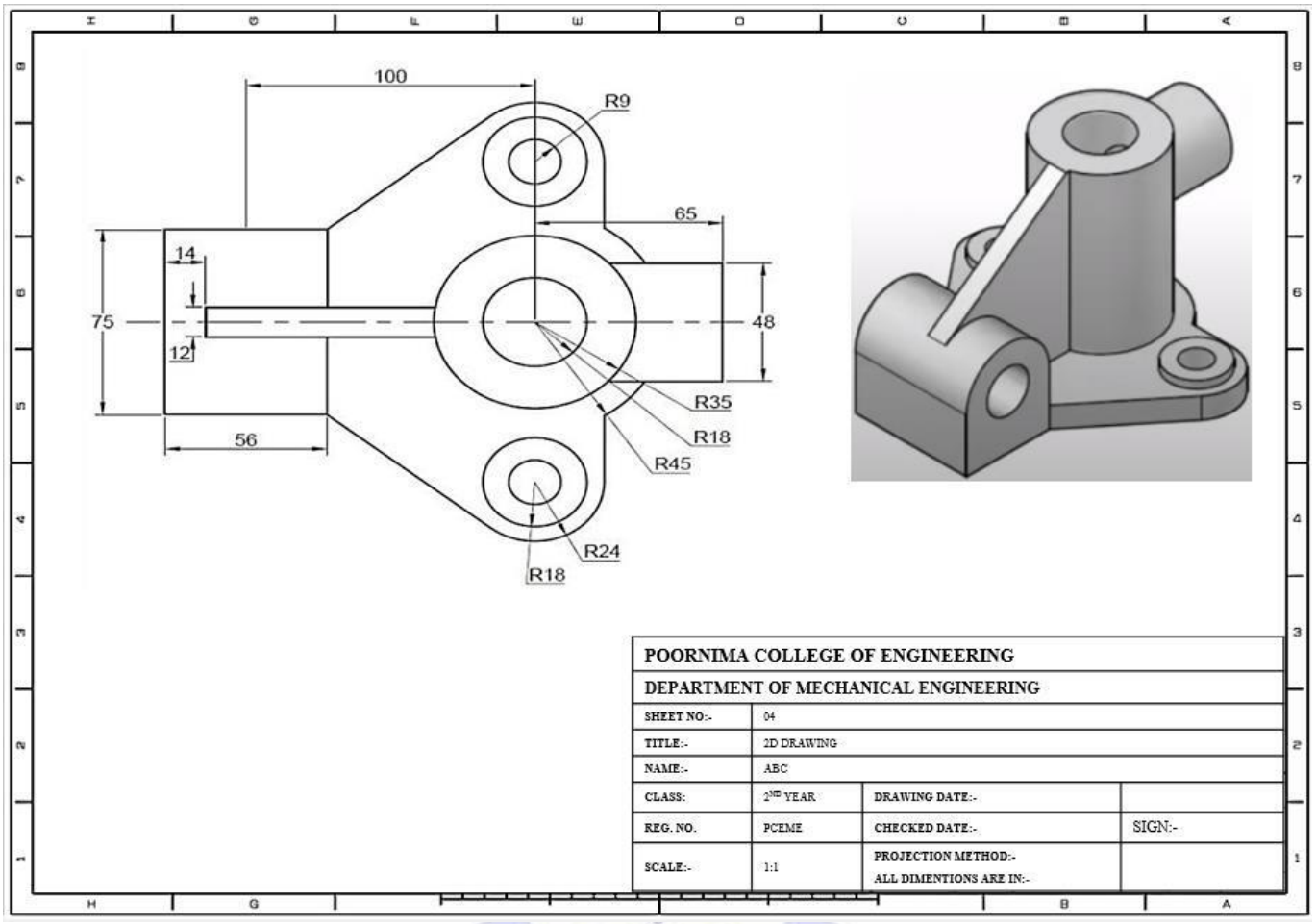


Fig. 6.0 2D Drawing of Machine component

Viva Questions

1. Explain the method to set the limits in AUTOCAD?
2. How to set Units in AUTOCAD?
3. What is difference between 2D & 3D drawing?
4. What do you know about coordinate system?
5. What is orthographic projection?
6. What is the use of LINE command?
7. What is the use of FILLET command?
8. Which command is use for dimensioning?
9. What is the use of PLINE?
10. Define LINETYPE command?

Experiment No.7- Draw 2D drawings of given Isometric drawing using AUTO CAD.

Objective: - To draw 2D drawings of given Isometric drawing using AUTO CAD. Students need to draw the following drawing with proper dimension by using AUTOCAD Software.

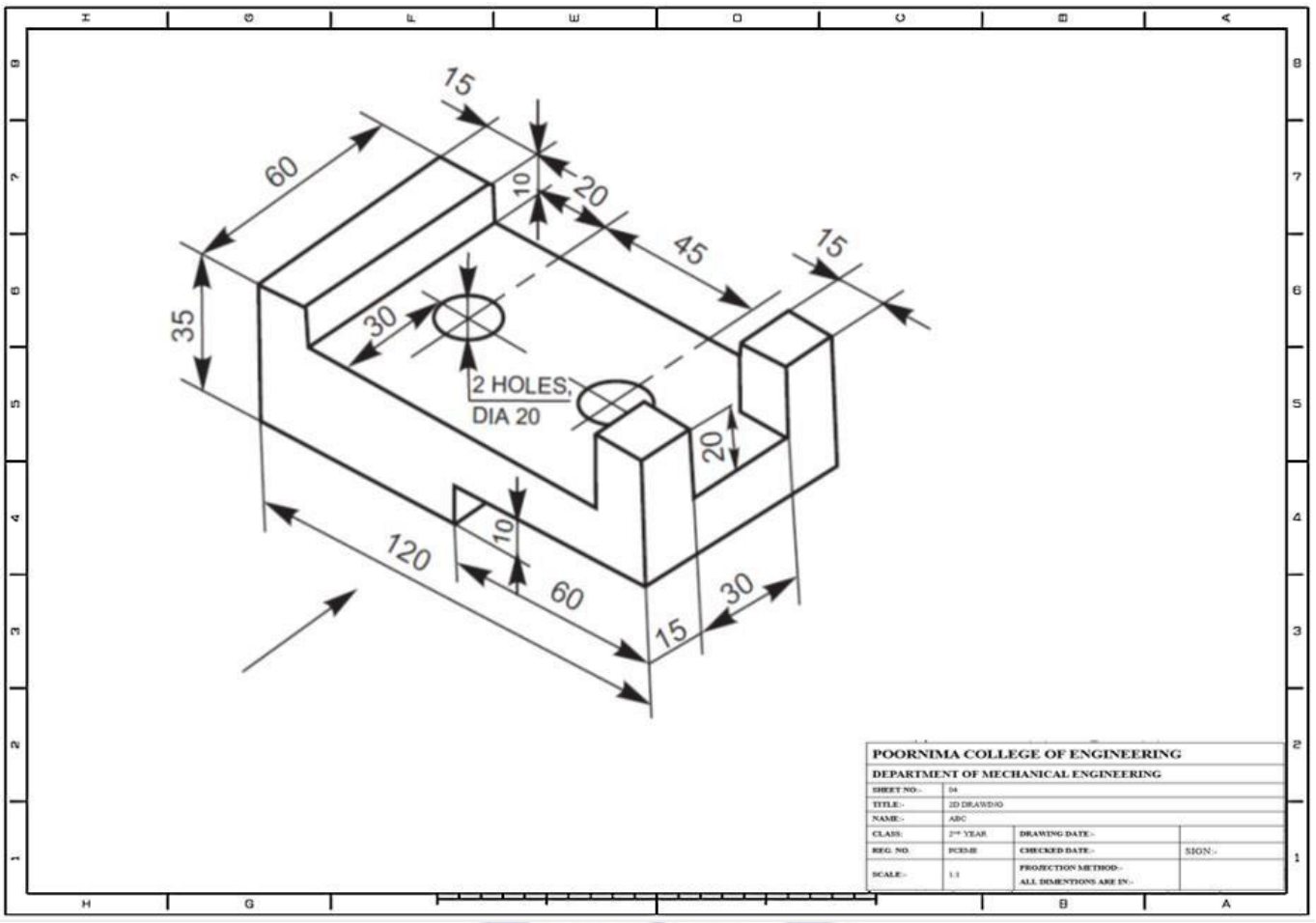


Fig. 7.0 Isometric drawing

Viva Questions

1. What is Isometric view in a drawing?
2. Why isometric view is important?
3. What is the use of OFFSET command?
4. Write syntax for MIRROR command?
5. What is the use of ARRAY command?
6. What is WCS and UCS?
7. Which command is use to breaks a compound object into its component objects?
8. What is regeneration of drawing?
9. How to change text height in AUTOCAD?
10. What is the total dimension of you object?

Experiment No.8- Draw 2D drawings of given Orthographic View using AUTO CAD.

Objective: - To Draw 2D drawings of given Orthographic View using AUTO CAD. Students need to draw the following drawing with proper dimension by using AUTOCAD Software.

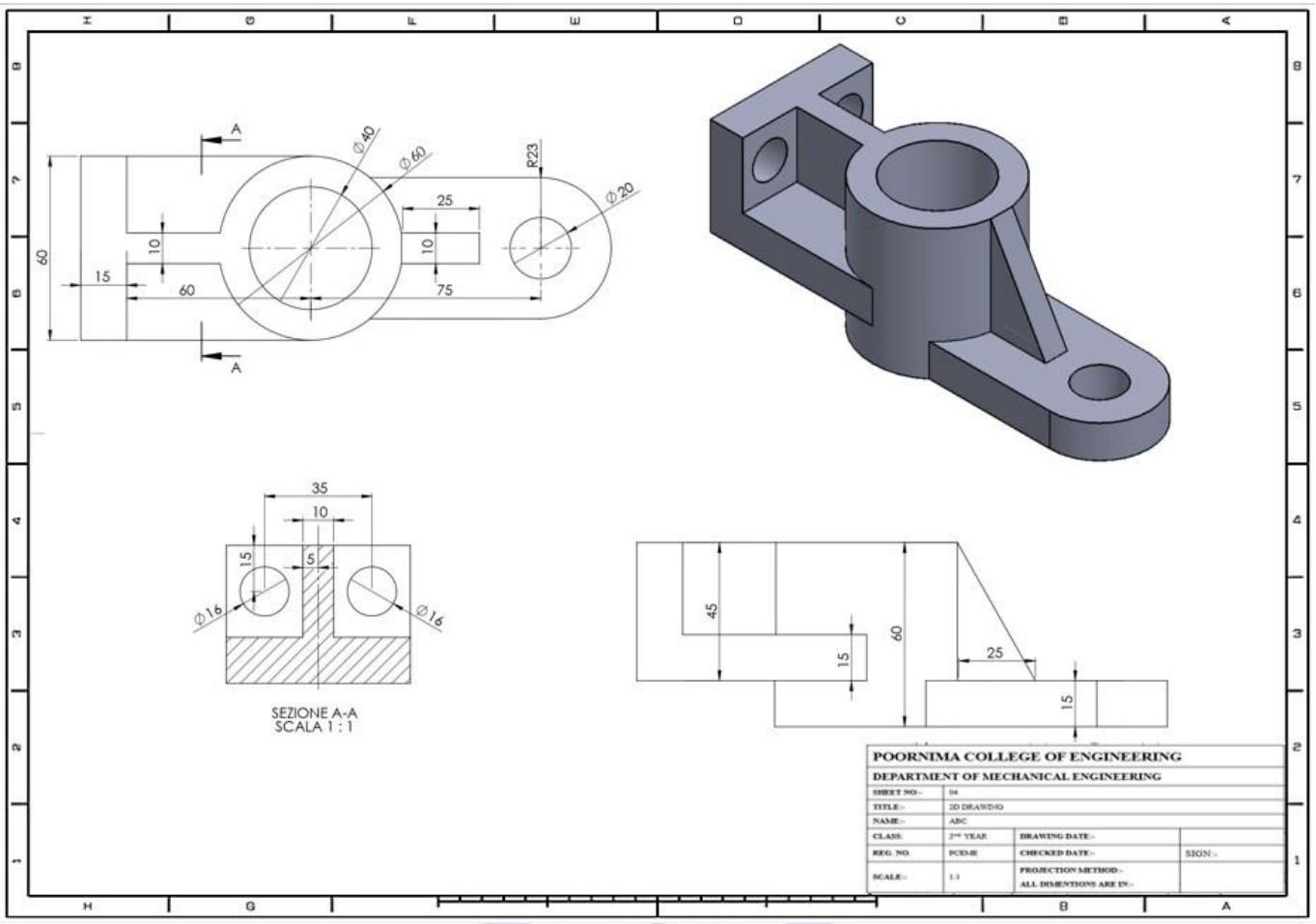


Fig. 8.0 Orthographic view of Mechanical component

Viva Questions

1. What do you mean by Orthographic view?
2. What do you mean by drafting?
3. Give some example for transformation?
4. Which command is use for enlarge and reduce to any object?
5. Which command is used to fit all object on the sheet?
6. What is the file formats used in design?
7. What are the benefits of using AutoCAD?
8. What is the process to draw a line more than one time and save it automatically?
9. What are the steps that enable the drag and drop feature in AutoCAD?
10. How you can copy a closed drawing?

Experiment No.9- 3-D Modeling of a given object drawing in AutoCAD

Objective: - To create 3-D Model of a given object drawing in AutoCAD. Students need to create the 3D model the following drawing with proper dimension by using AUTOCAD Software.

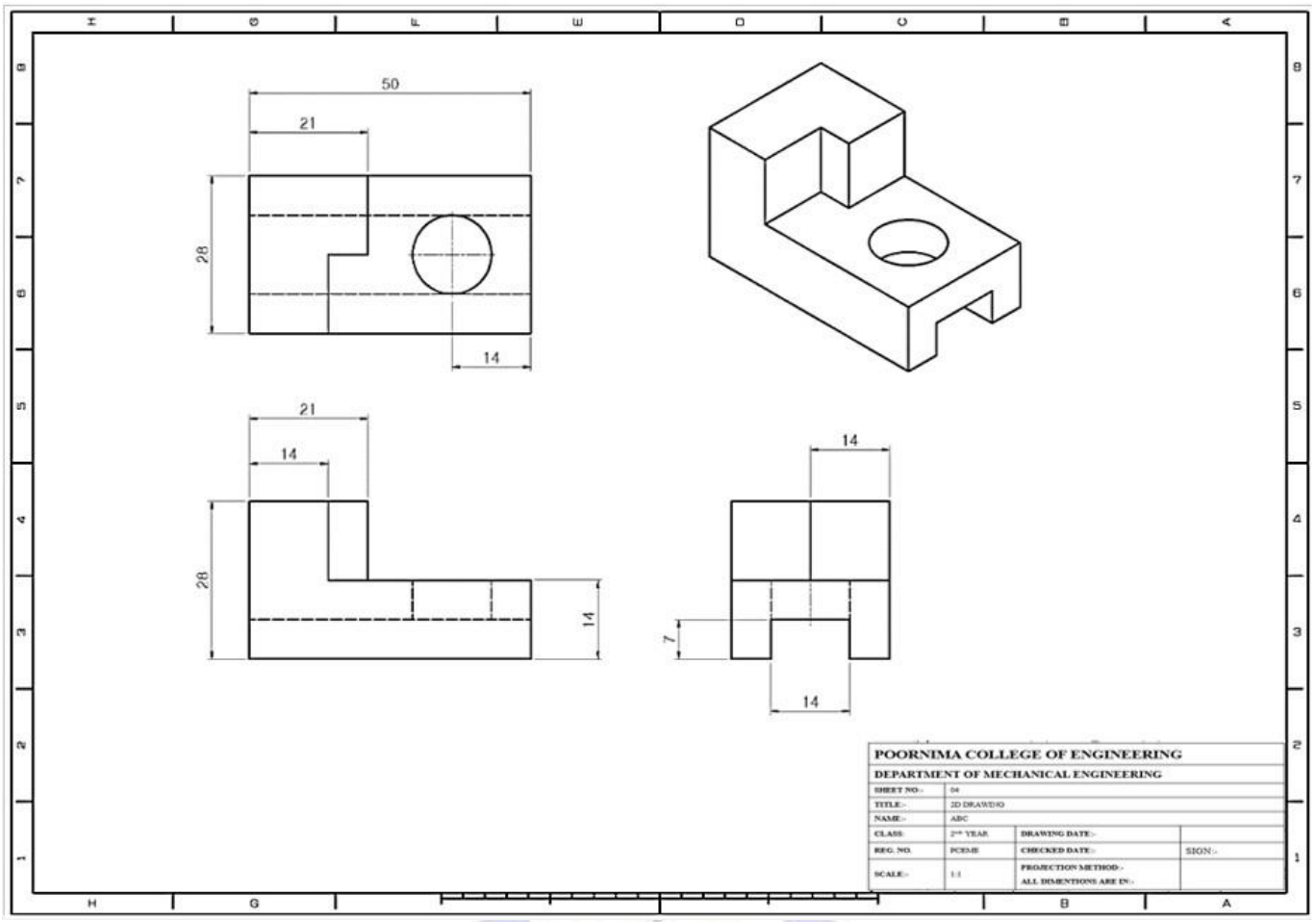


Fig. 9.0 3D Model

Viva Questions

1. What is the use of EXTRUDE command?
2. What is the difference between UNION and SUBTRACT command?
3. What do you know about 3-D MODELLING?
4. What is the use of TRACE command?
5. Which command is use for enlarge and reduce to any object?
6. Write syntax for following command BOX, REVOLVE, RENDER, and SLICE.
7. What is the use of SHAPE command?
8. What do you know about manipulation?
9. What is the use of STRETCH command?
10. What is the use of EXTEND command?

Experiment No.10- 3-D Modeling with Annotation & Drafting of a given object drawing in AutoCAD

Objective: - To create 3-D Model and drafting of a given object drawing in AutoCAD. Students need to create the 3D model the following drawing with proper dimension by using AUTOCAD Software.

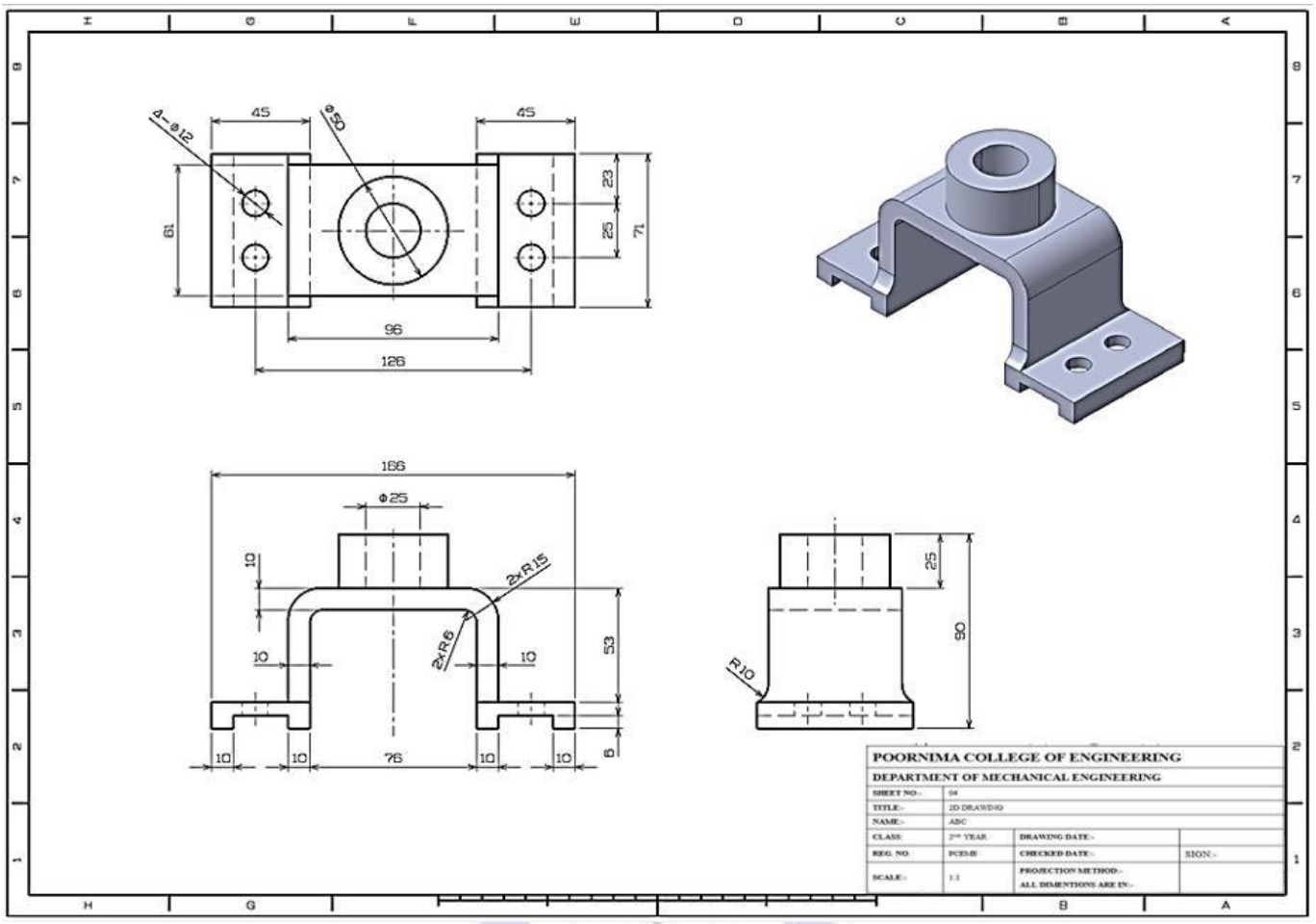


Fig. 10. 3D Model and drafting of Views

Viva Questions

1. What is the important feature for modification of drawing?
2. What are the use of ROTATE and MOVE command?
3. Explain drawing of polygon in CAD?
4. Explain the procedure to create an ELLIPSE?
5. What is the use of SOLID in detail drawing?
6. What is the use EXTRUDE?
7. What is the process of copying the dimension styles from one drawing to another in AutoCAD?
8. How you can open a drawing file that was created with the automatic save features?
9. What is cross hair cursor?
10. What is dwg?

Experiment No.11- Surface modelling Modeling in AutoCAD

Objective: - To create surface model of a given object drawing in AutoCAD. Students need to create the surface model the following drawing by using AUTOCAD Software.

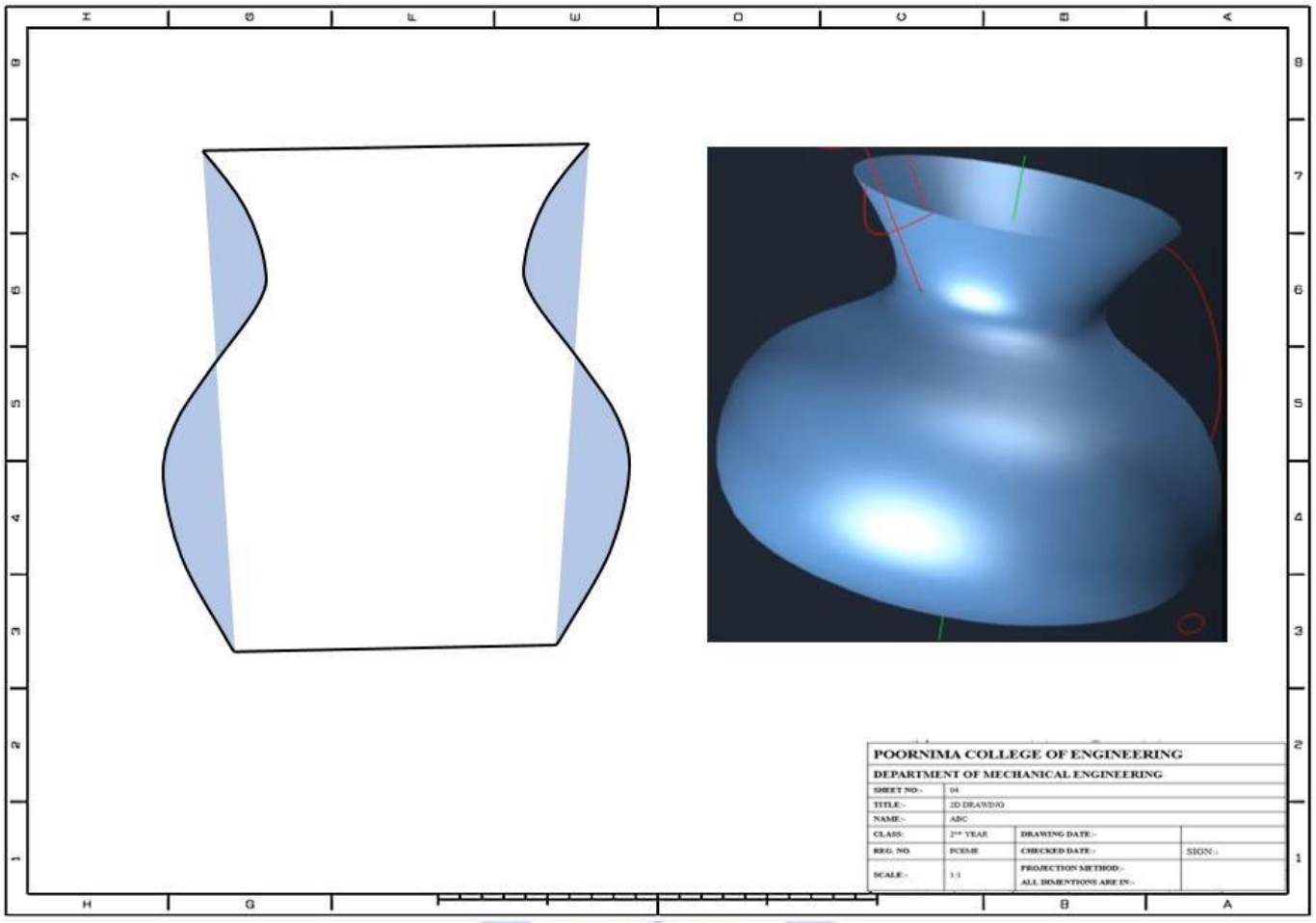


Fig. 11. Surface modelling Modeling in AutoCAD

Viva Questions

1. Define graphics window?
2. How to enter in surfacing interface a model in AutoCAD?
3. Name the main components of a CAD GUI?
4. Why surfacing is used.
5. What are the different commands used in surfacing?
6. How revolve command used in surfacing?
7. What is need for setting LIMITS?
8. What do you meant by GUI?
9. What is an ortho mode?
10. Explain surface modelling?

Experiment No.12- Assembly modelling by using AutoCAD

Objective: - To create Assembly modelling by using AutoCAD of a given object drawing in AutoCAD. Students need to Assembly modelling of Nut & Bolt by using AutoCAD.

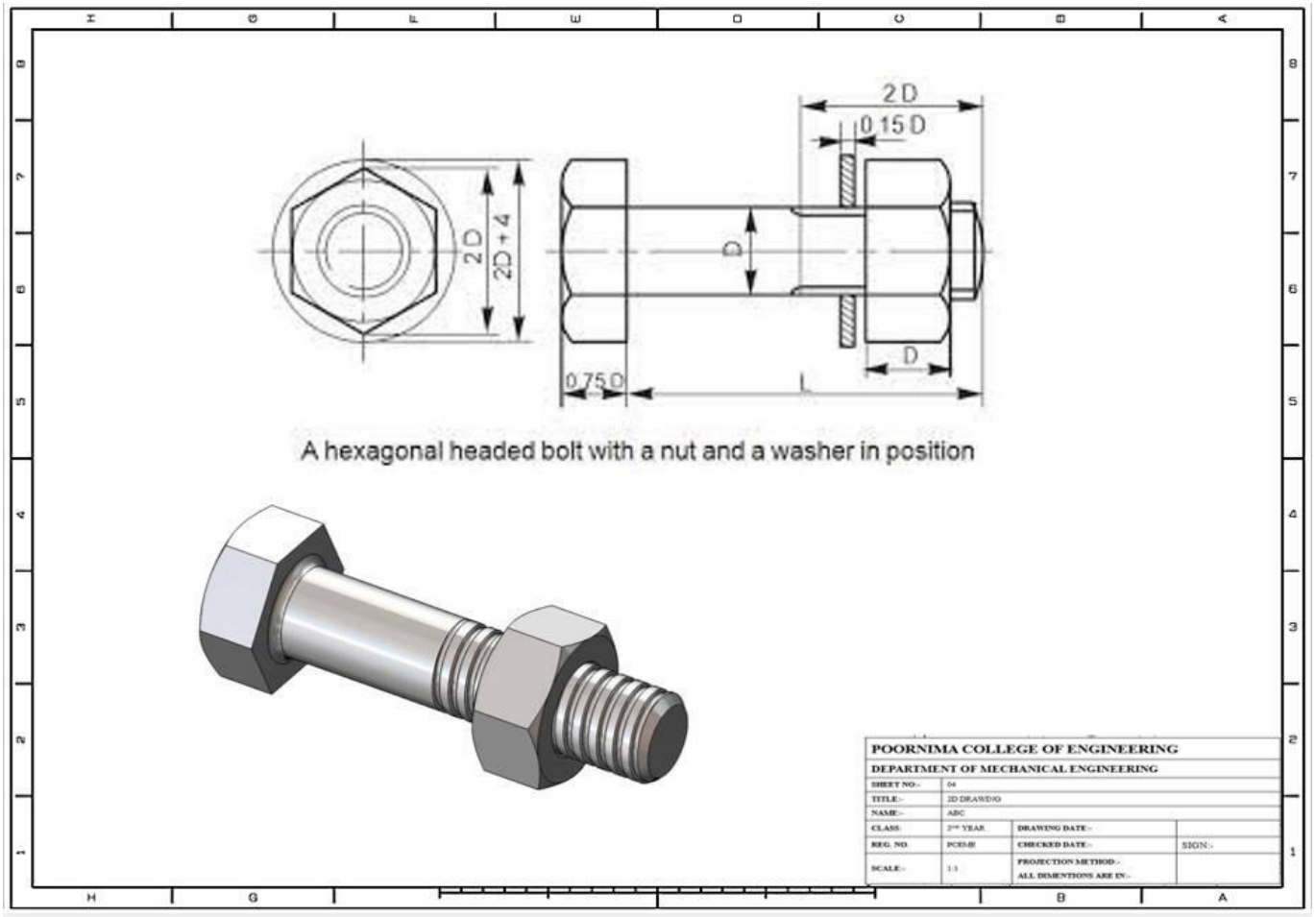


Fig. 12. Assembly modelling by using AutoCAD

Viva Questions

1. What do you mean by Assembly drawing?
2. How can you make a spring, spiral or screw thread?
3. What do you mean by Spiral?
4. Is it possible to show assembly of parts in AutoCAD?
5. What is meant by solid geometry?
6. What is the difference between chamfer and Fillet?
7. How to plot a drawing?
8. What is AutoCAD template?
9. What is Extend Command?
10. What is status bar?