Computer Aided Machine Drawing

LAB MANUAL

(18ME36A)

DEPARTMENT OF MECHANICAL ENGINEERING

BAPUJI INSTITUTE OF ENGINEERING AND TECHNOLOGY

DAVANGERE- 577 004

DEPARTMENT OF

MECHANICAL ENGINEERING

COMPUTER AIDED MACHINE DRAWING

(18ME36A/46A)

As per VTU Syllabus CBCS scheme for III Semester

Name : .....

USN : .....

Semester: ..... Batch No.....

Mohan T R
Faculty Incharge

Mallikarjuna V K
Instructor

BAPUJI INSTITUTE OF ENGINEERING AND TECHNOLOGY

DAVANGERE- 577 004

VISION OF THE INSTITUTE

To be center of excellence recognized nationally and internationally, in distinctive areas of engineering education and research, based on a culture of innovation and invention.

MISSION OF THE INSTITUTE

BIET contributes to the growth and development of its students by imparting a broad based engineering education and empowering them to be successful in their chosen field by inculcating in them positive approach, leadership qualities and ethical values.

VISION OF THE DEPARTMENT

The department endeavors to be a center of excellence, to provide quality education leading the students to become professional mechanical engineers with ethics, contributing to the society through research, innovation, entrepreneurial and leadership qualities.

MISSION OF THE DEPARTMENT

1. To impart quality technical education through effective teaching- learning process leading to development of professional skills and attitude to excel in Mechanical Engineering.
2. To interact with institutes of repute, to enhance academic and research activities.
3. To inculcate creative thinking abilities among students and develop entrepreneurial skills.
4. To imbibe ethical, environmental friendly and moral values amongst students through broad based education.

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

1. Enable to understand mechanical engineering systems those are technically viable, economically feasible and socially acceptable to enhance quality of life.
2. Apply modern tools and techniques to solve problems in mechanical and allied engineering streams.
3. Communicate effectively using innovative tools, to demonstrate leadership and entrepreneurial skills.
4. Be a professional having ethical attitude with multidisciplinary approach to achieve self and organizational goals.
5. Utilize the best academic environment to create opportunity to cultivate lifelong learning skills needed to succeed in profession.

PROGRAM SPECIFIC OUTCOMES (PSO'S)

PS01:-Apply the acquired knowledge in design, thermal, manufacturing and interdisciplinary areas for solving industry and socially relevant problems.

PS02:-To enhance the abilities of students by imparting knowledge in emerging technologies to make them confident mechanical engineers.

B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

COMPUTER AIDED MACHINE DRAWING			
Course Code	18ME36A/46A	CIE Marks	40
Teaching Hours/Week (L:T:P)	1:4:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire the knowledge of CAD software and its features.
- To familiarize the students with Indian Standards on drawing practices.
- To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- To make the students understand and interpret drawings of machine components leading to preparation of
  Assembly drawings manually and using CAD packages.
- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.

Part A

Introduction: Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section). Hidden line conventions. Precedence of lines.

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections. Conversion of pictorial views into orthographic projections of simple machine parts. Hidden line conventions. Precedence of lines. Conversion of pictorial views into orthographic projections of simple machine parts (with section planes indicated on the part).

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

Part B

Keys: Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.

Joints: Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)

Part C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. Lever Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool head of shaper

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Identify the national and international standards pertaining to machine drawing.

CO2: Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings

CO3: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.

CO4: Interpret the Machining and surface finish symbols on the component drawings.

CO5: Preparation of the part or assembly drawings as per the conventions.

Scheme of Examination: Two questions to be set from each Part A, part B and Part C. Student has to answer one question each from Part A and Part B for 25 marks each and one question from Part C for 50 marks.

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A)

EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C, 3D environment should be used for parts and assembly, and extract 2D views of assembly.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Machine Drawing	K.R. Gopala Krishna	Subhash Publication	2005
2	Machine Drawing	N.D.Bhat&V.M .Panchal	Charoratar publishing house	2005
Reference Books				
1	A Text Book of Computer Aided Machine Drawing	S. Trymbaka Murthy	CBS Publishers, New Delhi	2007
2	Engineering drawing	P.S.Gill	S K Kataria and Sons	2013
3	Machine Drawing	N. Siddeshwar, P. Kanniah, V.V.S. Sastri	Tata McGraw Hill	2006

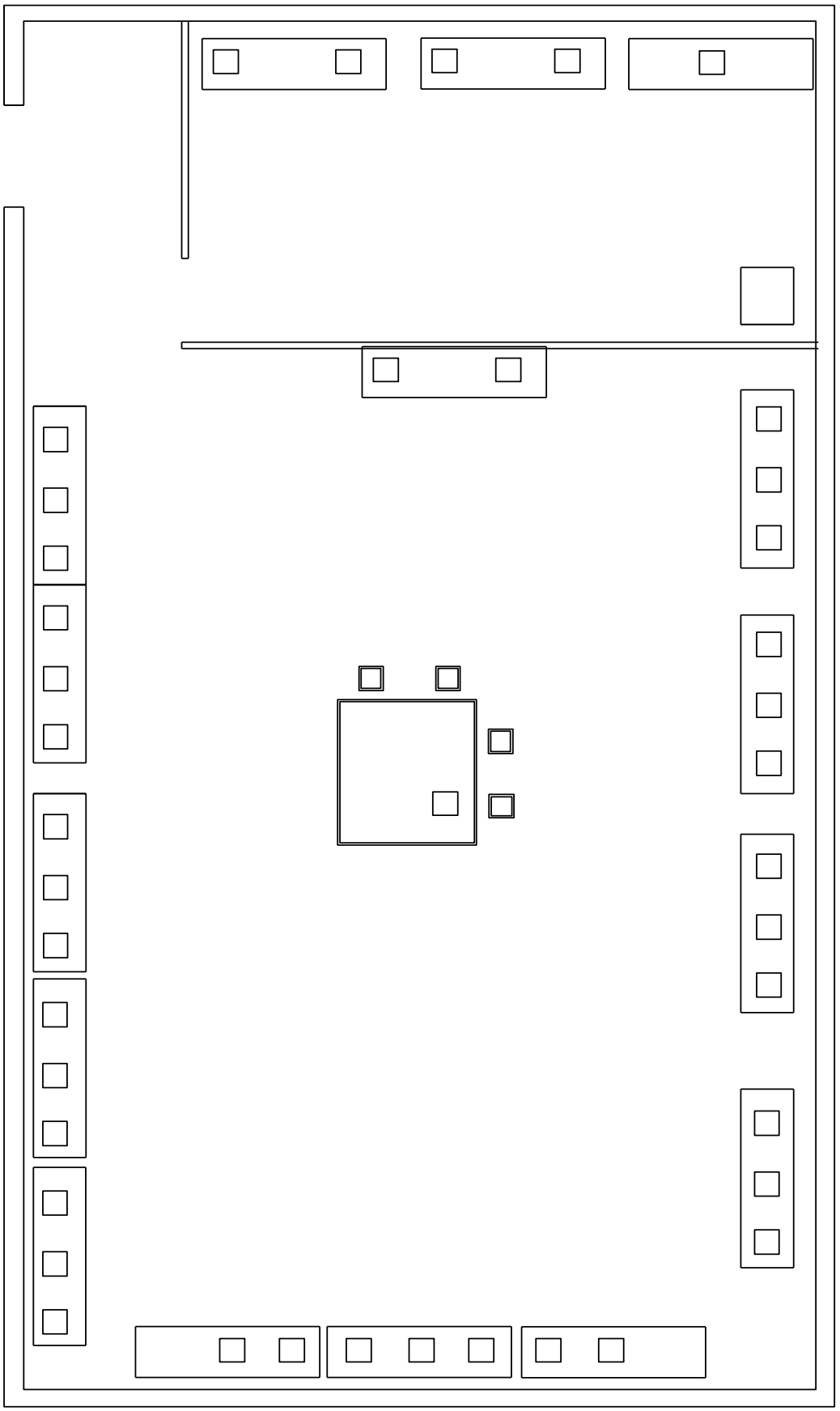
DO's

1. Computer lab users must sign in and out of the lab
2. Wearing Uniform in the lab is compulsory.
3. Take care of your eyes, by relaxing few minutes while using computer
4. Adjust the chair settings to adopt your body for the proper height and lumbar support.
5. Proper code of conduct and ethics must be followed in the lab.
6. Operate the computer system and other hardware devices with care

DONT's

1. Software may be installed by the Computer Lab staff only. Do not install any software on your own. Unnecessary files found in the system will be removed by the concerned staff.
2. Activities in computer Lab that are considered to be abusive to the software, hardware and/or personnel will be suitably penalized
3. Do not modify any software or files. Do not overwrite the operating system or any other parameters in the computer system
4. Copying software without appropriate authorization is not permitted.
5. External devices like pen drive, CD's should be avoided so that computer systems are free from virus.

CONTENTS

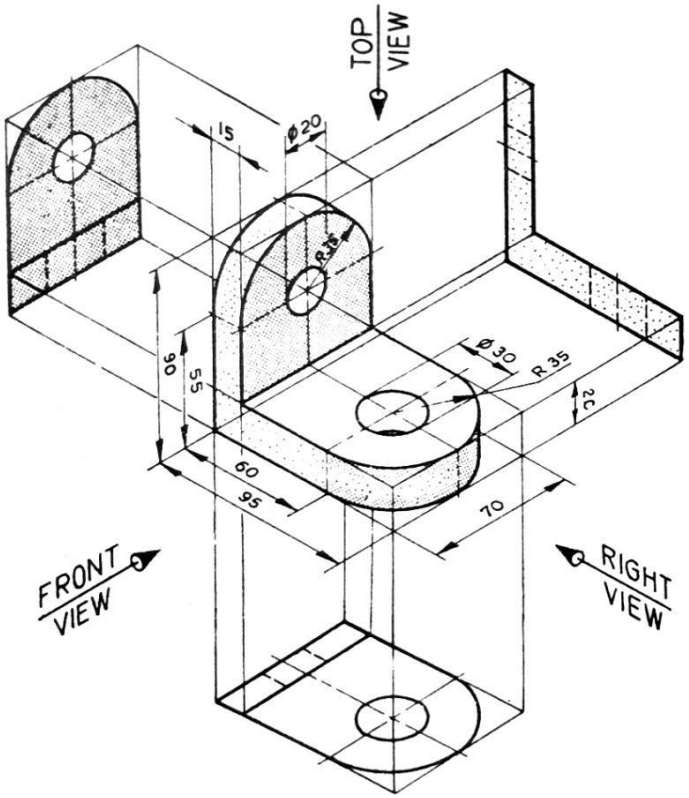


CAMD LAB LAYOUT

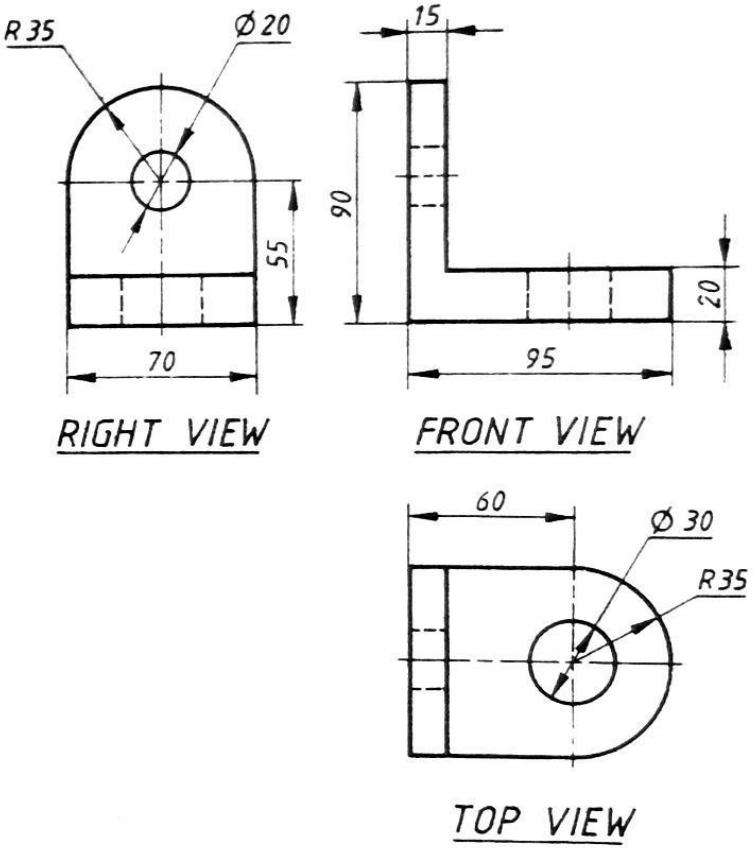
PART A

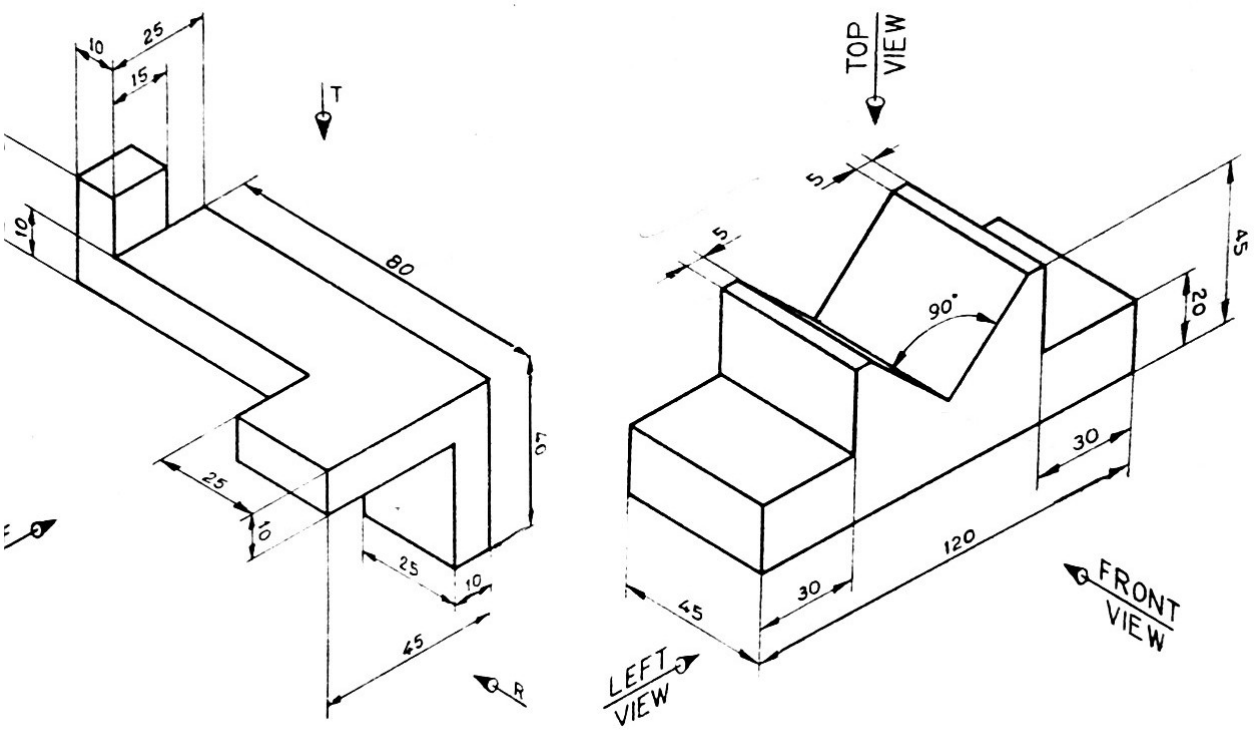
ORTHOGRAPHIC PROJECTIONS

Pictorial View :

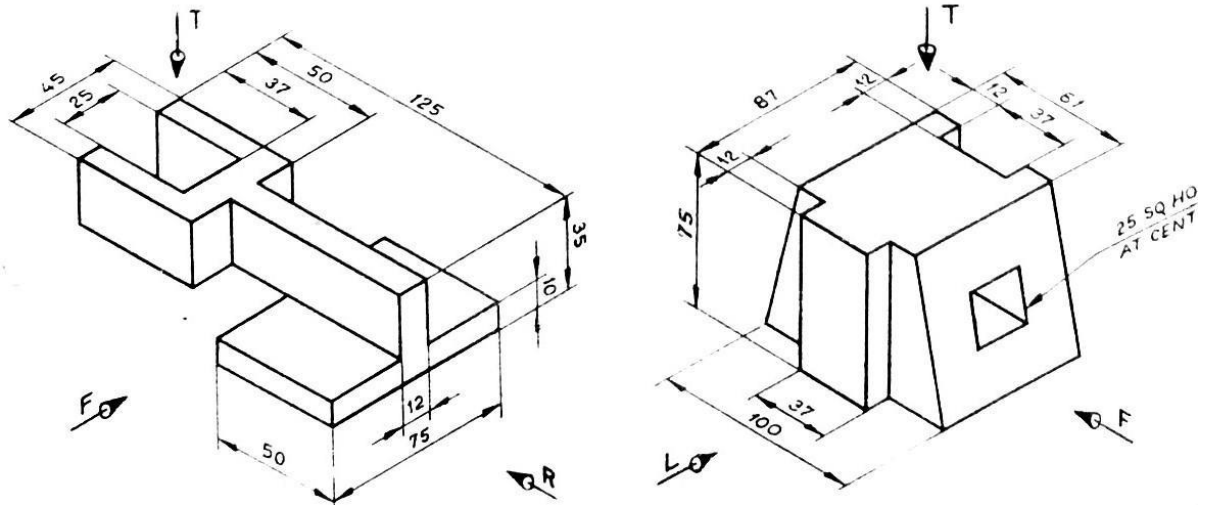


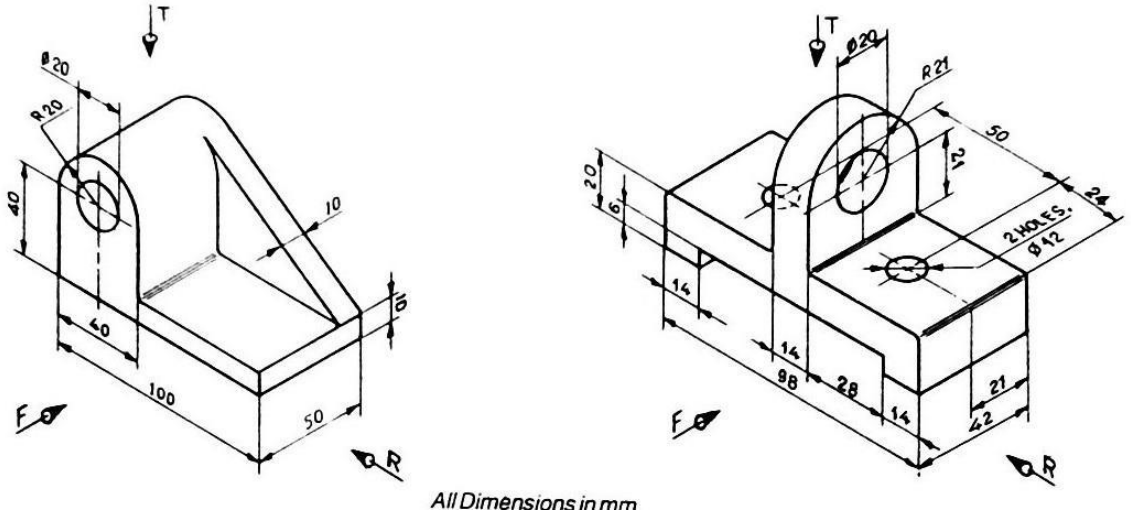
ORTHOGRAPHIC PROJECTIONS: WITHOUT SECTIONING





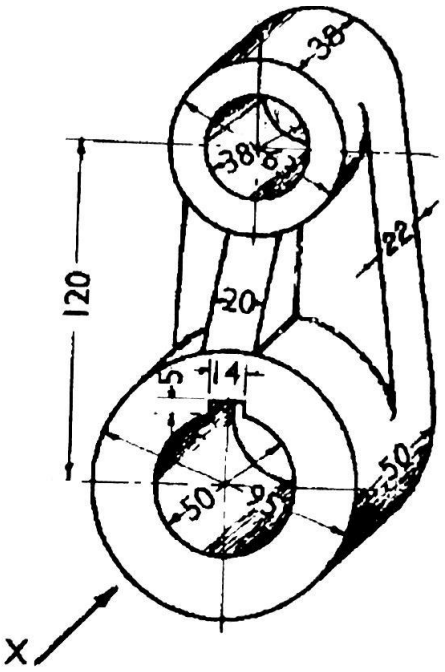
All Dimensions in mm

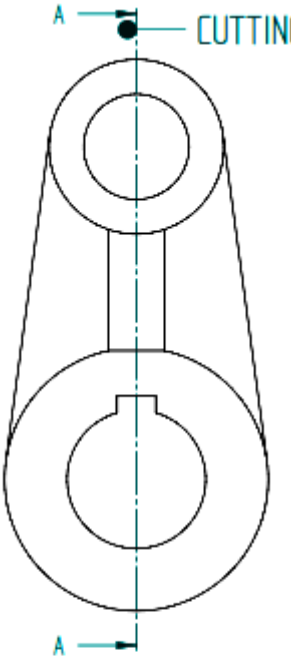




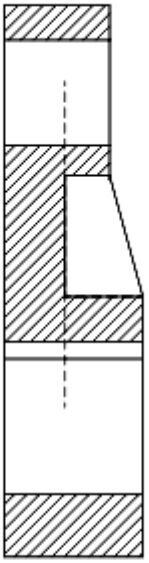
All Dimensions in mm

ORTHOGRAPHIC PROJECTIONS: WITH SECTIONING

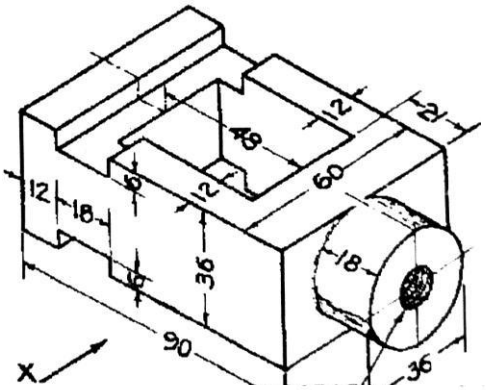


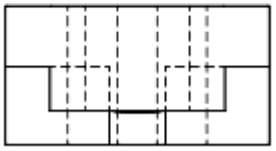


FRONT VIEW

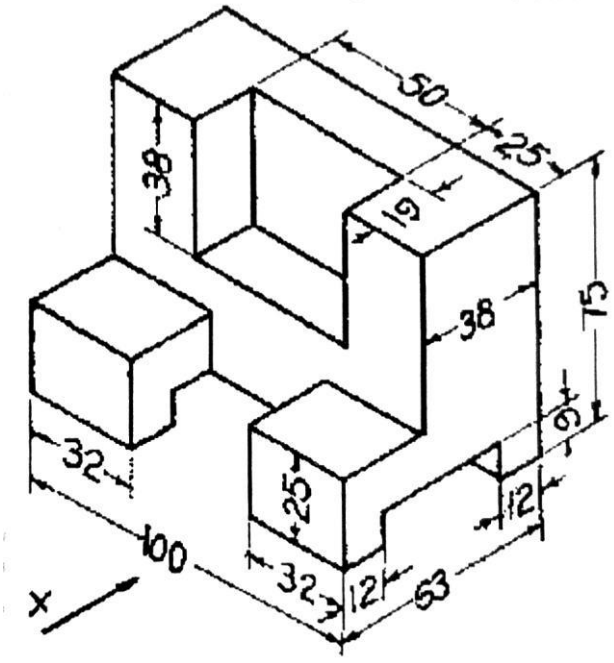


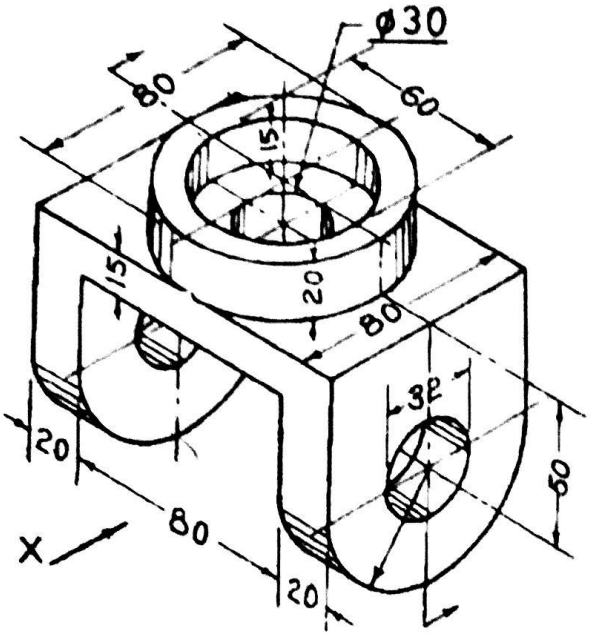
SECTIONED SIDE VIEW





TOP VIEW

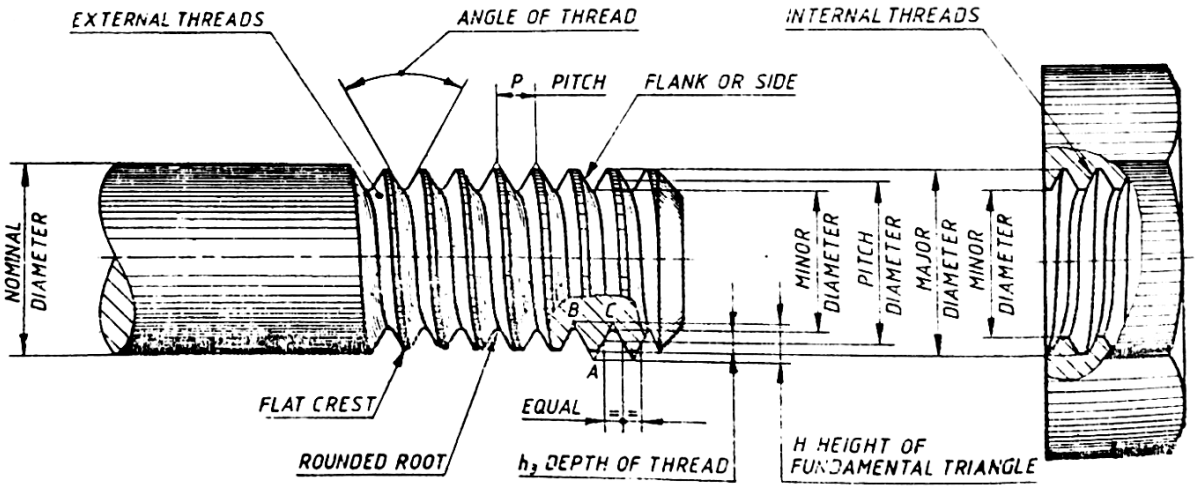




PART A THREAD

FORMS

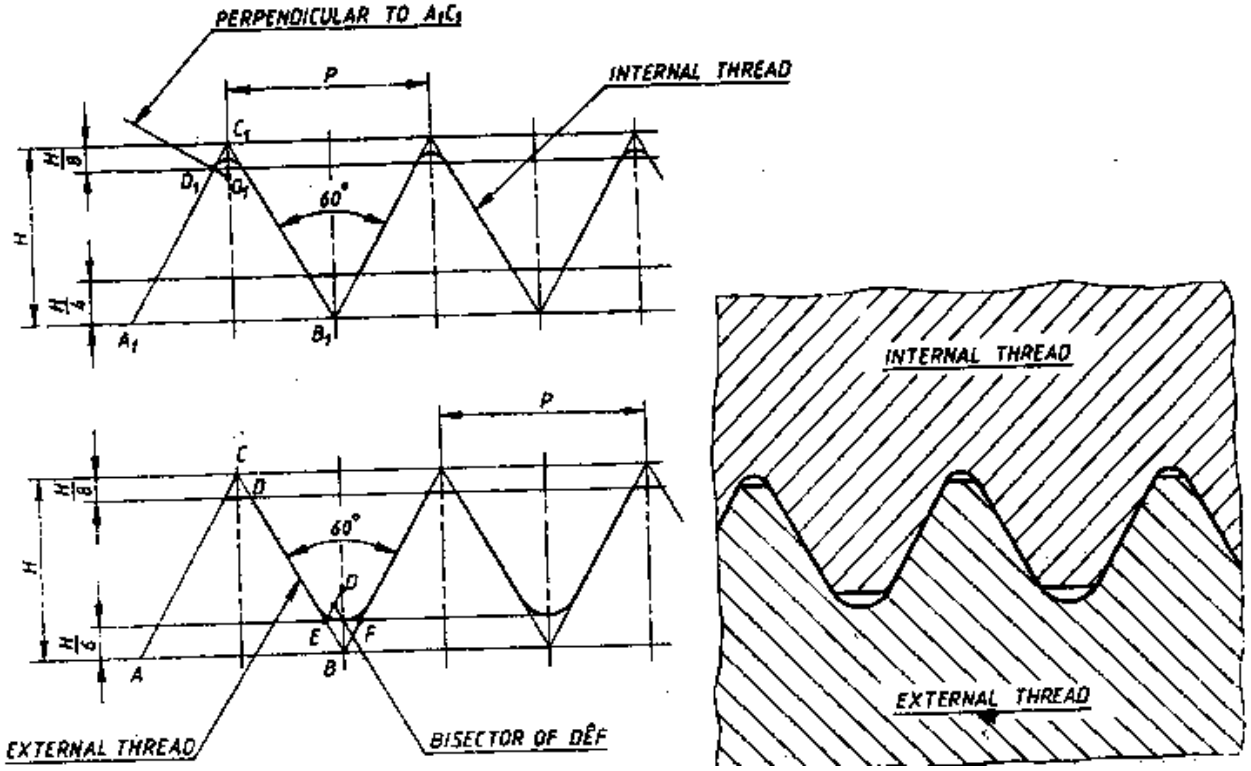
SCREW THREAD TERMINOLOGY:



Elements of a Screw Thread

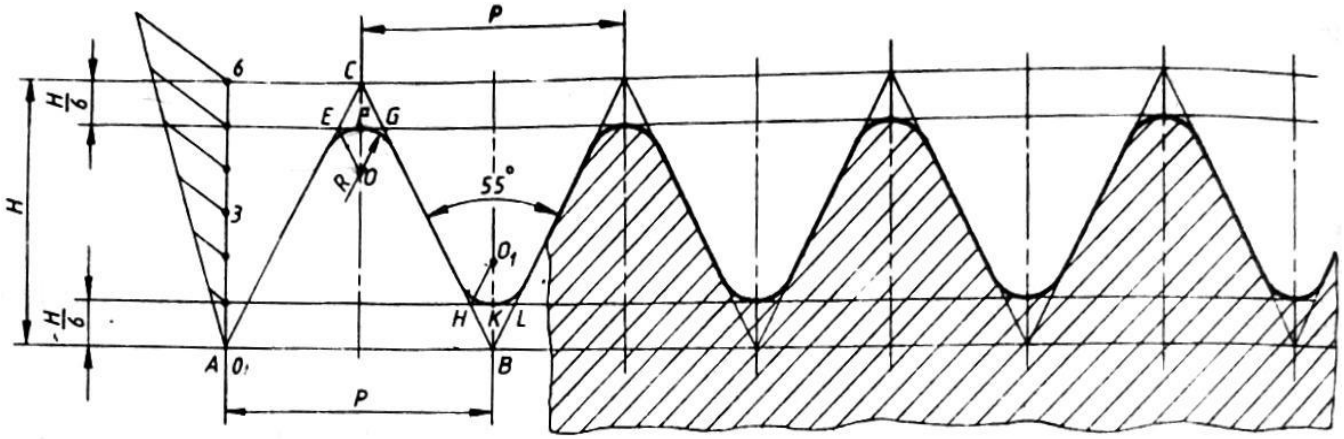
ISO Thread (Indian Standard) - Internal and external

Draw the ISO thread (Both internal and External) taking pitch, P = 50mm. Show at least three threads.



Whitworth Thread (British Standard) BSW Threads

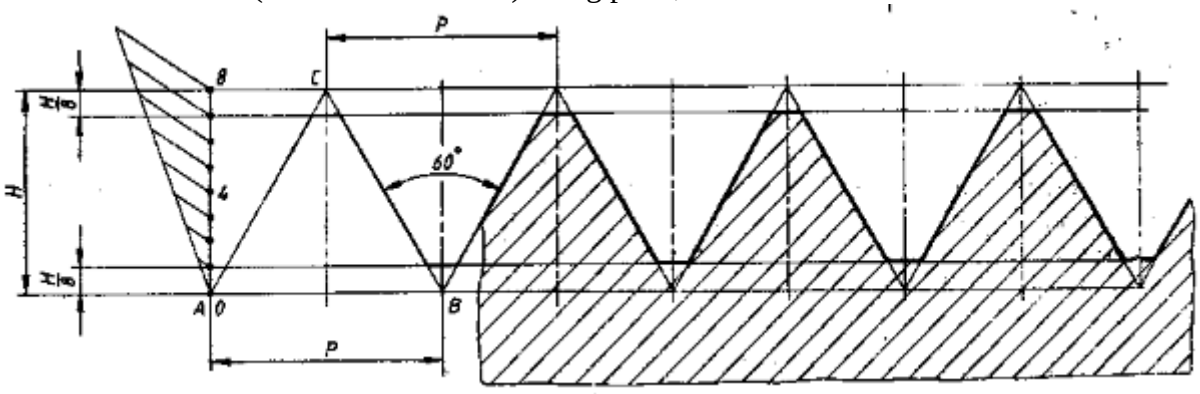
Draw Whitworth Thread (British Standard) taking pitch, P = 50mm. Show at least three threads.



Whitworth Thread

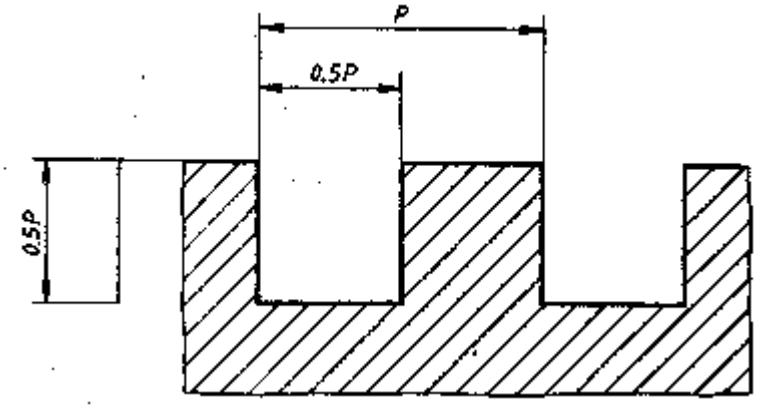
Sellers Thread (American Standard)

Draw Sellers Thread (American Standard)taking pitch, P = 30mm. Show at least three threads.



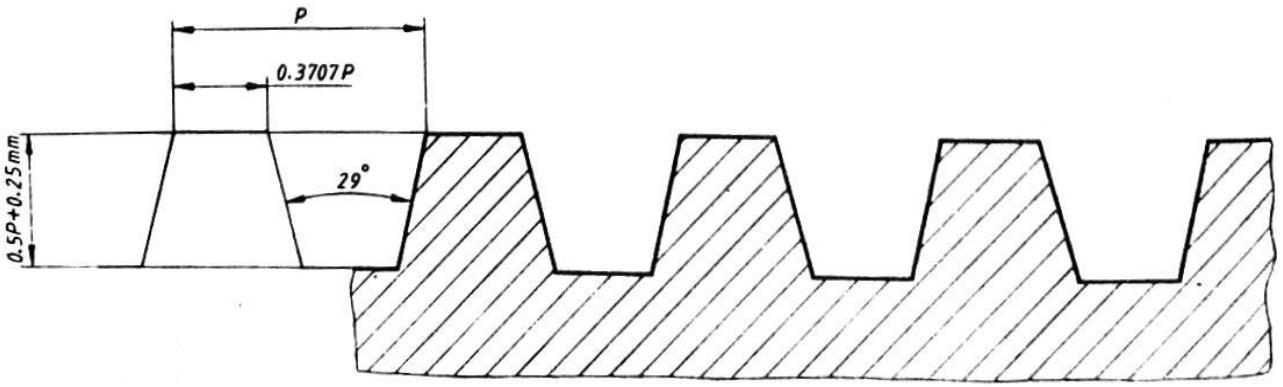
Basic Form of Square Thread

Draw Square Thread taking pitch, P = 50mm. Show at least three threads.



Acme Thread:

Draw Acme Thread taking pitch, P = 50mm. Show at least three threads.



Acme Thread

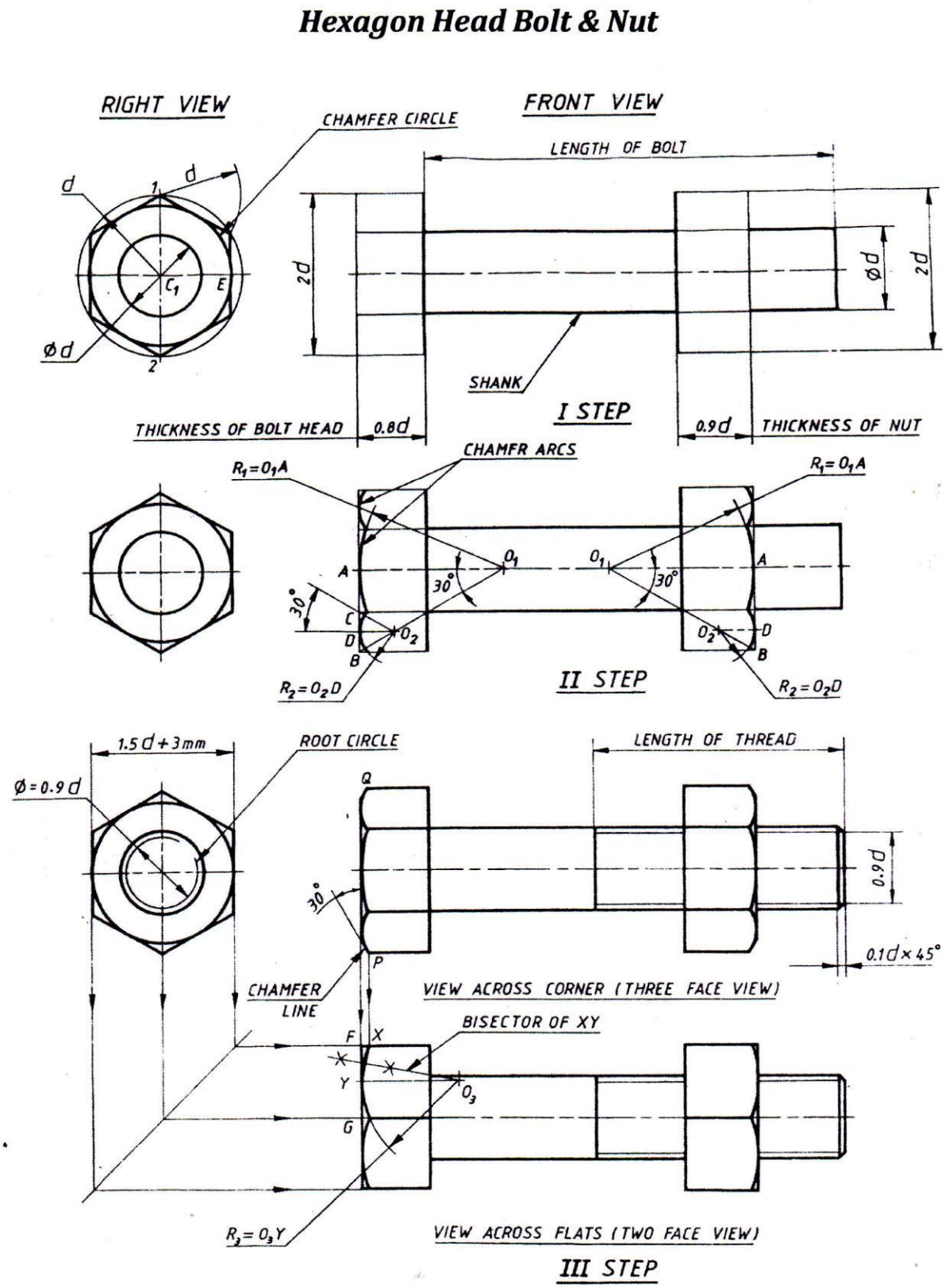
FASTENERS

Empirical Proportions of Hexagon and Square Head Bolt & Nut

Detail	*Proportion*
Nominal Diameter	**d** = Size of Bolt or Nut, mm
Width Across Flats	**s** = 1.5d + 3mm
Width Across Corners	**e** = 2d
Thickness of Bolt Head	**k** = 0.8d
Thickness of Nut	**m** = 0.9d
Root Diameter	$\mathbf{d_1}$ = d — (2 × Depth of Thread) or = d — (4 × Thickness of lines) or = 0.9d (approximate)
Length of Bolt	*l* = As specified
Thread Length	b = 2d + 6mm (for *l* < 150mm) = 2d + 12mm (for *l* > 150mm)
Radius of Bolt End	r = d (for spherical ends)
Chamfer of Bolt End	z = Depth of Thread × 45° or = 0.1d (Approximate)
Chamfer Angle of Bolt Head & Nut	= 30°

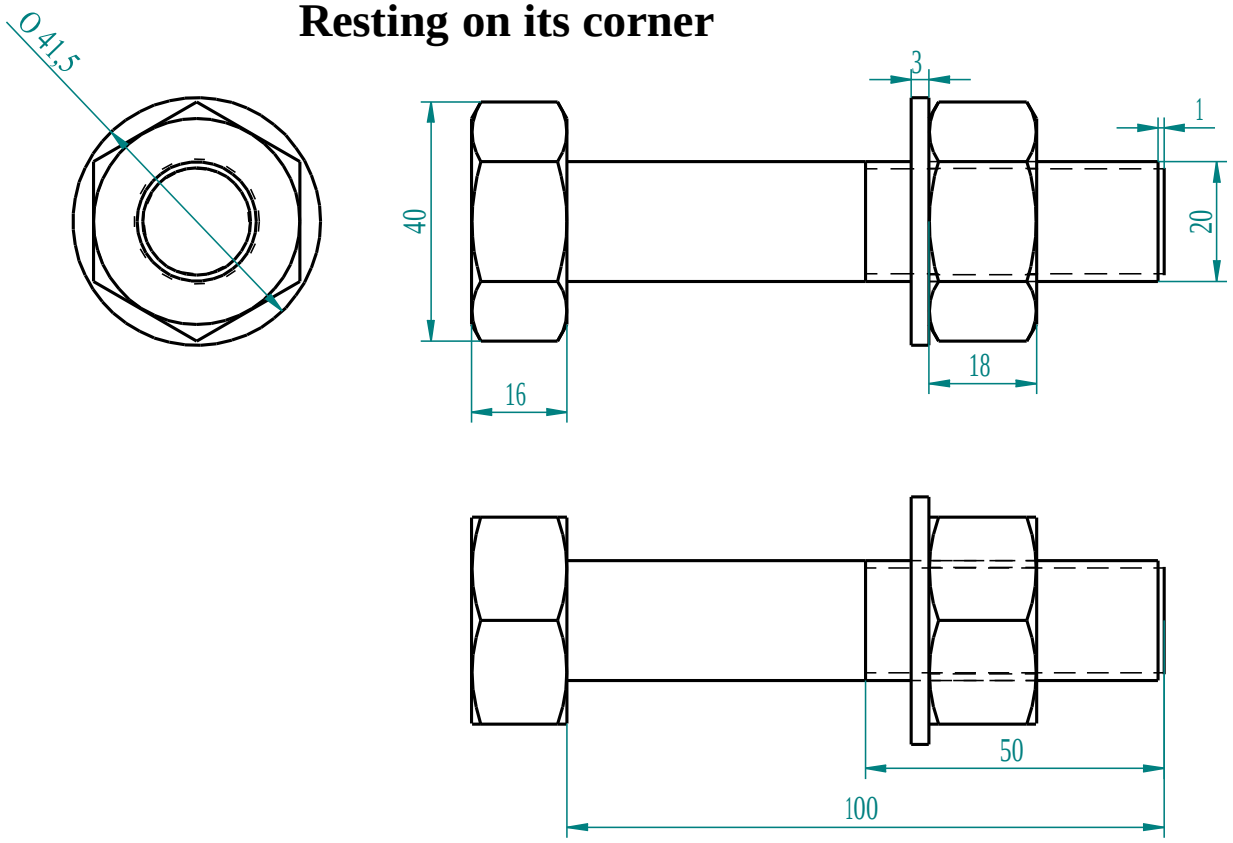
Exercise.1

Draw the three views of ISO threaded hexagonal bolt 100mm long, 20mm diameter and a thread length of50mm and hexagonal nut assembly in the axis horizontal position .Indicate all the proportions and the actual dimensions.

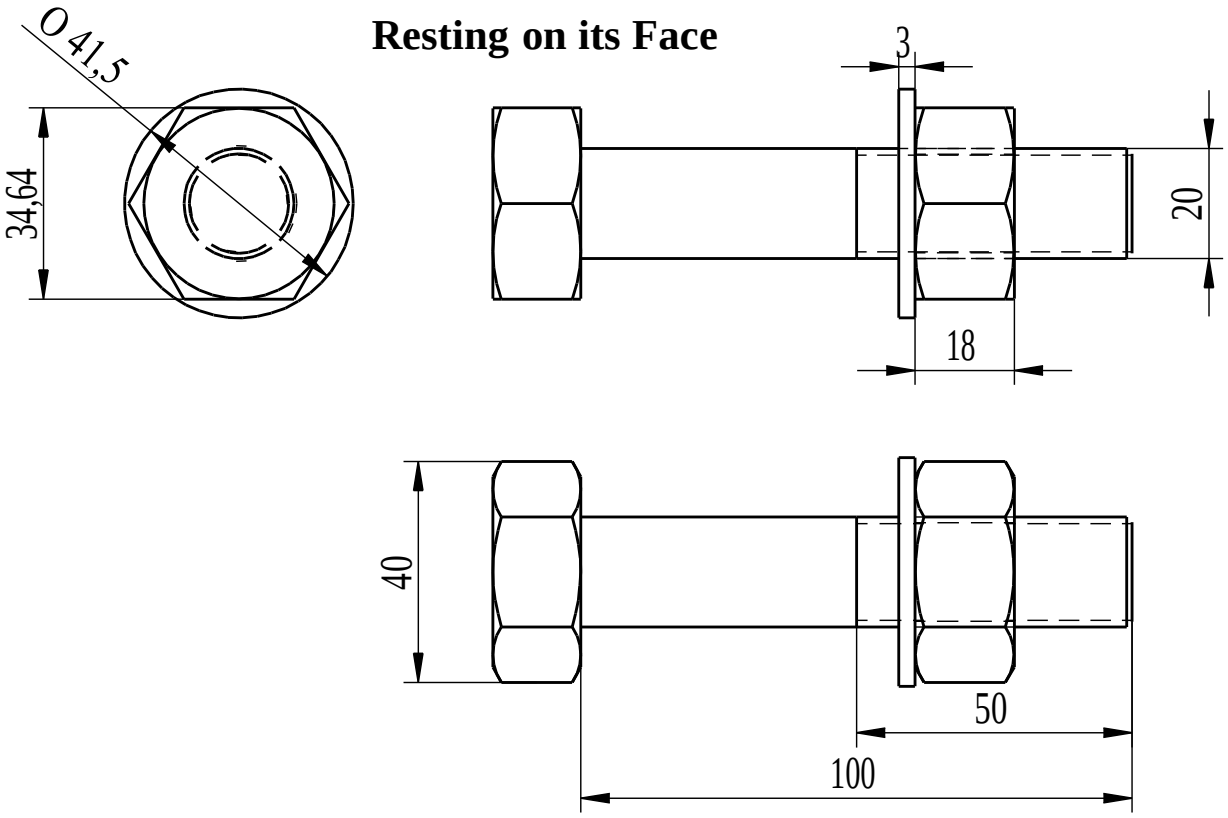


Steps in Drawing Hexagon Head Bolt & Nut

Resting on its corner



Resting on its Face

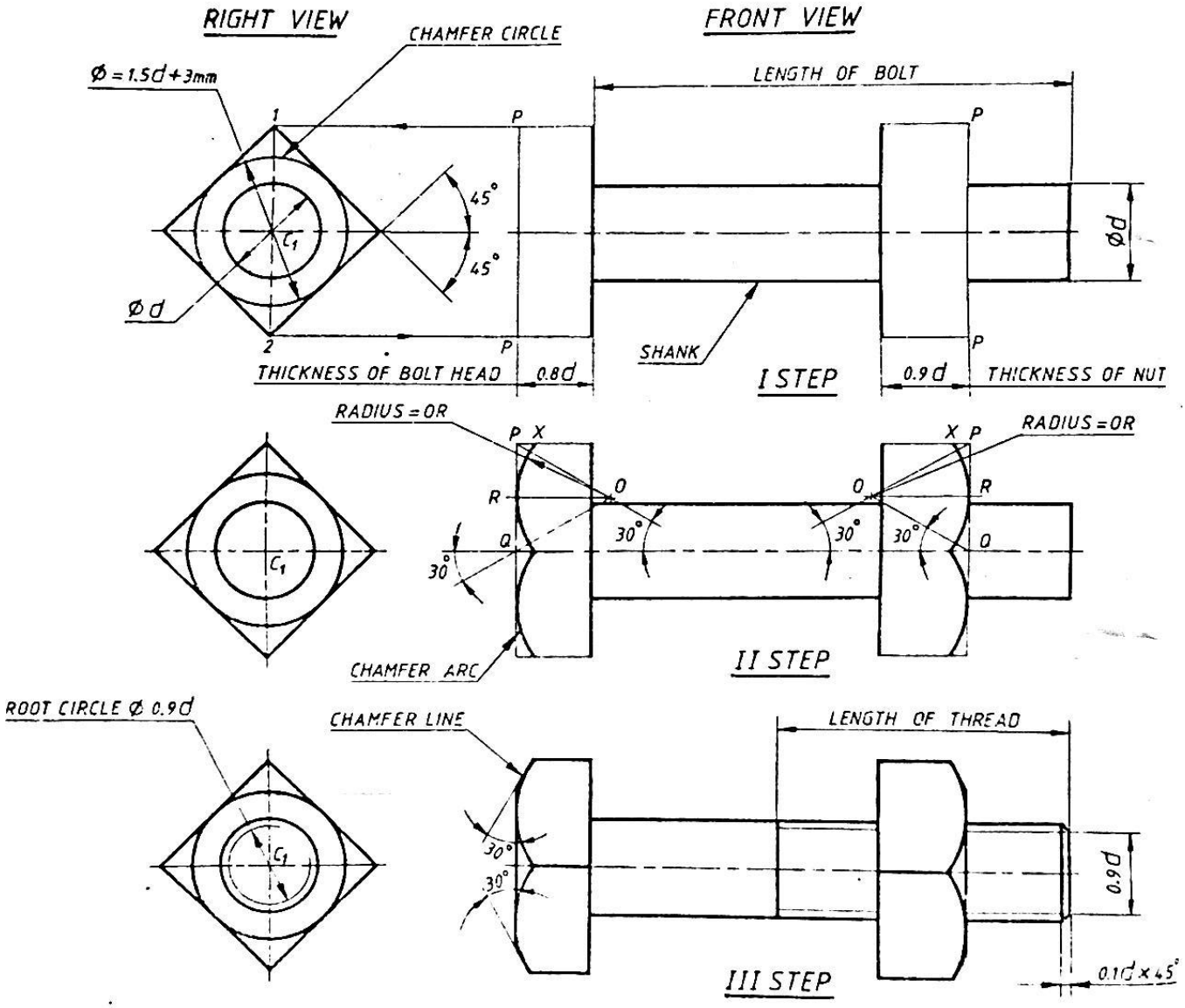


SQUARE HEADED BOLT, WASHER AND NUT ASSEMBLY:

Exercise.2

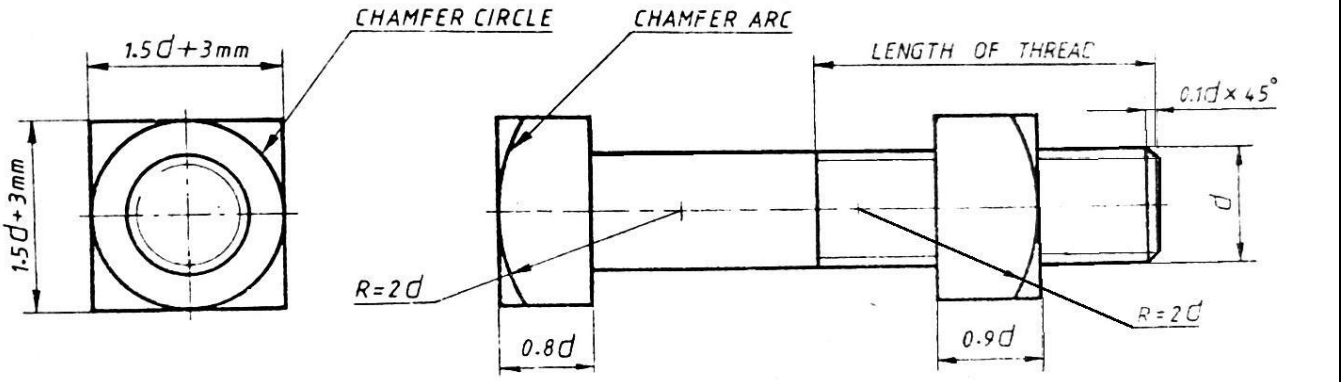
Draw the three views of ISO threaded square bolt 100 mm long, 20 mm diameter and a thread length of 50mm and square nut assembly in the axis horizontal position. Show the assembly of bolt and nut in the view across corners across corners and across flats. Indicate all the proportions and the actual dimensions.

CORNER PLACED:

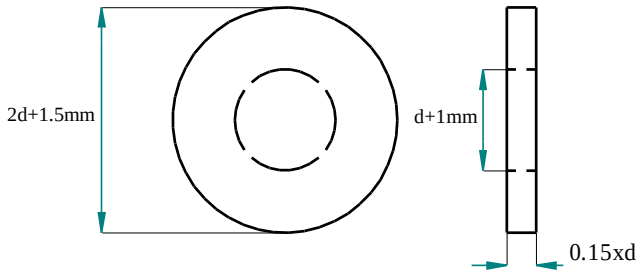


Steps in Drawing Square Head Bolt and Nut in View Across Corners

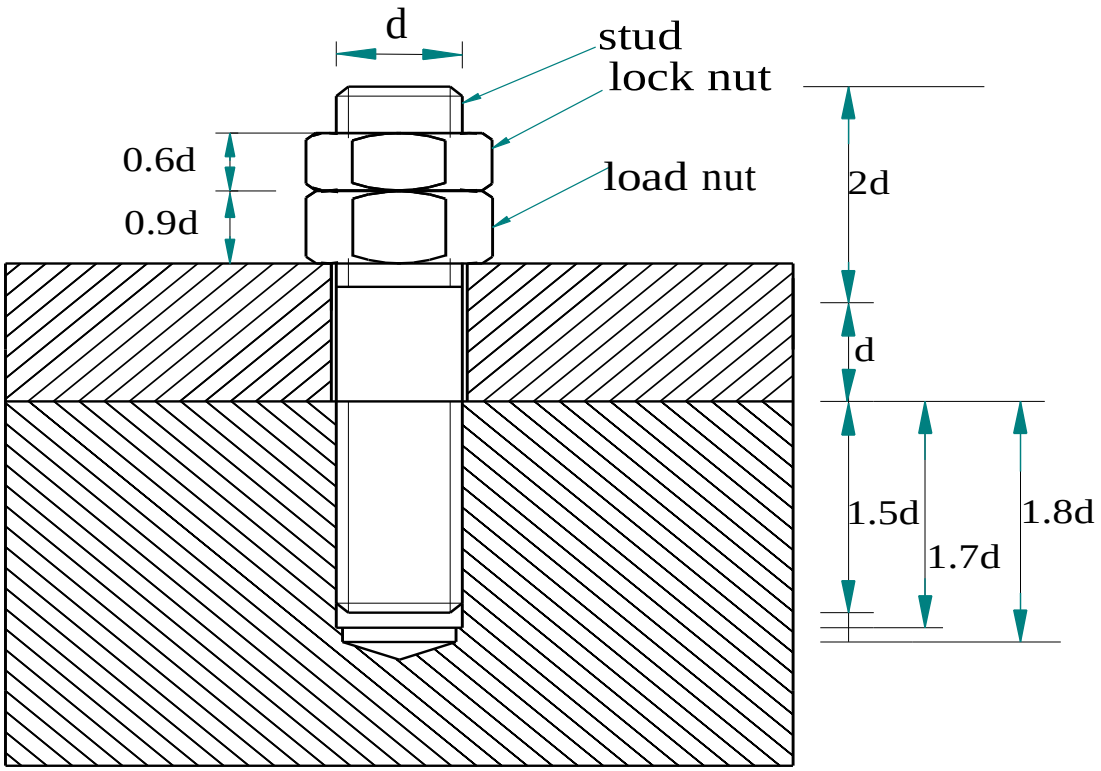
Across Flats:



WASHER :

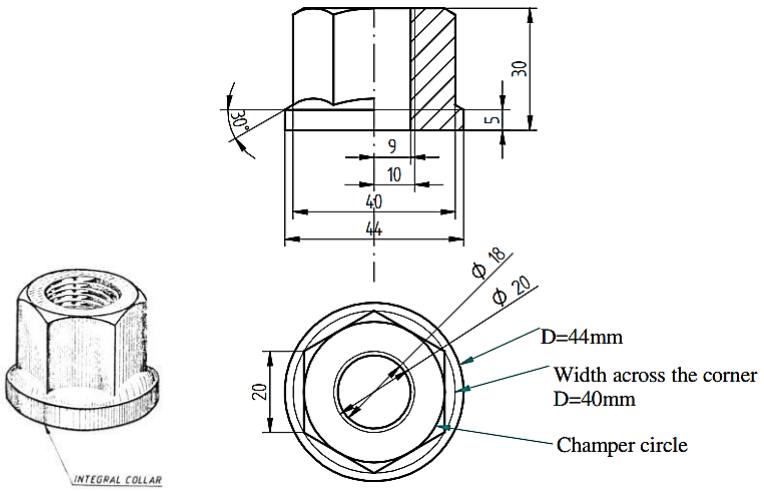


STUD BOLT AND LOCK NUT ASSEMBLY:

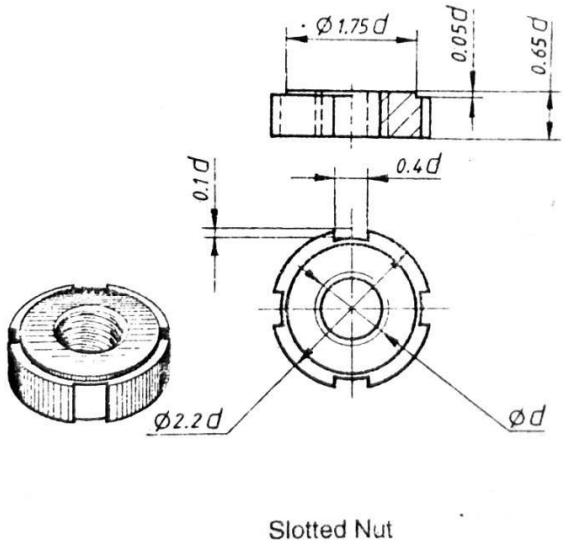


NUTS AND BOLTS:

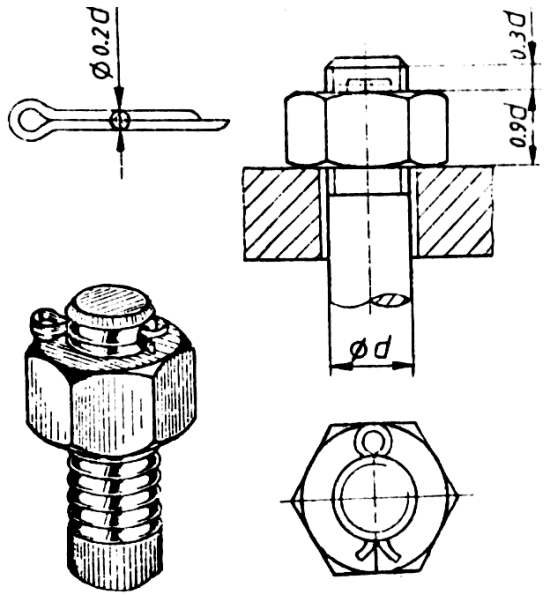
Flanged nut



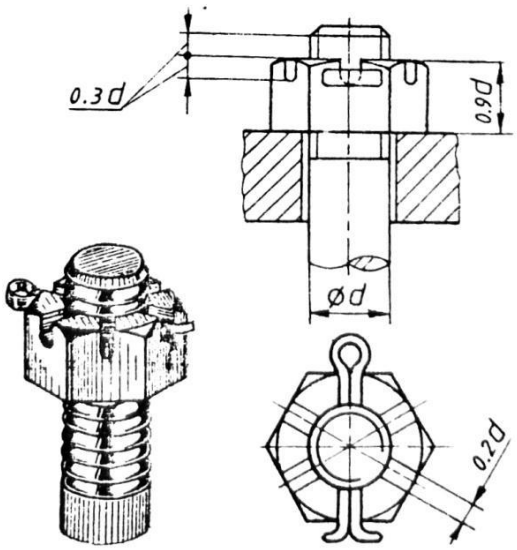
slotted nut



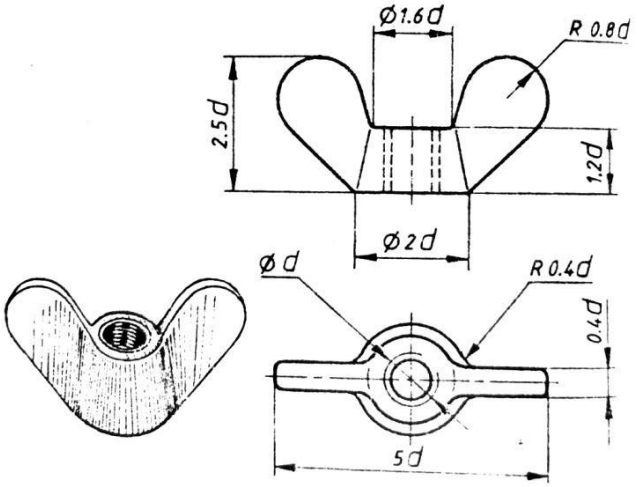
Split pin lock nut assembly



Slotted nut assembly

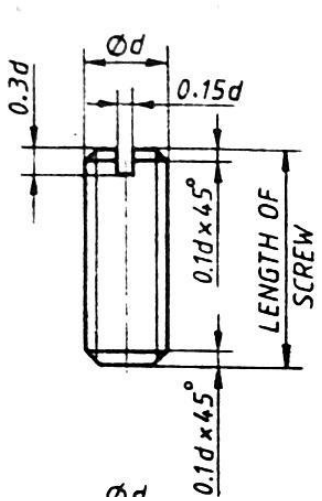


Wing nut

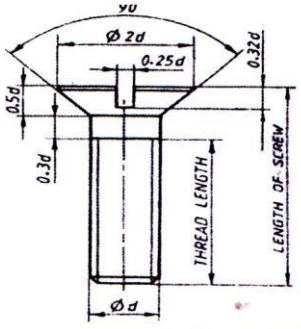


Wing Nut

Grub screw

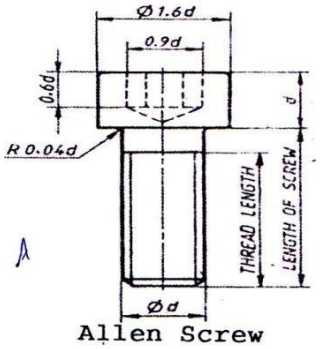


Counter sung head screw



Counter Sunk Head Screw

Allen screw

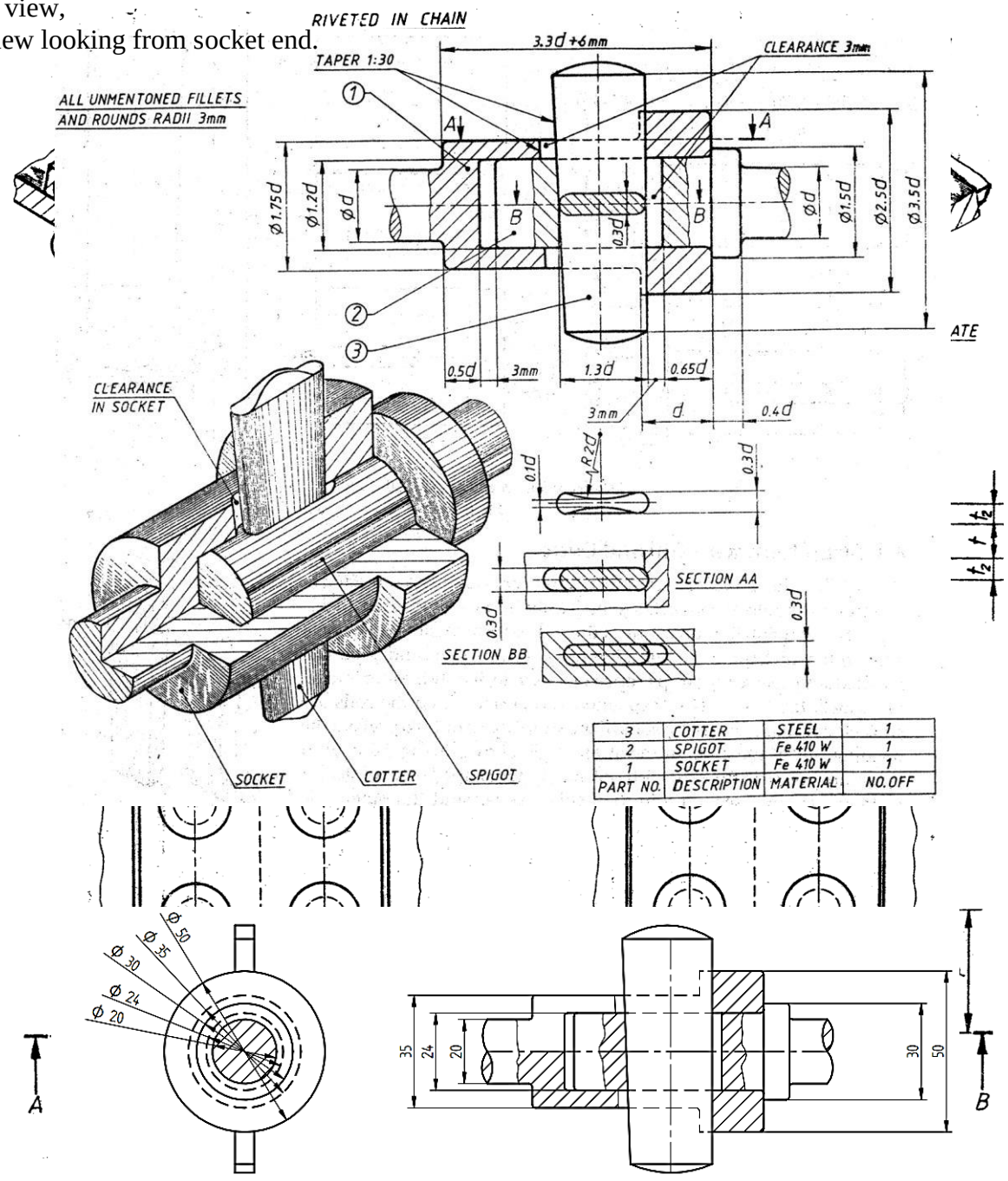


Allen Screw

PART B
JOINTS
SOCKET AND SPIGOT COTTER JOINTS

Draw the following views of an assembled Socket and Spigot Cotter Joint to 1:1 scale assuming the diameter of the rods d=20mm.

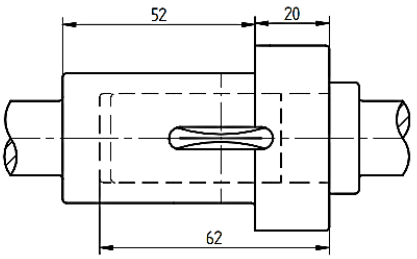
1. Front view in half section,
2. Top view,
3. A view looking from socket end.



Side View from spigot end

Front View in full section

Socket and Spigot Cotter Joint



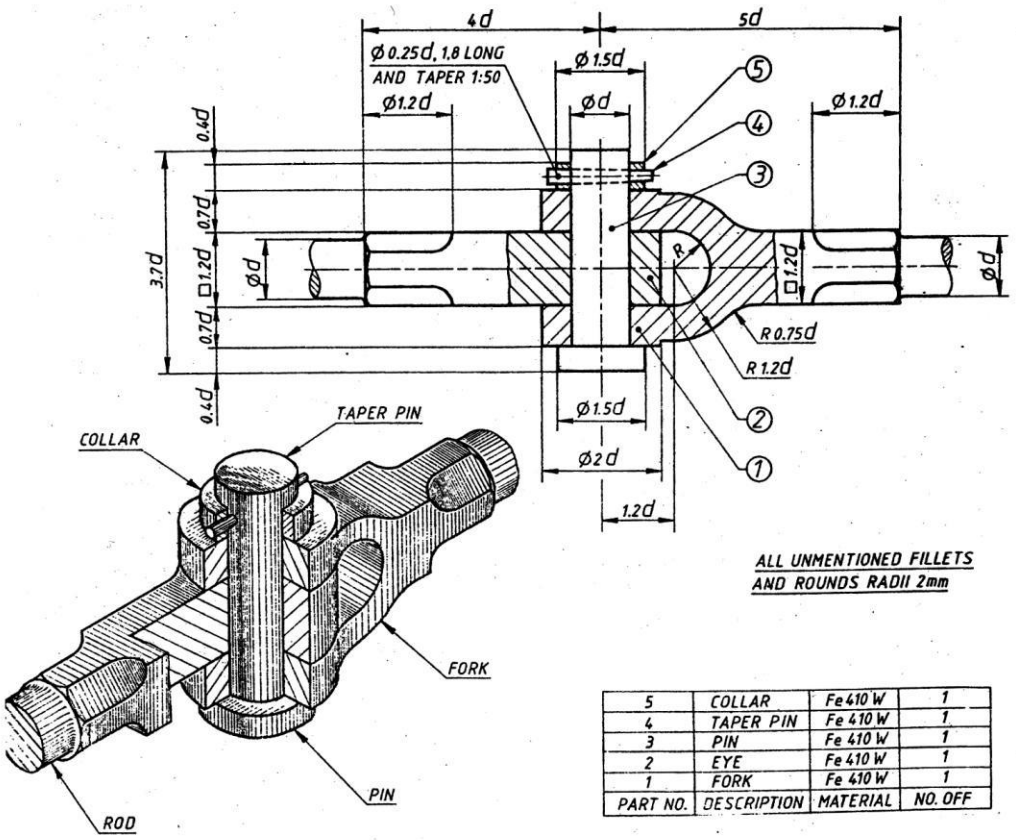
Top View

KNUCKLE JOINT

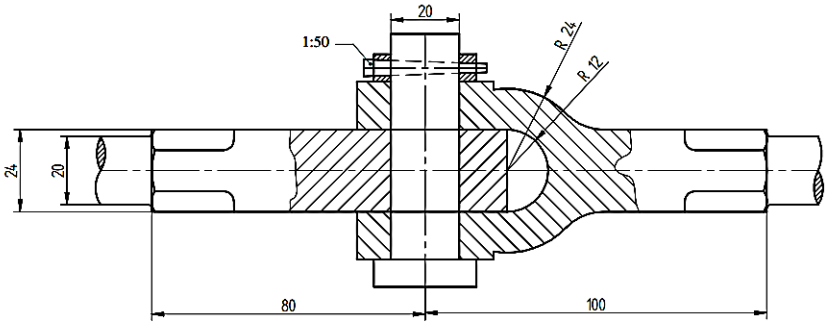
Draw the following views an assembled knuckle joint to 1:1 scale assuming the diameter of the rods d = 20mm.

1. Front view with top half in section,
2. Top view,
3. A view from the eye end of the rod.

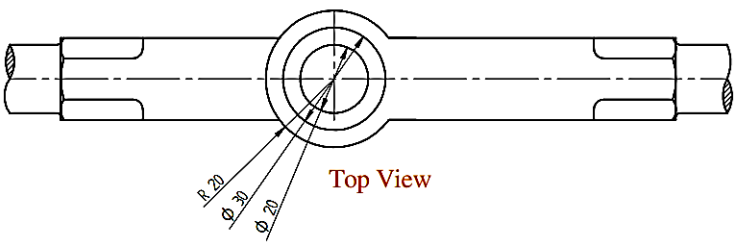
Indicate the important assembly dimensions and write the item list.



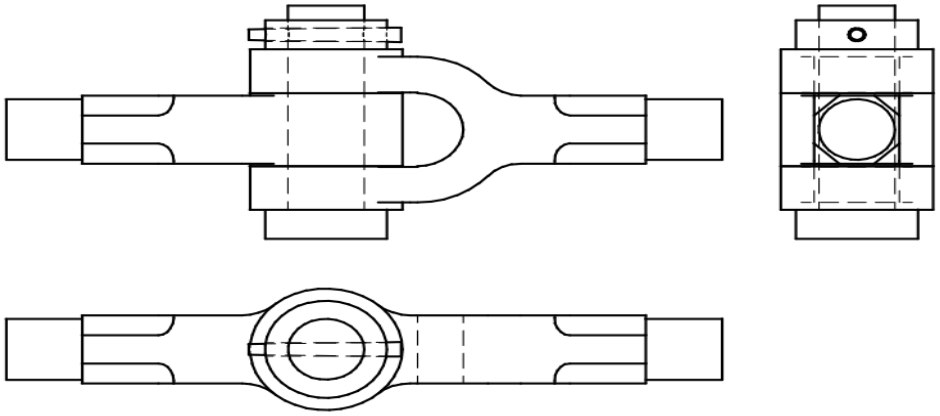
PART NO.	DESCRIPTION	MATERIAL	NO. OFF
5	COLLAR	Fe 410 W	1
4	TAPER PIN	Fe 410 W	1
3	PIN	Fe 410 W	1
2	EYE	Fe 410 W	1
1	FORK	Fe 410 W	1



front View in Full section



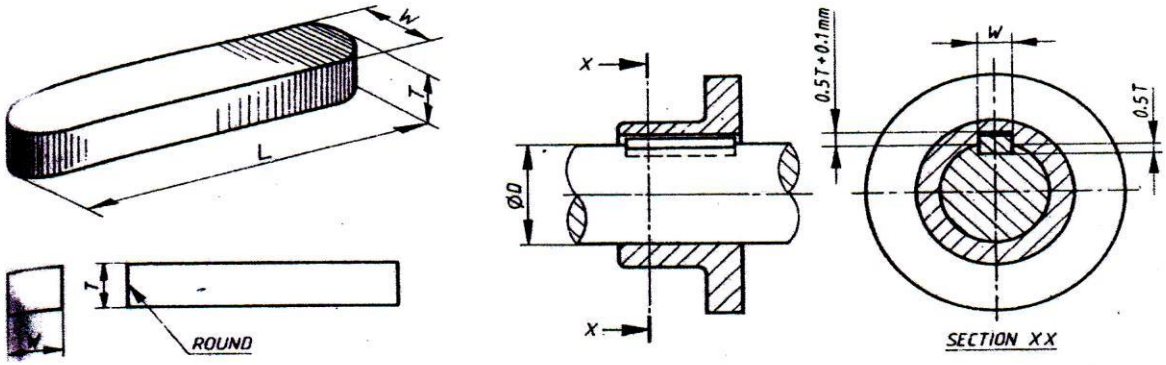
Top View



KEYS

Draw Proportionately the keys given below:

Feather or Parallel key



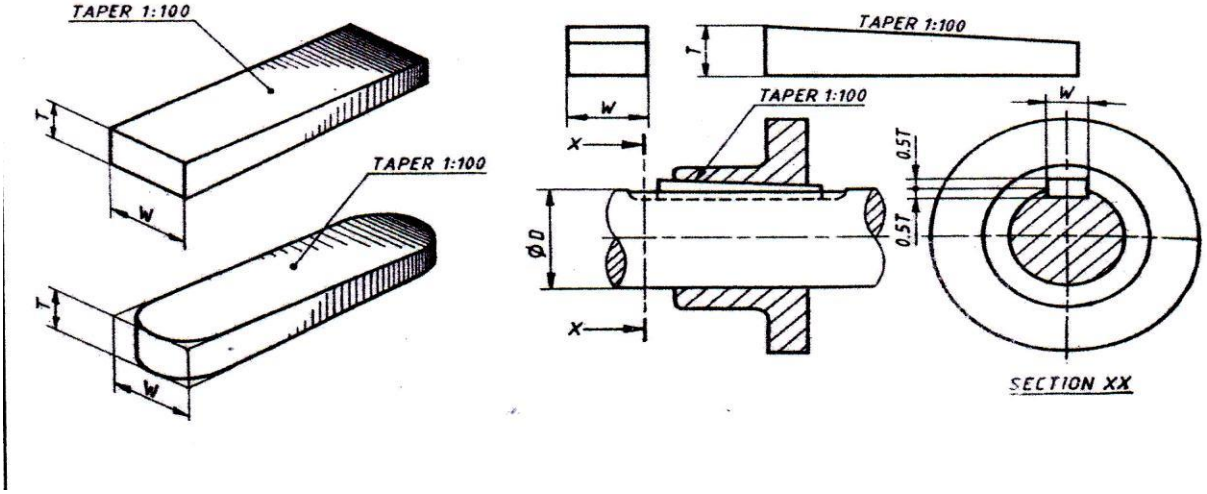
Taper Sunk key

If D = diameter of the shaft in mm, W = width of the key and T = thickness of key,

Width of key = 0.25 D + 2 mm

Nominal Thickness = 0.66 W

Standard Taper = 1 : 100



Gib Head key

If D = diameter of the shaft in mm, W = width of the key, T = thickness of key, h = height of the gib-head, and b = width of the gib-head,

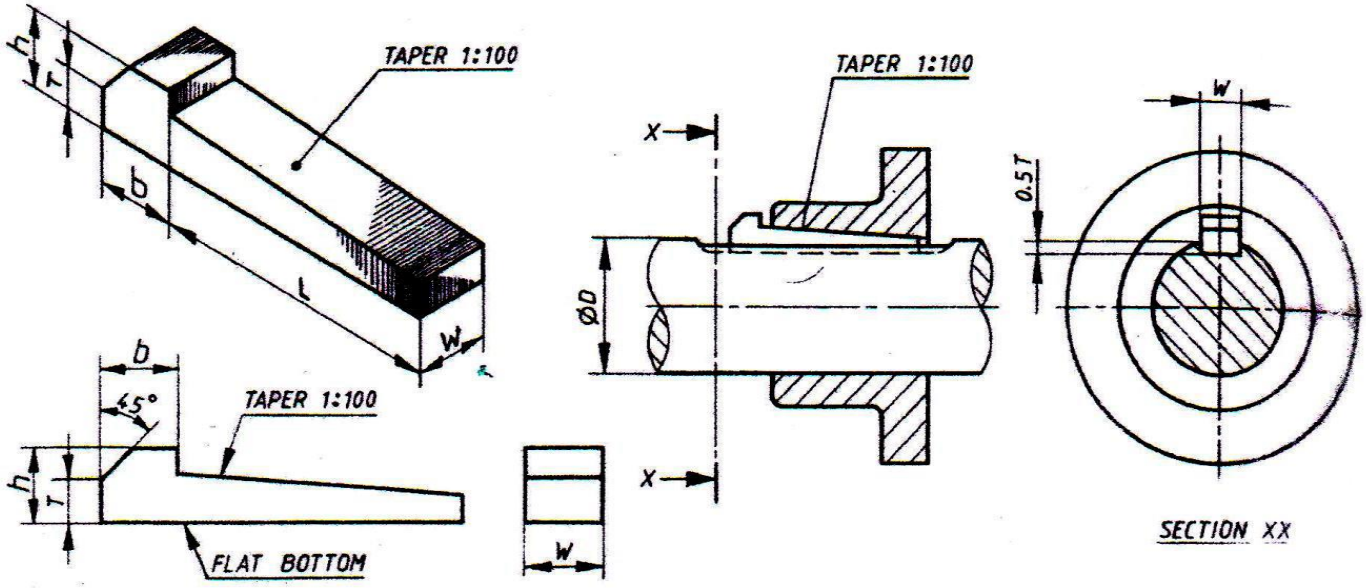
Width of key = 0.25 D + 2 mm

Nominal Thickness = 0.66 W

Standard Taper = 1 : 100

Height of Gib-head = 1.75 T

Width of Gib-head = 1.5 T



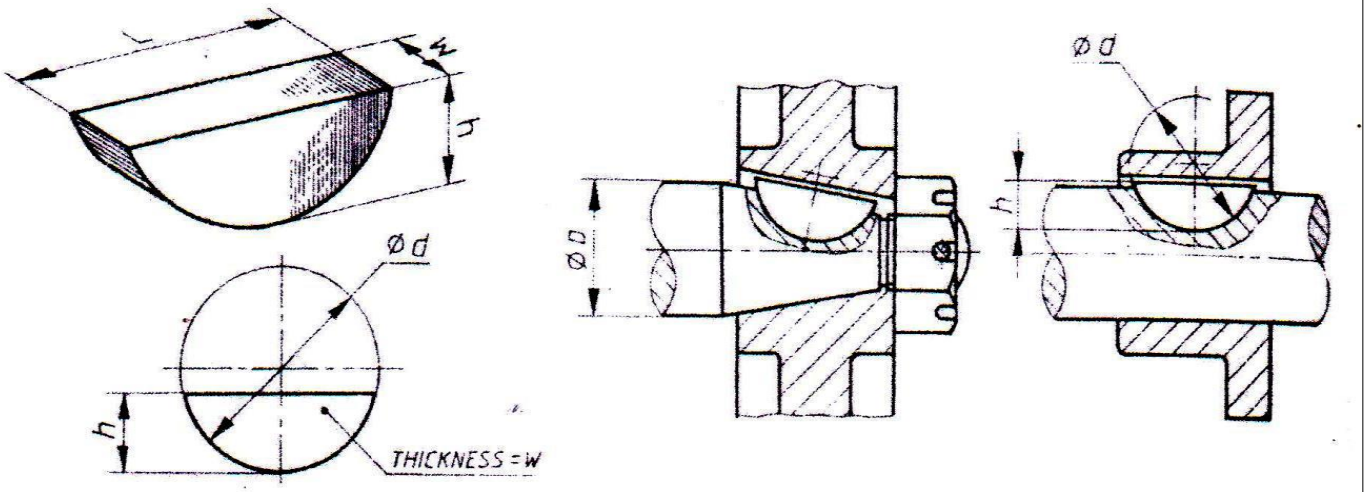
Woodruff key

If D = diameter of the shaft in mm, d = diameter of the key, h = height of the key, W = Width of the key.

Width of key = 0.25 D

Diameter of key = 4 W

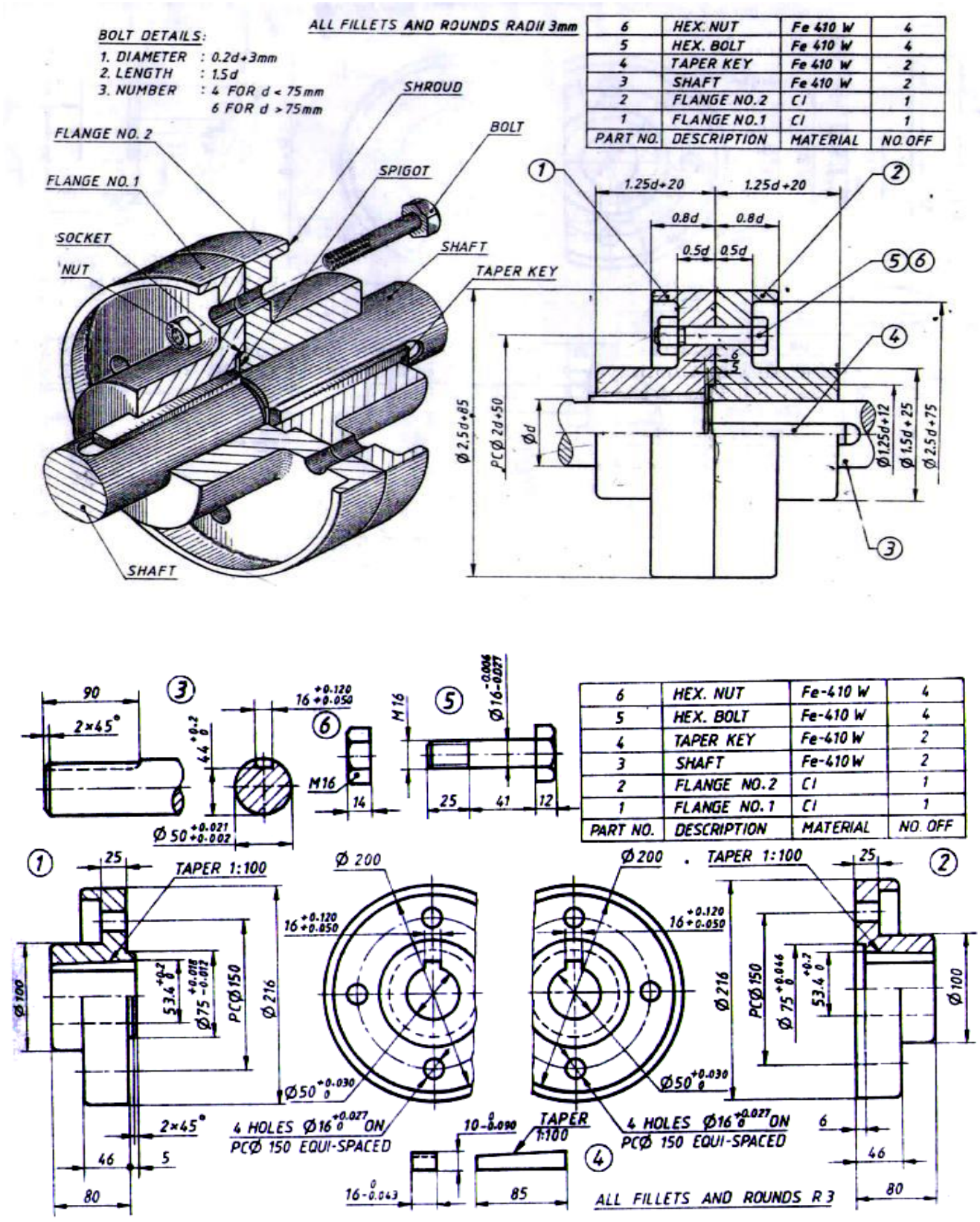
Height of key = 1.75 W



COUPLINGS

1. Protected type flanged coupling:

Following drawing shows the Protected type flanged coupling with proportions expressed in terms of shaft diameter 'd=25mm'. Draw the sectional front view and sectional profile view with 1:1 scale.

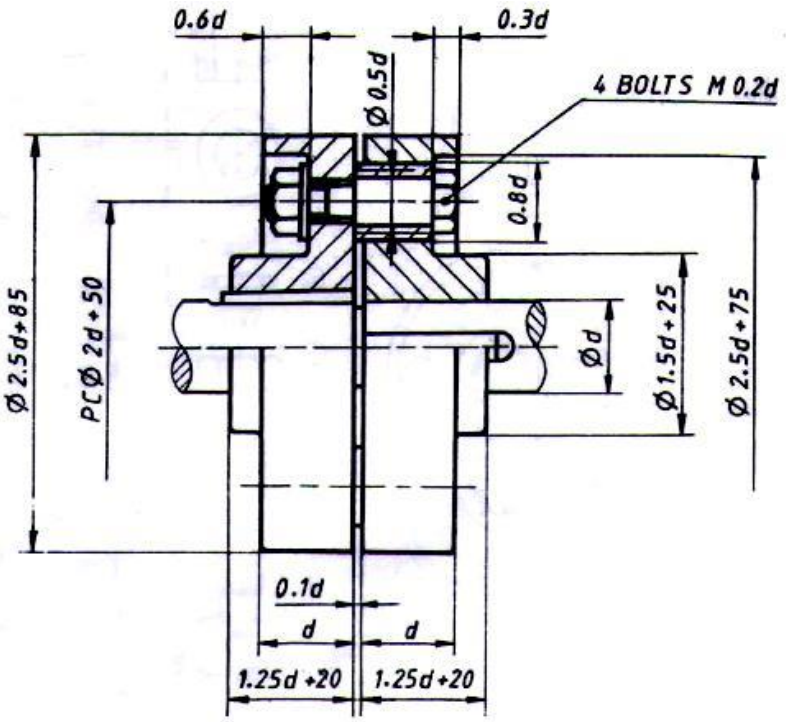


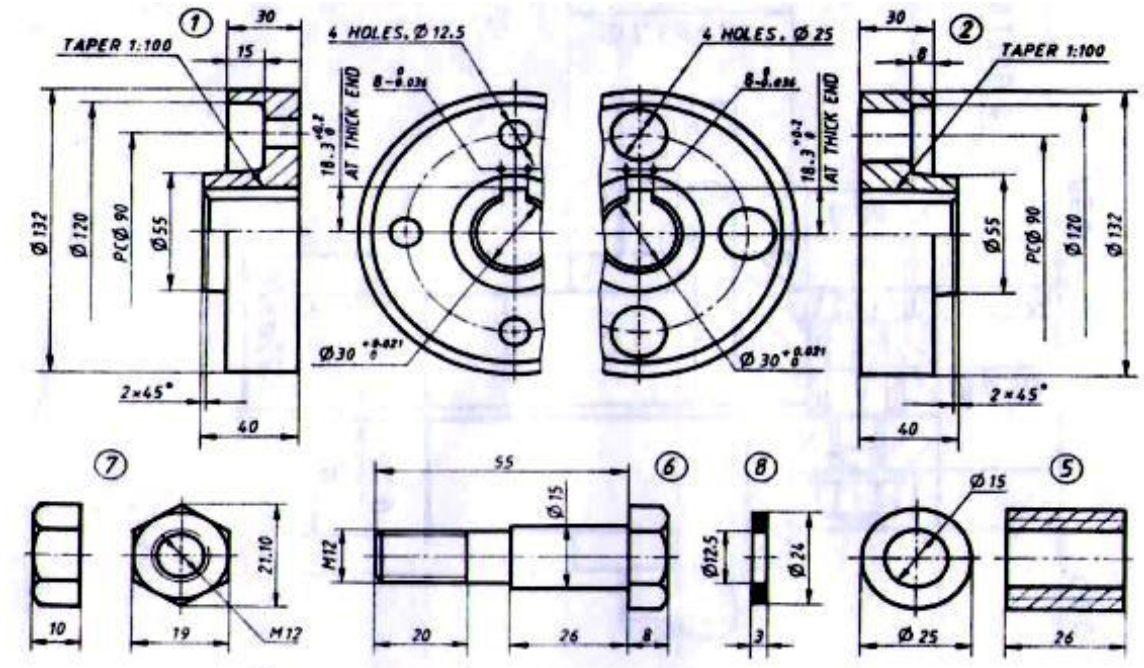
PART NO.	DESCRIPTION	MATERIAL	NO. OFF
6	HEX. NUT	Fe 410 W	4
5	HEX. BOLT	Fe 410 W	4
4	TAPER KEY	Fe 410 W	2
3	SHAFT	Fe 410 W	2
2	FLANGE NO.2	CI	1
1	FLANGE NO.1	CI	1

PART NO.	DESCRIPTION	MATERIAL	NO. OFF
6	HEX. NUT	Fe-410 W	4
5	HEX. BOLT	Fe-410 W	4
4	TAPER KEY	Fe-410 W	2
3	SHAFT	Fe-410 W	2
2	FLANGE NO.2	CI	1
1	FLANGE NO.1	CI	1

2. Pin (bush) type Flexible coupling:

Following drawing shows the Pin (bush) type Flexible coupling with proportions expressed in terms of shaft diameter 'd=25mm'. Draw the sectional front view and sectional profile view with 1:1 scale.



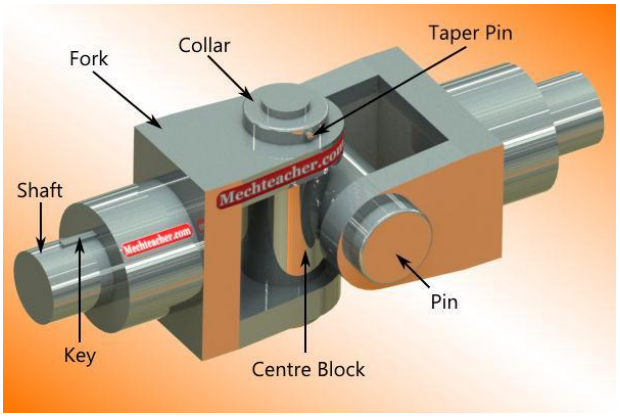


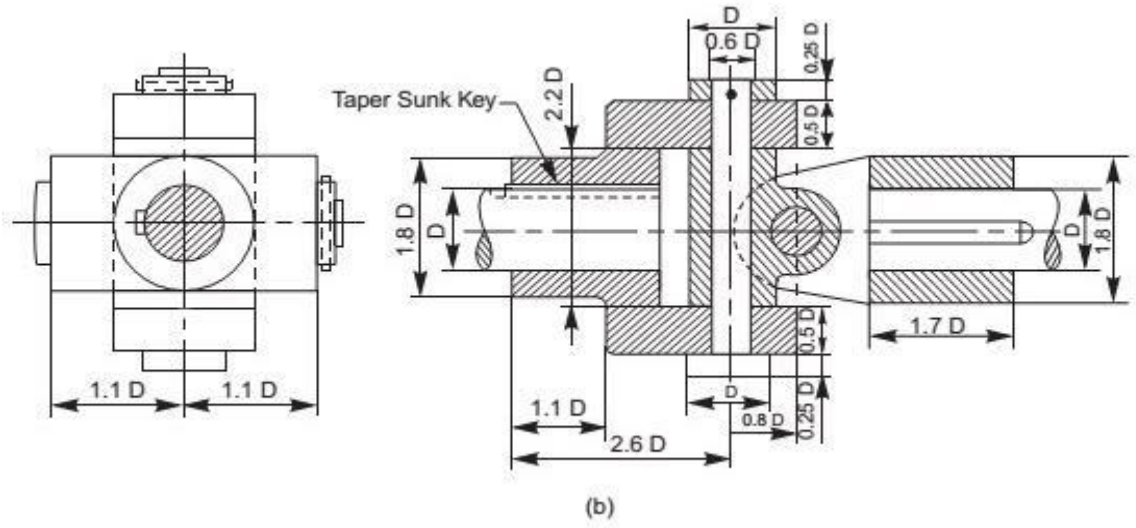
PART NO.	DESCRIPTION	MATERIAL	NO. OFF
8	WASHER	Fe 410 W	4
7	NUT	Fe 410 W	4
6	BOLT	Fe 410 W	4
5	FABRIC BUSH	FABRIC	4
4	KEY	Fe 410 W	2
3	SHAFT	Fe 410 W	2
2	FLANGE NO.2	CI	1
1	FLANGE NO.1	CI	1

All Dimensions in mm
Details of Pin Type Flexible Coupling

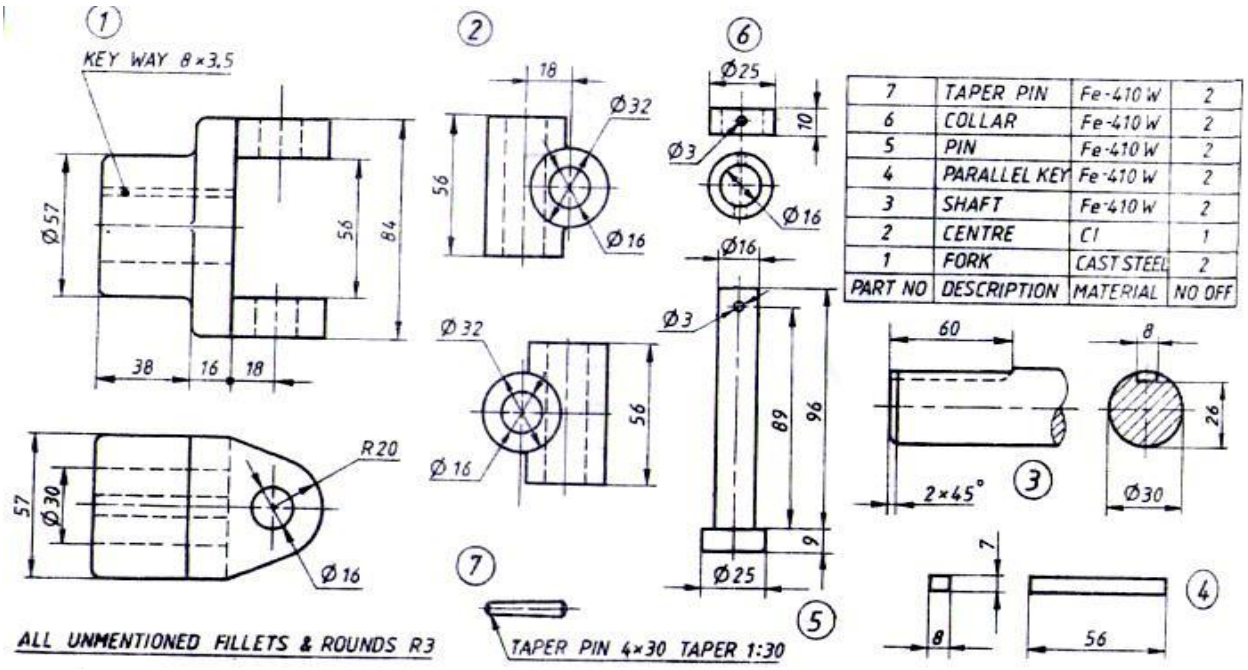
3. Universal coupling:

Following drawing shows the Universal coupling with proportions expressed in terms of shaft diameter 'd=25mm'. Draw the sectional front view and sectional profile view with 1:1 scale.





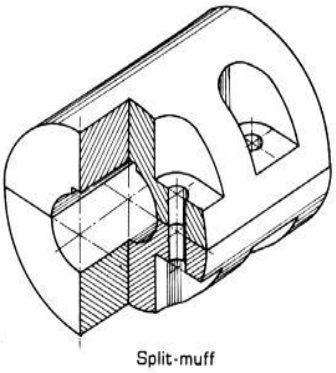
(b)

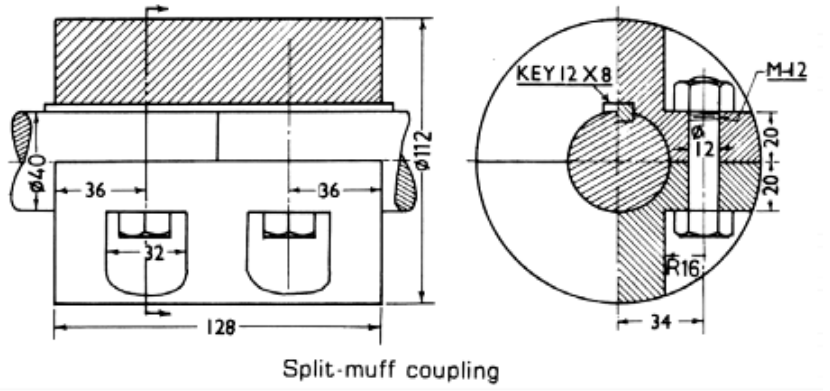


PART NO	DESCRIPTION	MATERIAL	NO OFF
7	TAPER PIN	Fe-410 W	2
6	COLLAR	Fe-410 W	2
5	PIN	Fe-410 W	2
4	PARALLEL KEY	Fe-410 W	2
3	SHAFT	Fe-410 W	2
2	CENTRE	CI	1
1	FORK	CAST STEEL	2

4. Split muff coupling:

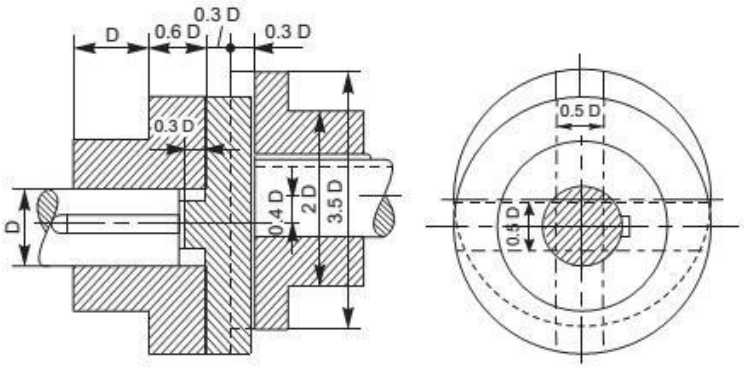
Following drawing shows the split muff coupling with proportions expressed in terms of shaft diameter 'd=25mm'. Draw the sectional front view and sectional profile view with 1:1 scale.

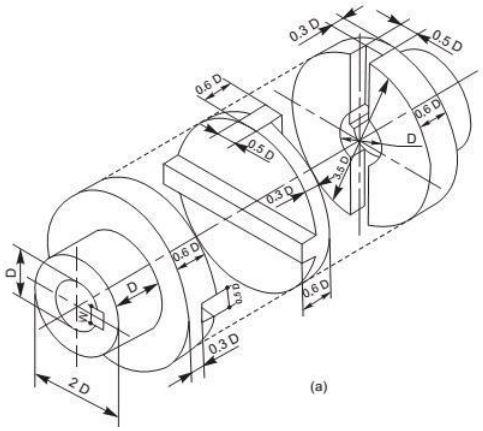


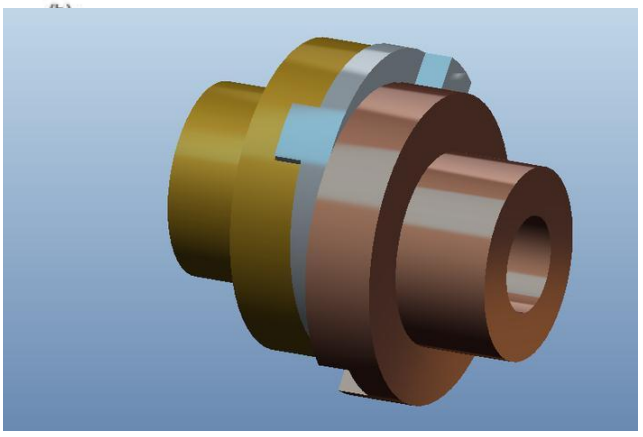


5. Oldham'scoupling:

Following drawing shows the Pin (bush) type Flexible coupling with proportions expressed in terms of shaft diameter'D=25mm'. Draw the sectional front view and sectional profile view with 1:1 scale.



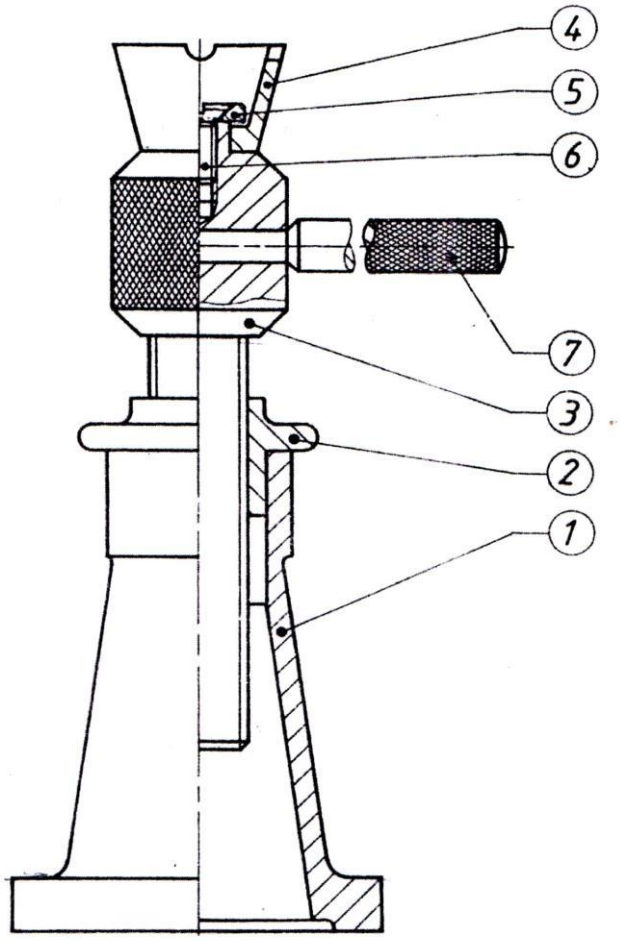


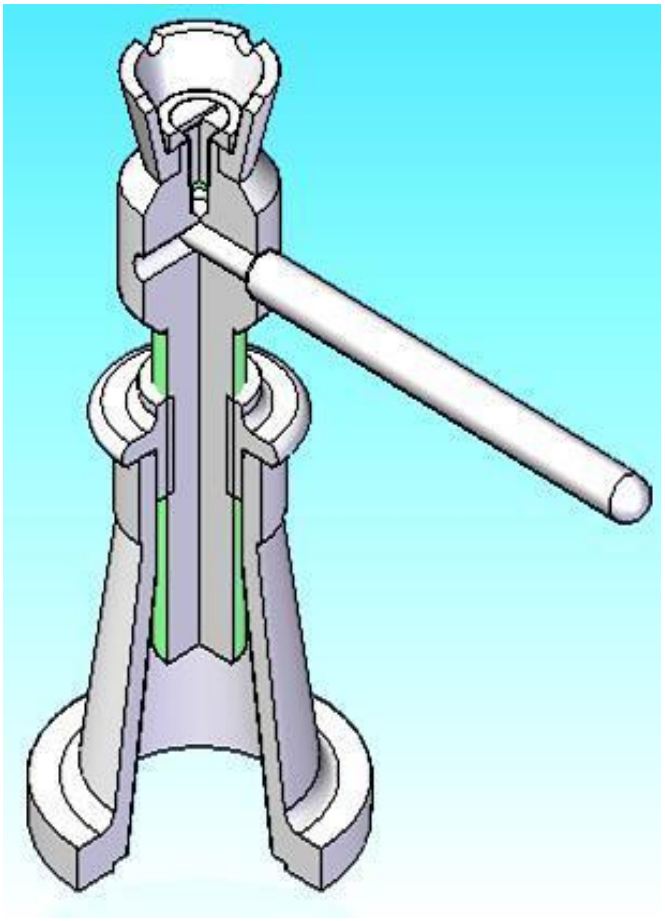


PART C

ASSEMBLY DRAWING

1. SCREW JACK

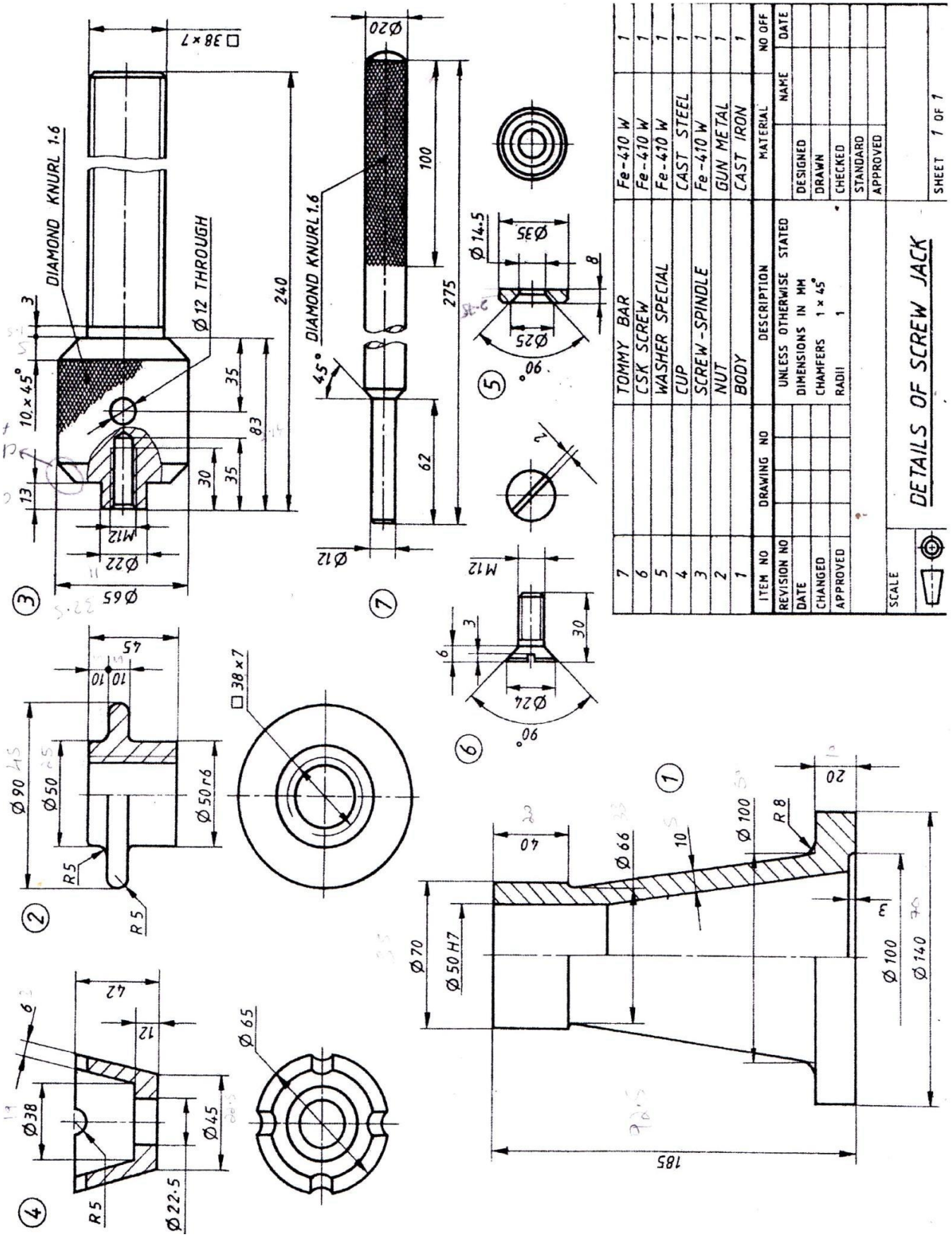




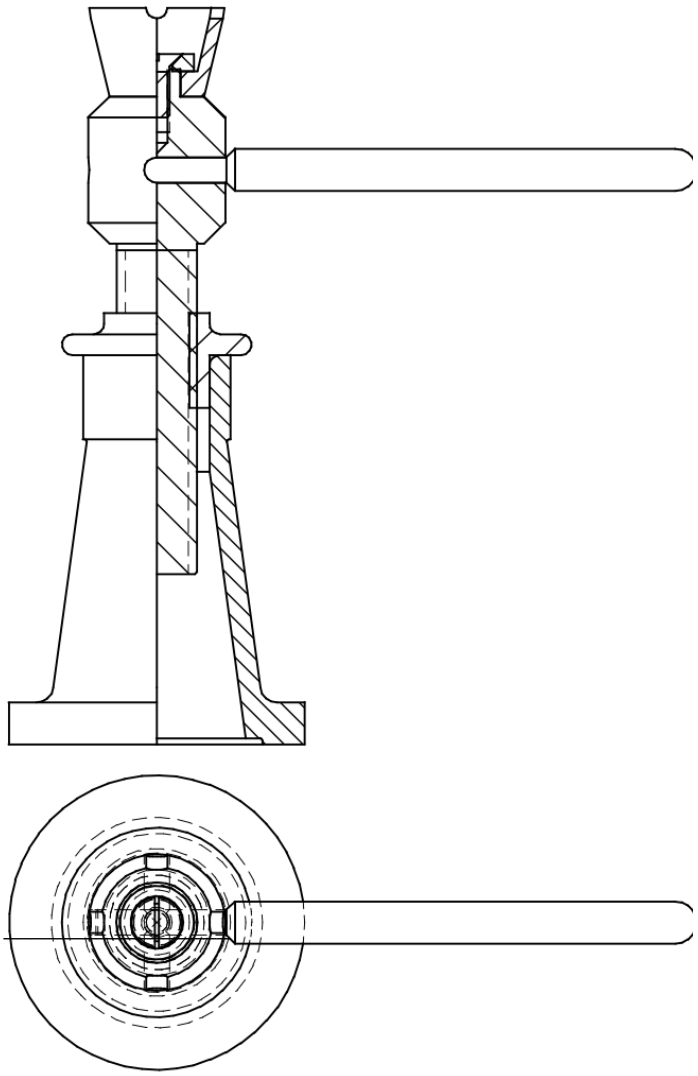
Details of Screw Jack are shown in figure below. Assemble the parts and draw the following views of the assembly :

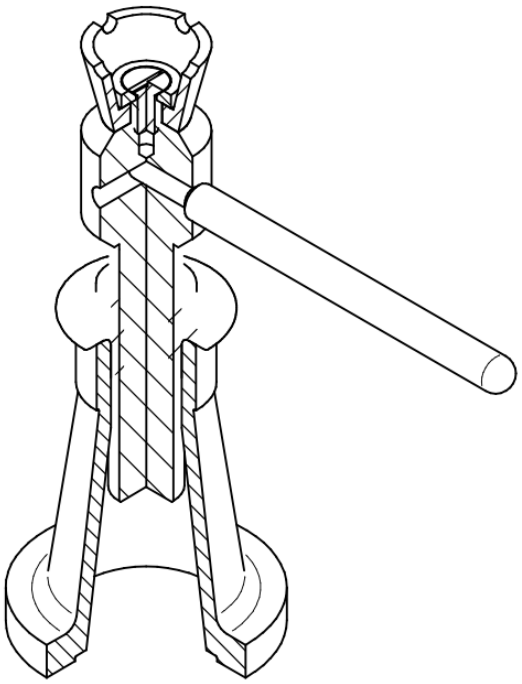
i) Front view showing right half in section ii) Top view

iii) Assembled 3D view iv) Exploded view



Create the following views in separate sheet along with part list.



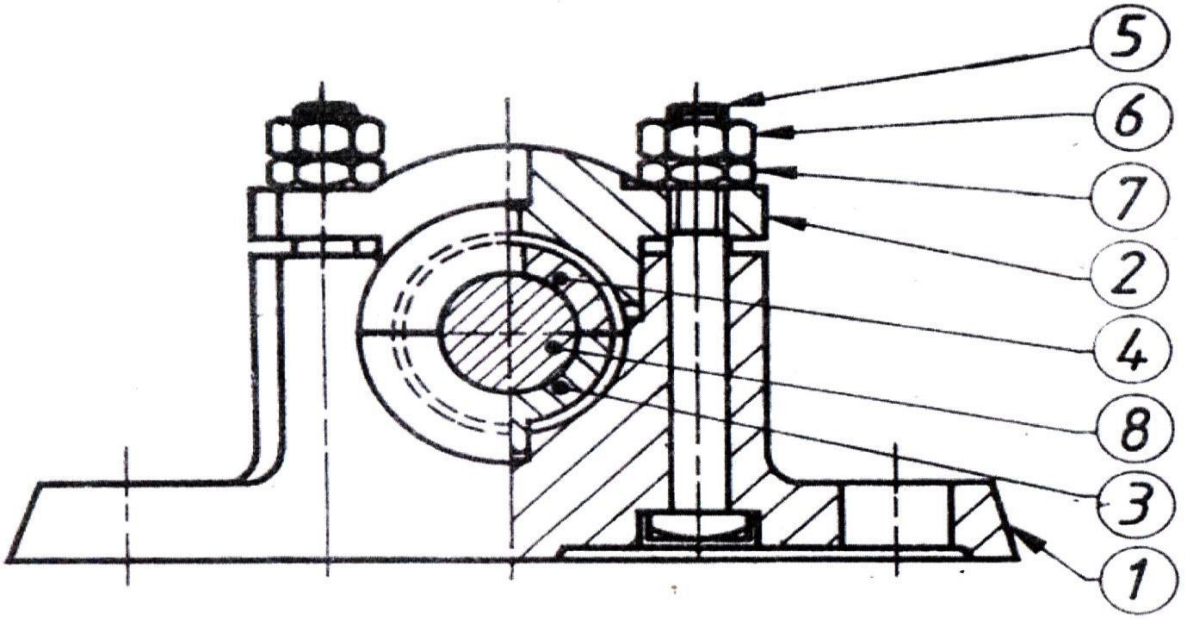


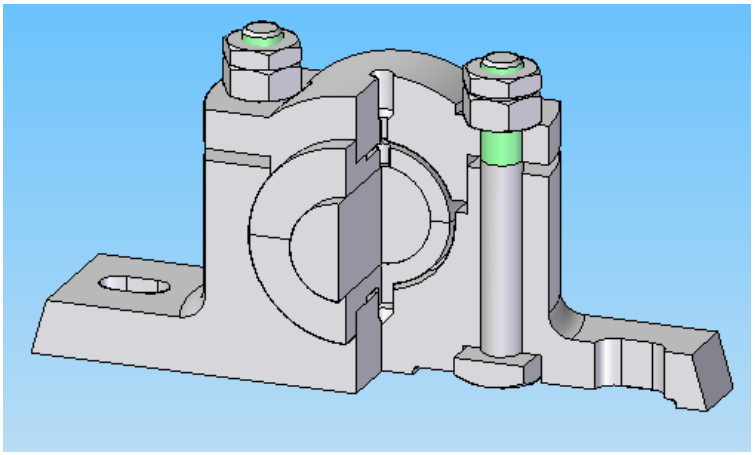
3D ISOMETRIC VIEW

Sectioned Front view And Top view

Item Number	Document Number	Title	Material	Quantity
1"	01	Body	CAST IRON	1
2"	02	Nut	GUN METAL	1
3"	03	Spindle	Fe410W	1
4"	04	Cup	CAST STEEL	1
5"	05	washer special	FE-410W	1
6"	06	CSK Screw	Fe-410W	1
7"	07	TOMMY BAR	Fe-410w	1

2.PLUMMER BLOCK

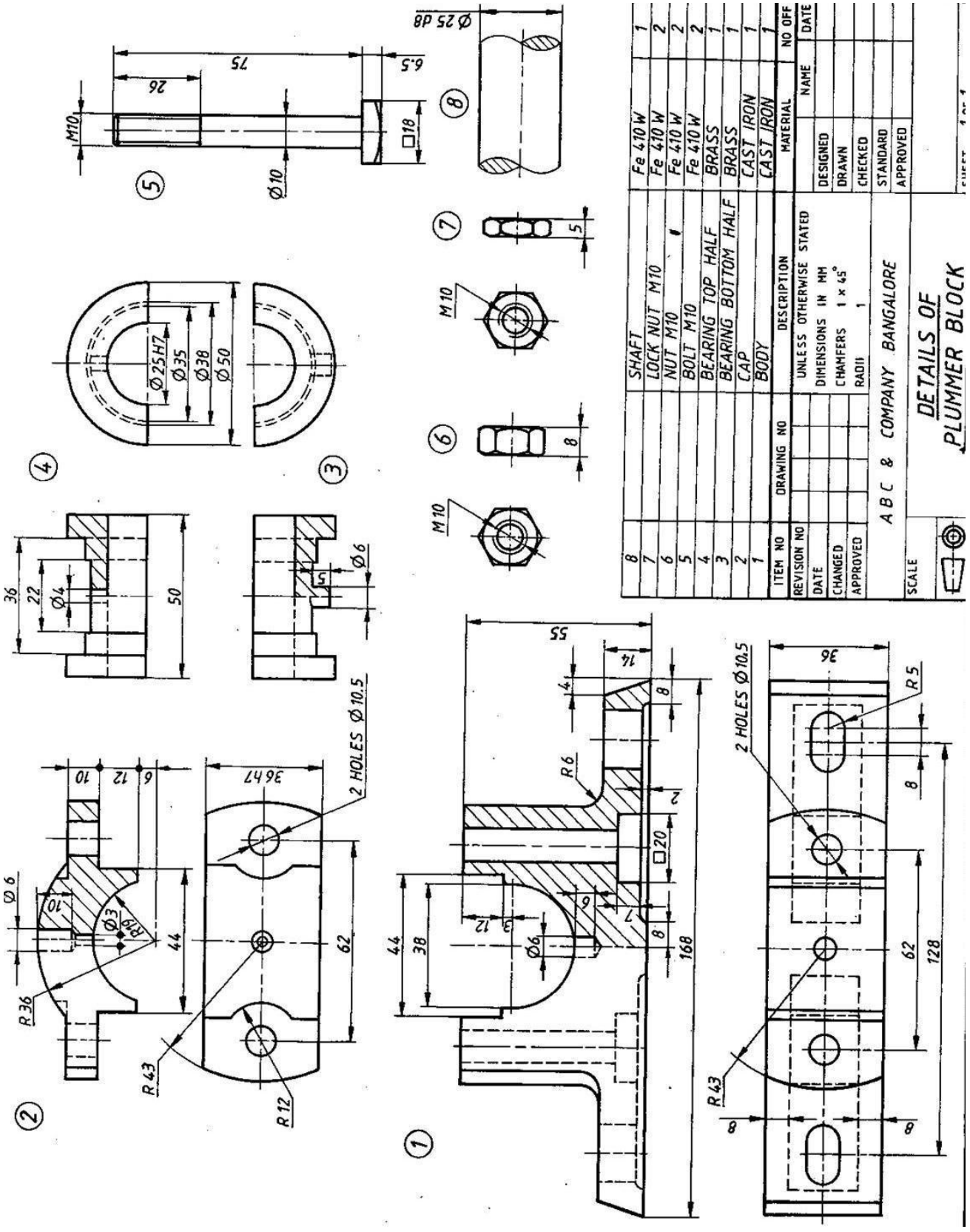




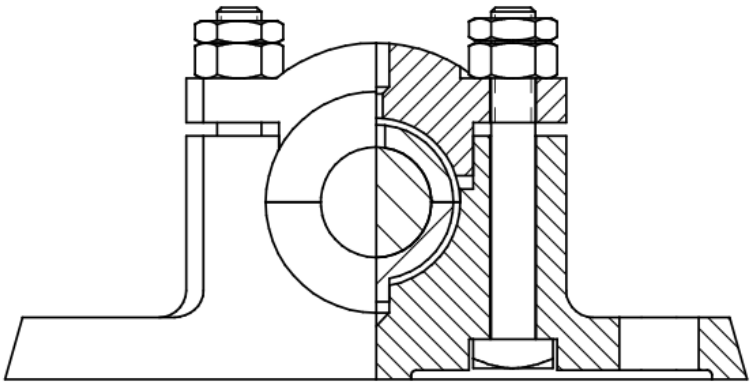
Details of Plummer Block are shown in figure below. Assemble the parts and draw the following views of the assembly :

i) Front view showing right half in section ii) Top view

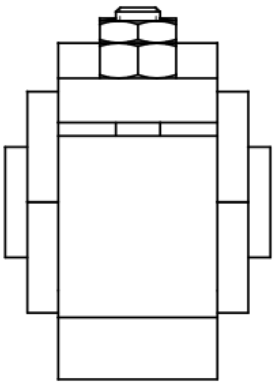
iii) Assembled 3D view iv) Exploded view



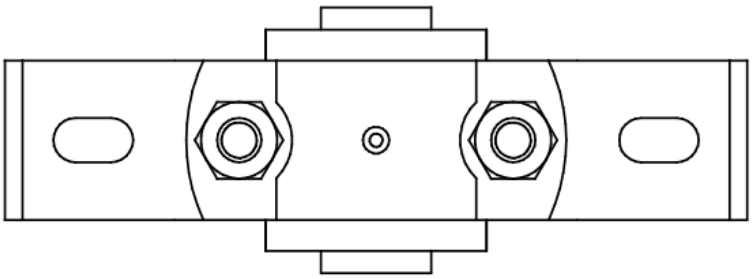
Create the following views in separate sheet along with part list.



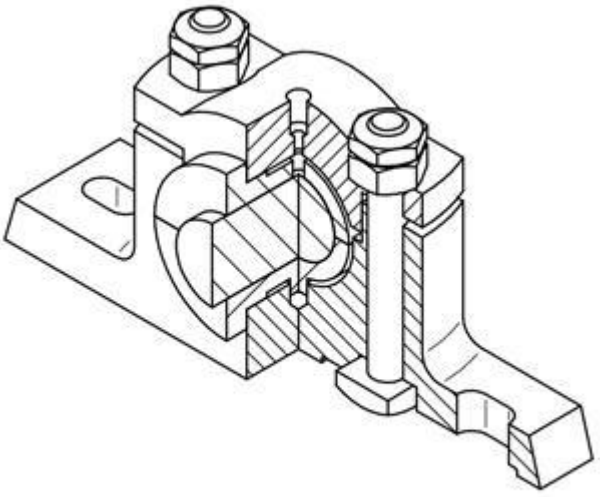
HALF SECTIONAL FRONT VIEW



LEFT SIDE VIEW



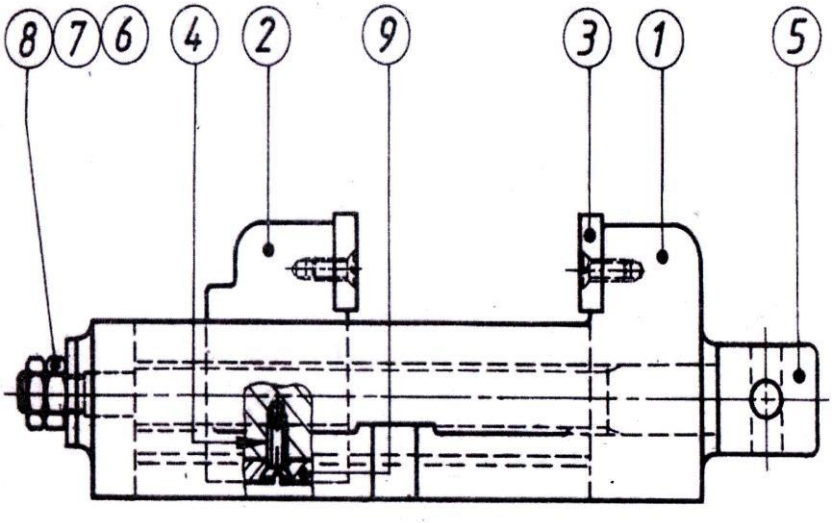
TOP VIEW

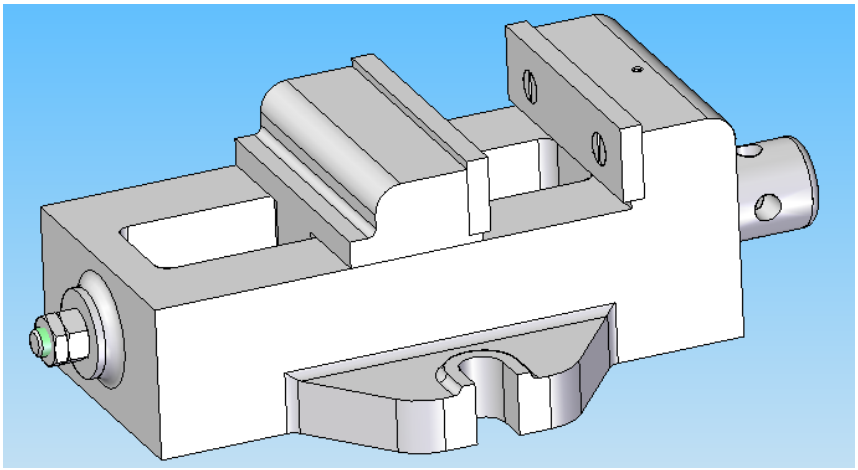


3D ISOMETRIC VIEW

Item Number	Document Number	Title	Material	Quantity
1	01	Body	Cast Iron	1
2	03	Bearing Bottom Half	Brass	1
3	04	Bearing top Half	Brass	1
4	02	Cap	Cast iron	1
5	05	Bolt M10		2
6	06	Nut M10	Fe-410w	2
7	07	Lock Nut M10	Fe-410w	2
8	08	Shaft	Fe-410w	1

3. ASSEMBLY OF MACHICE VICE

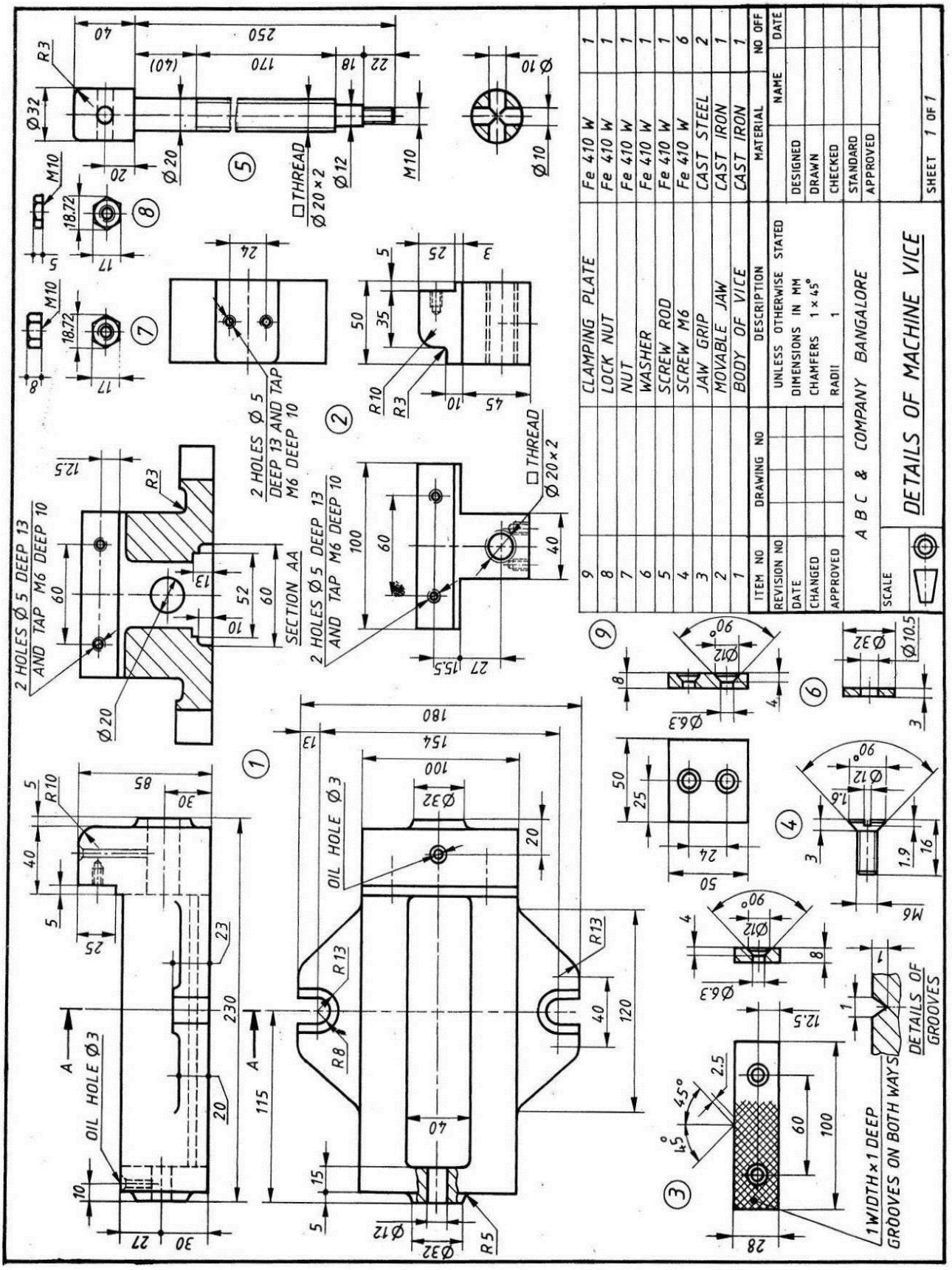




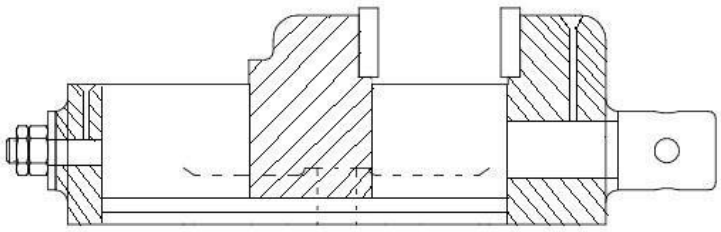
Exercise 2:

The details of a MACHICE VICE are shown in Fig. Draw the following views of the assembled vice to 1:1 scale with the jaws spread to hold the work-piece of maximum size.

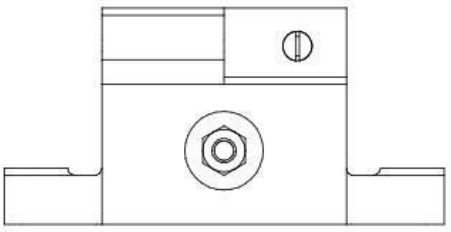
1. Half sectional front view showing fixed jaw in section.
2. Top view.
3. Left view.



Create the following views in separate sheet along with part list.

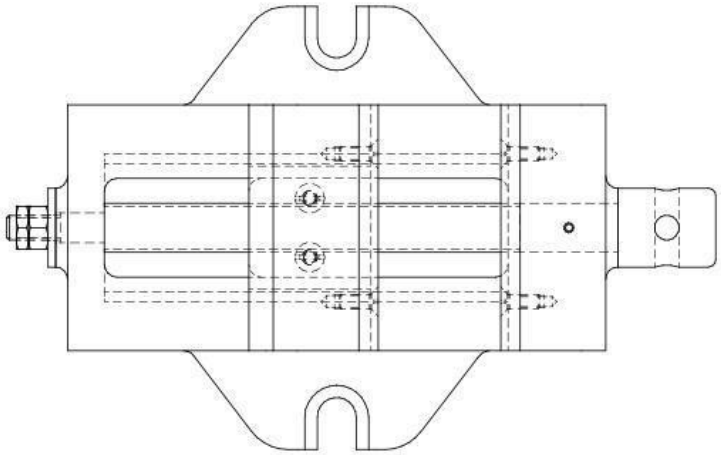


SECTIONAL FRONT VIEW

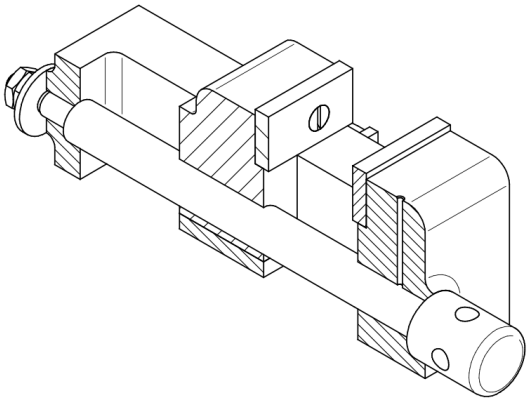


LEFT SIDE VIEW

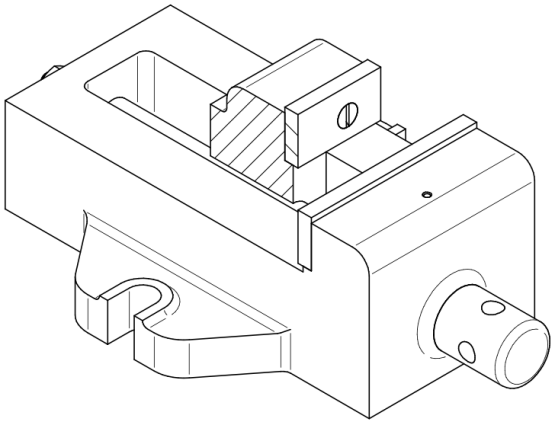
MOVEABLE JAW IN SECTION



TOP VIEW



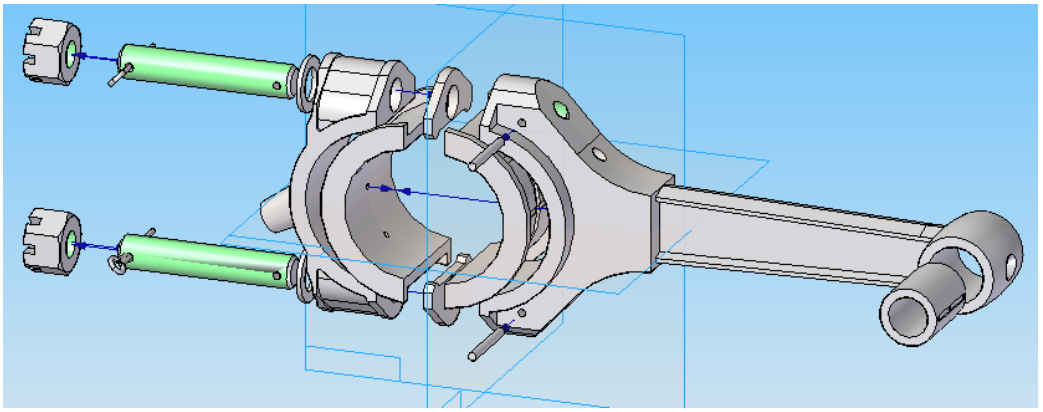
Isometric View In Full Section



3D Isometric View with movable jaw in section

Item Number	Document Number	Title	Material	Quantity
1"	01	Body of Vice	CAST IRON	1
2"	02	Movable Jaw	Cast Iron	1
3"	03	Jaw Grip	cast steel	2
4"	06	Screw Rod	Fe-410W	1
5"	07	Nut	Fe-410w	1
6"	06	Washer	Fe-410W	1
7"	08	Lock Nut	Fe-410w	1
8"	09	Clamping Plate	Fe-410W	1
9"	04	Screw M 6	Fe-410W	6

4. ASSEMBLY OF PETROL ENGINE CONNECTING ROD



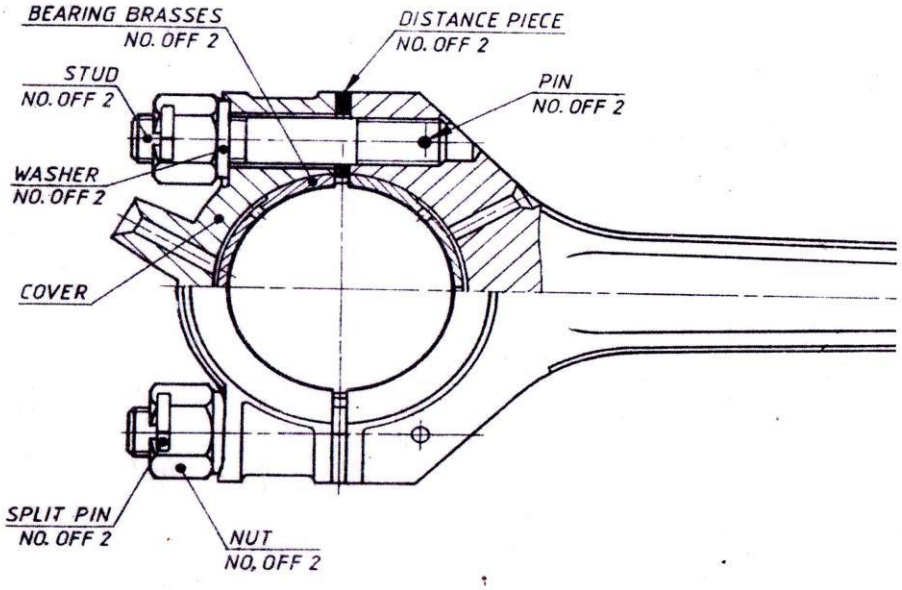
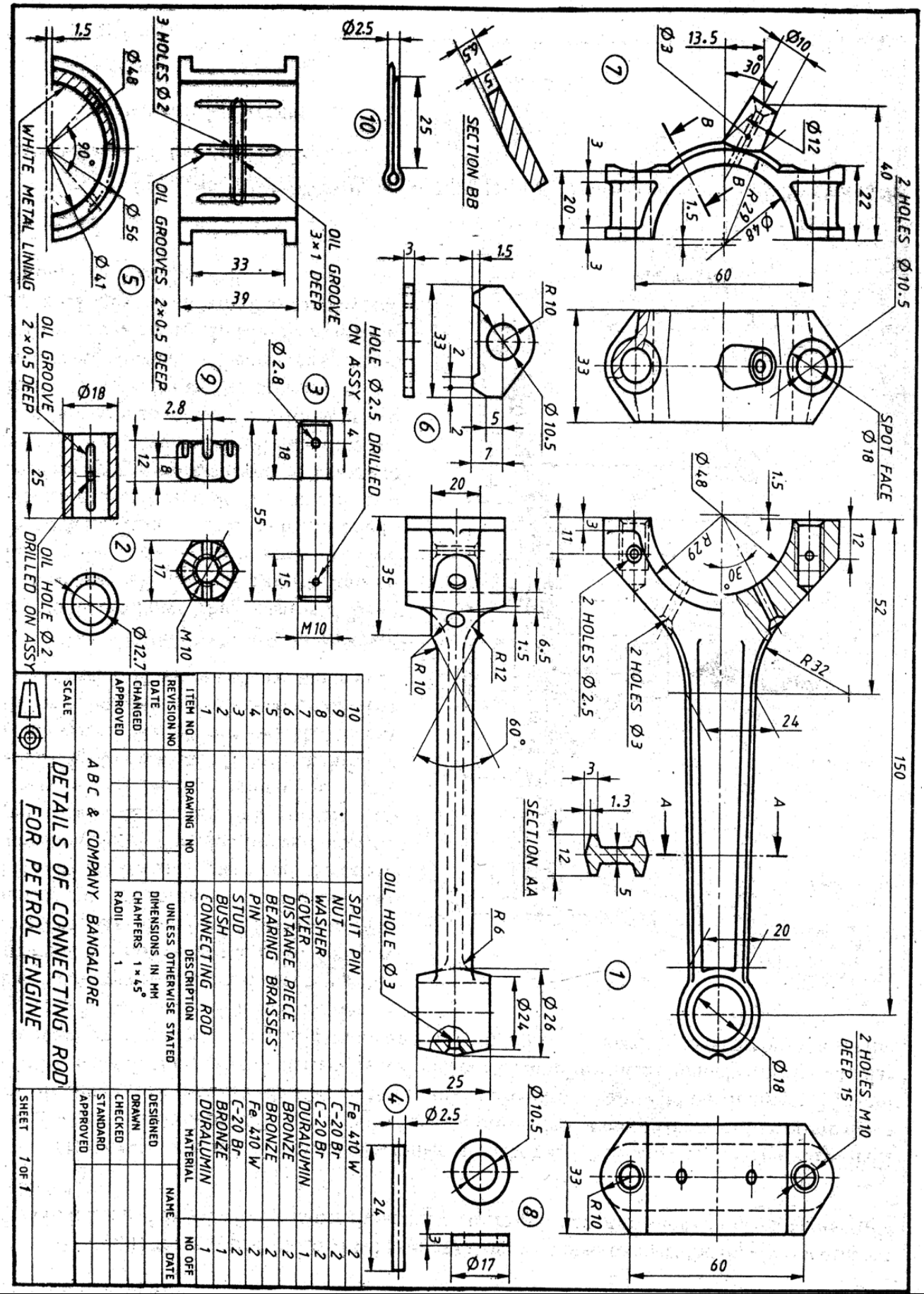
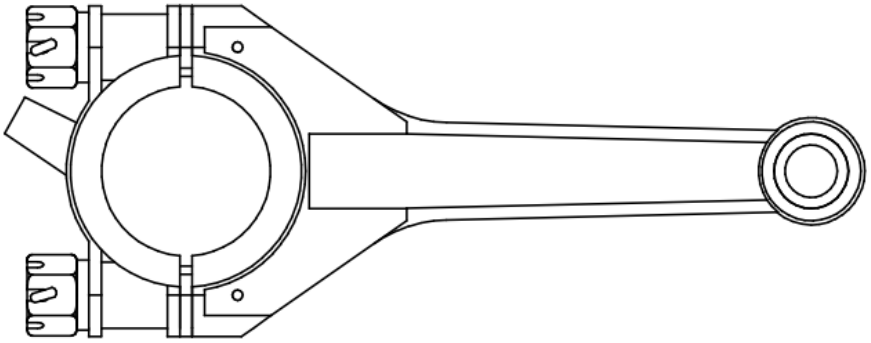


Fig. shows the details of a PETROL ENGINE CONNECTING ROD. Draw the following assembled views of the connecting rod with its axis horizontal to 2:1 scale.

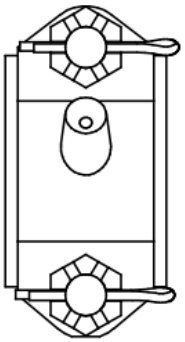
1. Front view with top half in section.
2. Top view with front half in section.
3. Side view with bottom half in section looking from the big end.



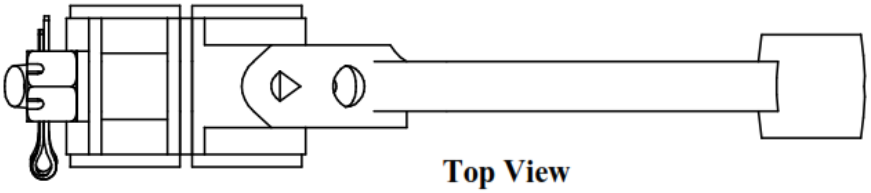
Create the following views in separate sheet along with part list.



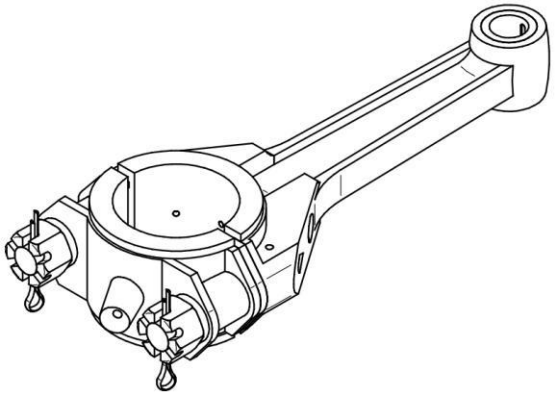
Front View



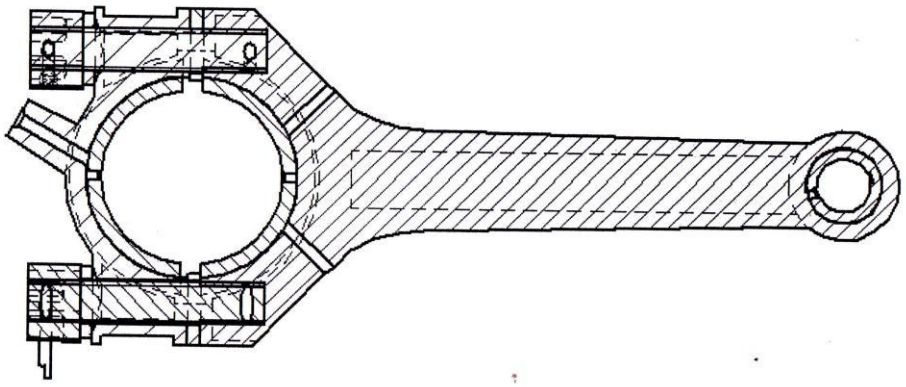
Left side View

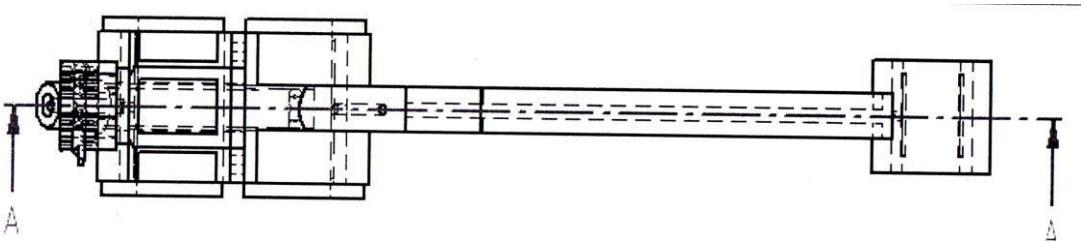


Top View



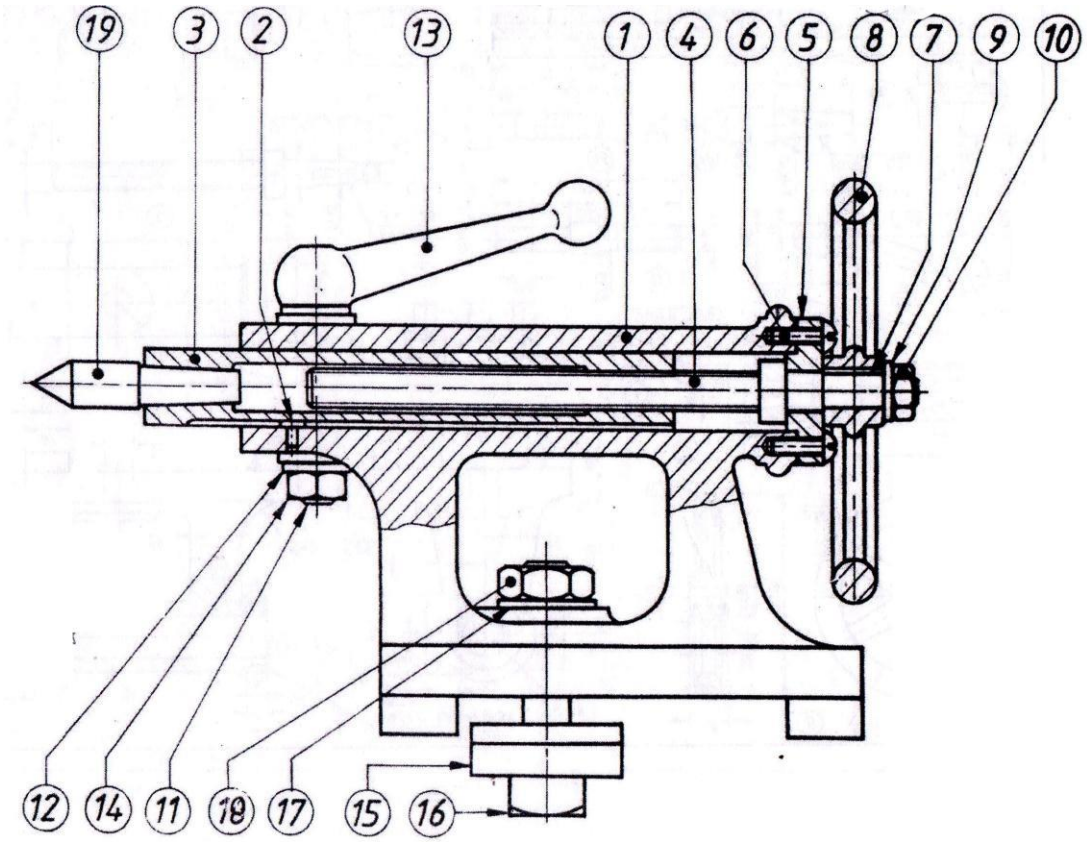
ISOMETRIC VIEW





Half sectioned front and top view

5. ASSEMBLY OF TAIL STOCK OF A LATHE



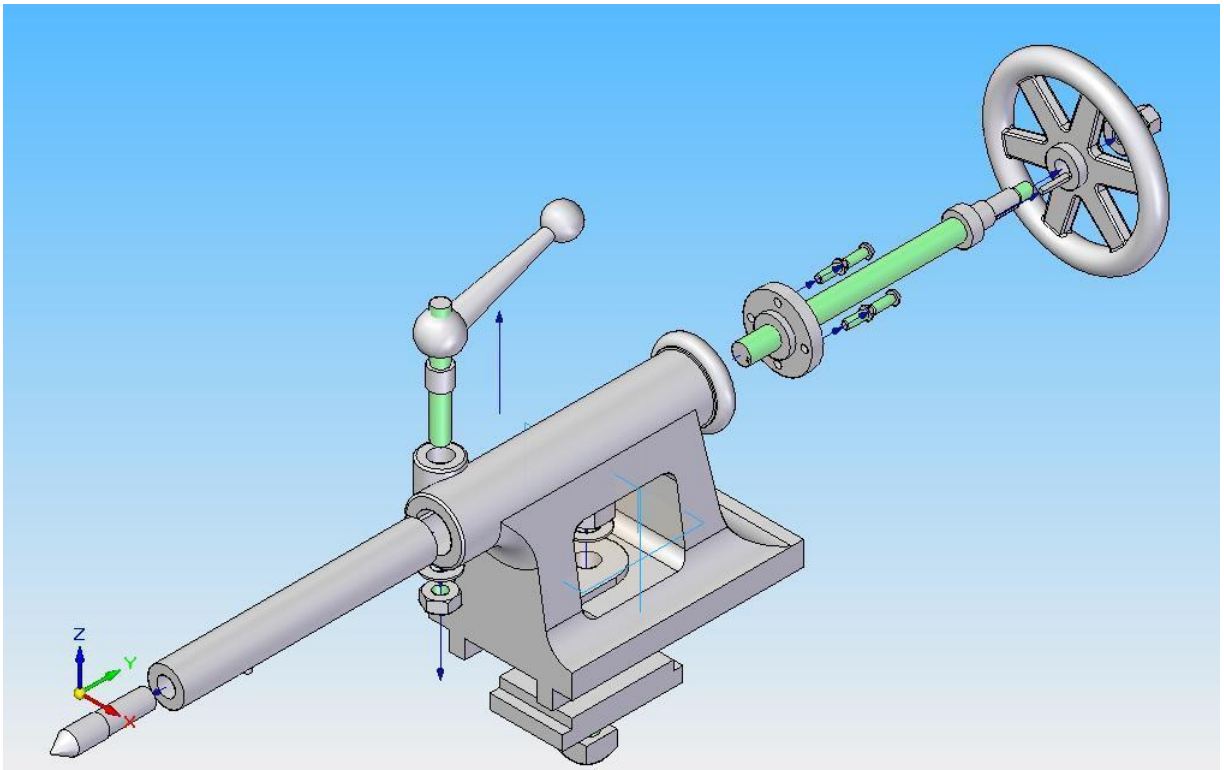
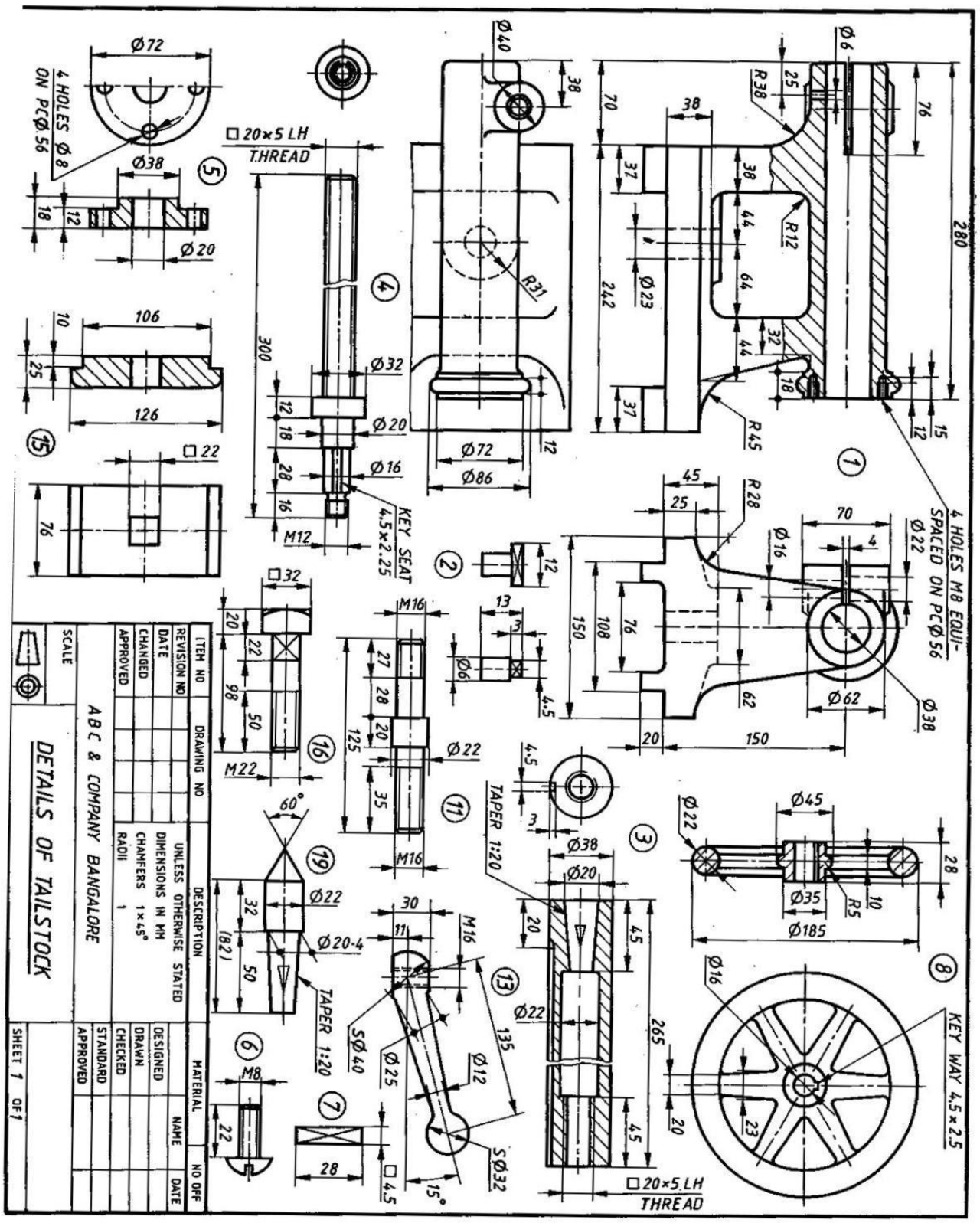


Figure shows the details of a tail stock of a lathe. Assemble the parts and draw

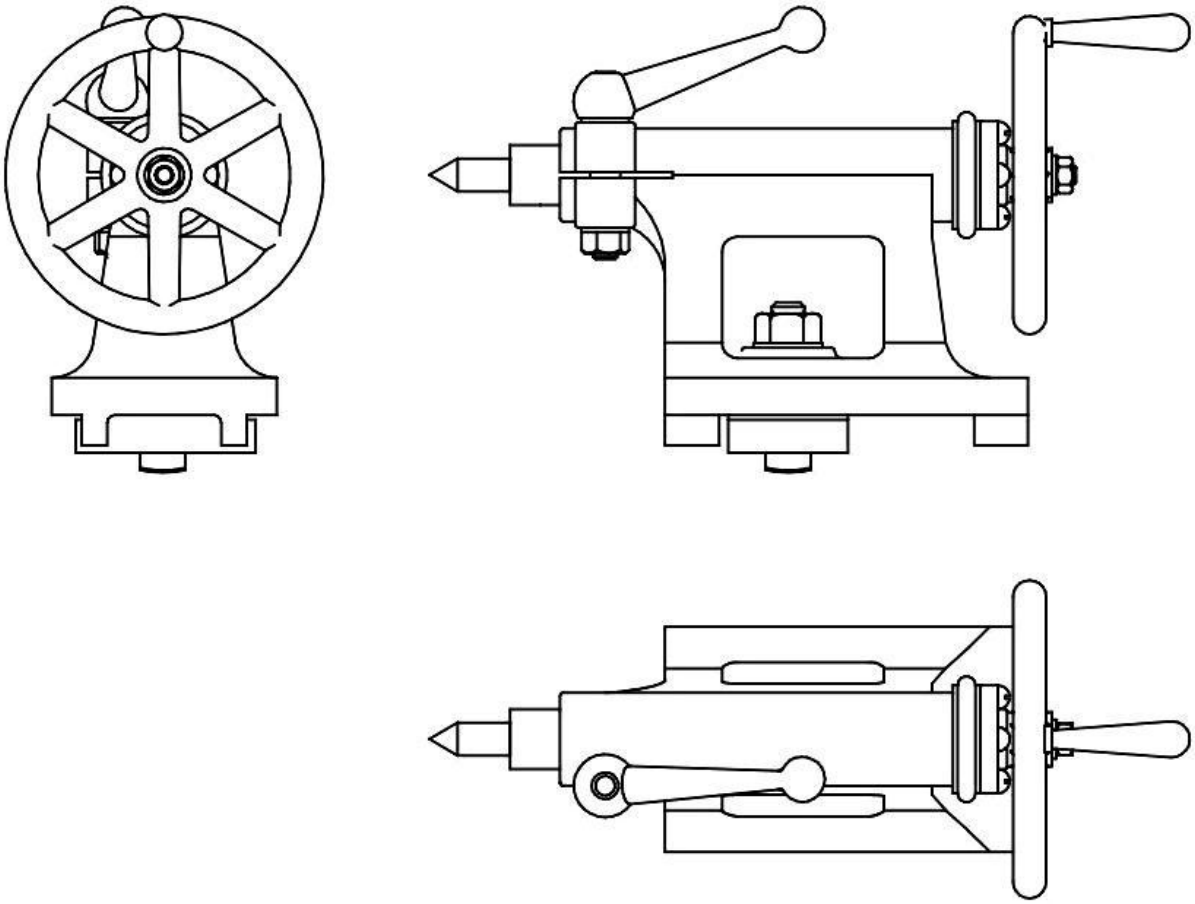
i) Front view

ii) Top view

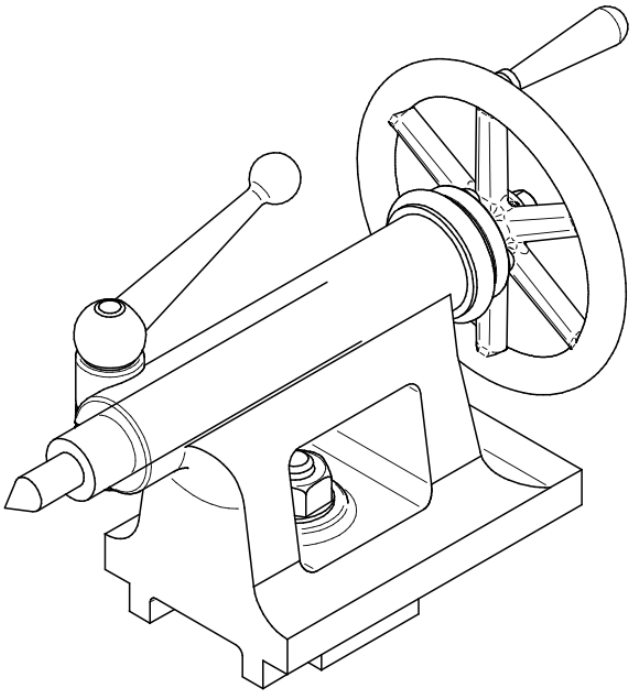
iii) Side view looking from hand wheel.



Create the following views in separate sheet along with part list.



Top , Front and Side views



Isometric view