DRAUGHTSMAN CIVIL

NSQF (LEVEL - 5)

2nd Year (Volume I of II)

TRADE PRACTICAL

SECTOR: Construction

Directorate General of Training

DIRECTORATE GENERAL OF TRAINING
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENT OF INDIA

Sector : Construction

Duration : 2 - Year

Trade : Draughtsman Civil 2nd Year, (Volume I of II) - Trade Practical - NSQF LEVEL 5

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Rs. 230/-

FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Mentor Councils comprising various stakeholder's viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Draughtsman Civil 2ⁿᵈ Year, (Volume I of II) Trade Practical NSQF Level - 5 in Construction Sector under Semester Pattern.** The NSQF Level - 5 Trade Prcatical will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 5 trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 5 the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

RAJESH AGGARWAL
Director General/ Addl. Secretary
Ministry of Skill Development & Entrepreneurship,
Government of India.

New Delhi - 110 001

PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of the Federal Republic of Germany. The prime objective of this institute is to develop and provide instructional materials for various trades as per the prescribed syllabi (NSQF LEVEL - 5) under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and transparencies are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

R. P. DHINGRA
Chennai - 600 032   **EXECUTIVE DIRECTOR**

ACKNOWLEDGEMENT

INTRODUCTION

Trade Practical

The trade practical manual is intended to be used in practical workshop /Hall. It consists of a series of practical exercises to be completed by the trainees during the third semester course of **Draughtsman Civil** under **NSQF Level - 5** Syllabus, which is supplemented and supported by instructions / informatics to assist in performing the exercises. These exercises are designed to ensure that all the skills in prescribed syllabus are covered.

    Module 1 - Building Drawing

    Module 2 - Computer Practice

    Module 3 - 3D Modeling in CAD

    Module 4 - Building Drawing (Public)

    Module 5 - Reinforced Cement Concrete Structure

    Module 6 - Steel Structures

    Module 7 - Public Health and Sanitation

The skill training in the shop floor is planned through a series of practical exercise centered around some practical object. However, there are few instances where the individual exercise does not from a part of project.

Contents of Trade Theory

The manual of trade theory consists of theoretical information for the third semester course of the Draughtsman Civil under NSQF - Level 5. The contents are sequenced according to the practical exercise contained in the manual on trade practical. Attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This correlation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

The trade theory has to be taught and learnt along with the corresponding exercise contained in the manual of the trade practical. The indications about the corresponding practical exercises are given sheet of this manual.

It will be preferable to teach/learn trade theory connected to each exercise at least one class before performing the related skill in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

The material is not the purpose of self-learning and should be considered as supplementary to class room instruction.

CONTENTS

LEARNING/ ASSESSABLE OUTCOME

On completion of this book you shall be able to

- **Draw single storied building site plan layout.**
- **Create objects on CAD workspace using Toolbars, Commands, Menus, formatting layer and style.**
- **Draw a sanction plan of double storied flat root residential building by using CAD.**
- **Create objects 3D modeling concept in CAD.**
- **Prepare a drawing of public building detailing with roofand columns by frame structures using CAD.**
- **Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule.**
- **Draw the details of a framed structure and portal frame of a residential building using CAD.**
- **Draw the different types of steel sections, rivets and bolts using CAD.**
- **Draw the details of girders, roof trusses and steel stanchions using CAD.**
- **Prepare the detailed drawing showing the different types of sanitary fittings, arrangements of manholes, details of septic tank using CAD.**
- **Draw the details flow diagram of water treatment plant (WTP) and swerage treatment plant (STP).**

SYLLABUS FOR DRAUGHTSMAN CIVIL

2nd Year, (Volume I of II)

Duration: Six Month

Week No.	Ref. Learning Outcome	Professional Knowledge (Trade Theory) with Indicative hours	Professional Skills (Trade Practical) Building:-
53-54	Draw single storied Building site plan layout.	Drawing details of:- 91. Single storied residential house with attached bath of both pitched and flat roof. (12 hrs) 92. Making plan, elevation, and section with aid of line diagrams of the building. (26 hrs) 93. Layout and detailing of residential building. (06 hrs) 94. Create a drawing of building showing set backs. (06 hrs) 95. Showing layout plan and key plan. (06 hrs)	• Principle of planning • Objectives & importance. • Function& responsibility. • Orientation. • Local building Bye-Laws as per ISI code. • Lay out plan & key plan. • Submitted in composition of drawing. • Provisions for safety. • Requirement of green belt and land.
55-56	Create objects on CAD workspace using Toolbars, Commands, Menus, formatting layer and style.	Computer practice:- 96. Function of keys and practice of basic commands. (06 hrs) 97. Use of elementary commands by CAD toolbar. (06 hrs) 98. Creation of objects in different layers on CAD workspace. (10 hrs) 99. Plotting of drawing from CAD. (02 hr) 100. 2D drafting of flash door, panel door, window, hand railing, wash basin, sewerage pipe joints, etc. (20 hrs) 101. Preparing Library folder by creating blocks of the above items. (12 hrs)	Computer aided drafting:- • Operating system ,Hardware & software. • Introduction of CAD. • Its Graphical User Interface. • Method of Installation. • Basic commands of CAD. • Knowledge of Tool icons and set of Toolbars. • Knowledge of shortcut keyboard commands.
57-58	Draw a sanction plan of double storied flat roof residential building by using CAD.	Building Drawing (Residential) Prepare:- 102. Plan, section and elevation of buildings with specifications for the given line drawing to suitable Scale. (32 hrs) 103. A Reading room with R.C.C flat roof. (06 hrs) 104. A House single storeyed residential building with	Building Planning:- • Economy & orientation. • Provision for lighting and ventilation. • Provision for drainage and sanitation. • Types of building. • Planning & designing of residential , public and commercial building.

59-60	Draw a sanction plan of double storied flat roof residential building by using CAD.	105. A residential building with double beded rooms with R.C.C. flat roof slab. (10 hrs.) 106. House with single bed and hall with partly tiled and partly R.C.C. flat roof slab. (12 hrs.) 107. Two roomed house with RCC slope roof with gable ends. (12 hrs.) 108. A House with fully tiled roof with hips and valleys. (10 hrs.) 109. Design and create a double storied residential building (3BHK) with Positioning layout of Furniture, Electrical appliances and plumbing / sanitary fittings. (12 hrs.)	Prefabricated Structure:- • Preparation. • Method of construction, assembling. • Advantages & disadvantages.
61	Create objects on 3D modeling concept in CAD.	3D modeling in CAD :- (28 hrs) 110. Create and use model space viewports. 111. Create a standard engineering layout. 112. Create and edit wireframe model. 113. Create and edit solid mesh and surface modeling. 114. Create and edit simple 2D regions and 3D solid models. 115. Generate 3D text and dimensions using a variety of 3D display techniques. 116. Render a 3D model with a variety of lights and materials.	3D modeling concept in CAD • 3D coordinate systems to aid in the construction of 3D objects • Knowledge of shortcut keyboard commands.
62-63	Prepare a drawing of public building detailing with roof, column by framed structure using CAD	Building Drawing (Public) Prepare:- 117. A Primary health center for rural area with R.C.C roof. (10 hrs.) 118. A Village Library building with R.C.C flat roof. (06 hrs.) 119. A small Restaurant building with R.C.C flat roof. (06 hrs.) 120. A Single storeyed School building with R.C.C flat roof. (10 hrs.) 121. A Small workshop with north light steel roof truss (6 to 10m Span) over R.C.C. Columns. (12 hrs.) 122. Service plans. (06 hrs) 123. A Bank building with R.C.C flat roof. (06 hrs)	• Parks & play ground- Types of recreation, landscaping. etc • Concepts of design of earthquake resisting buildings- requirements resistance , safety, flexible building elements, special requirements, base isolation techniques.

64-65	Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule.	Drawing details of RCC members with reinforcement:- 124. Rectangular beams(Single reinforced & Double reinforced). (17 hrs) 125. Lintel, chajjas & slabs. (12 hrs) 126. Stair - details of step. (17 hrs)	Reinforced cement concrete structure:- • Introduction to RCC uses. • Materials - proportions • Form work • Bar bending details as per IS Code. • Reinforced brick work.
66-68	Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule.	Draw Reinforced details of RCC members:- 127. Preparing bar-bending schedule. (12 hrs) 128. Details of one-way slab & two-way slab. (20 hrs) 129. T-beam, Inverted beam, cantilever, retaining wall, Lift well. (16 hrs) 130. Column with footing. (12 hrs) 131. Continuous columns showing disposition of reinforcement. (12 hrs) 132. RCC framed structure, portal frame, B.I.S. Code 456-2000, SP - 34 and its application. (12 hrs)	Materials used for RCC:- • Construction. • Selection of materials - coarse aggregate, fine aggregate, cement water and reinforcement. • Characteristics. • Method of mixing concrete - machine mixing and hand mixing. • Slump test. • Structure - columns, beams, slabs - one-way slab & twoway slab. • Innovative construction. • Safety against earthquake. • Grade of cement, steelbehaviour and test. • Bar-bending schedule. • Retaining wall. • R.C.C. Framed structure.
69-70	Draw the different types of steel sections, rivets and bolts using CAD. Draw the details of girders, roof trusses and steel stanchions using CAD	Drawing of different types of:- 133. Steel sections, rivet,bolts,etc. (16 hrs) 134. Section and elevation of girders. (12 hrs) 135. Structural Joints. (12 hrs) 136. Plate girders roof trusses, stanchion etc. (16 hrs)	Steel structures:- • Conmen forms of steel sections. • Structural fasteners , Joints. • Tension & compression member. • Classification, fabrication. • Construction details.
71-73	Prepare the detailed drawing showing the different types of sanitary fittings, arrangements of manholes, details of septic tank using CAD. Draw the details of rapid sand filter.	Public Health & Sanitation. 137. Drawings of showing various pipe joints for underground drainage. (12 hrs) 138. Types of sanitary fittings in multi-storeyed building. (12 hrs) 139. Manholes and septic tank. (16 hrs) 140. Water supply system. (10 hrs) 141. R.C.C square overhead tank	House drainage of building:- • Introduction. • Terms used in PHE. • Systems of sanitation. • System of house drainage. • plumbing, sanitary fittings, etc. • Types of sewer appurtenance. • Systems of plumbing. • Manholes & Septic tank. • Water treatment plant • Swerage treatment plant

	supported by four columns. (12 hrs) 142. Preparation of service plan (drainage plan) for isolated building & in sewer system. (10 hrs) 143. Drawings of toilet fixtures. (06 hrs) 144. Flow diagram of water treatment plant (WTP) and Swerage Treatment plant (STP). (06 hrs)	
74-75	Project work / on the job training Broad area :- (a) Draw residential building plan of single/ double storied building using CAD for Municipal/ approval (b) Prepare drawing of public building detailing with roof, structure etc. using CAD. (c) Prepare drawing of Bath/ Kitchen/ Reception Hall in details using Auto CAD 3D modeling with rendering.	
76-77	Revision	
78	Examination	

Note: -

1. Some of the sample project works (indicative only) are given against each semester.
2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
3. The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill.
4. If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce part/ sub-drawings in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.
5. Drawings at weeks 1 to 54 are in traditional and from 55 to 99 weeks are in computer drafting.

Single storied residential building with atteched bath (flat roof)

Objectives: At the end of this exercise you shall be able to
• **identify the thickness of wall**
• **draw the plan of building**
• **draw the section of the building**
• **draw the elevation of residence.**

PROCEDURE

TASK 1 : **Draw the plan of the building, section on AA and front elevetion of the residence (Fig 1)**

• Select a scale of 1:50

• Layout the drawing sheet for plan, section and Elevation.

• Prepare the plan starting from the corner of Living room.

• Draw wall thickness as per the scale.

• Create the rooms as per the Figure.

• Erase the unnecessary construction lines.

• Mark the position of door, windows etc.

• Furnish the dimensions and notes where ever needed.

• Complete the plan.

— — — — — — — —

TASK 2 : **Draw the section (Fig 2)**

• Draw a horizontal lines shows the ground level

• Identify the position of cutting plane

• Create projection lines for walls. as per the room size.

• Draw the basement line, roof line, parapet- line etc.

• Furnish the foundation details as shown.

• Hatch the section as per the materials used.

• Furnish the dimensions.

• Complete the section.

— — — — — — — —

TASK 3 : **Draw the elevation (Fig 2)**

• Draw projection lines from plan and section.

• Remove the unwanted projection lines and develop the elevation.

• Furnish the door, window, sunshade details etc.

• Finish the required elevation by outlines.

• Complete the working drawing with specification schedule of joinery and other details

— — — — — — — —

1

Fig 1

A

W

V

KITCHEN
240X270

TOILET
150X180

D

W
A
S
H

D

D

D

BED
300X270

DINING
270X360

W

W

W

W

W

D

D

LIVING
300X300

D

W

A
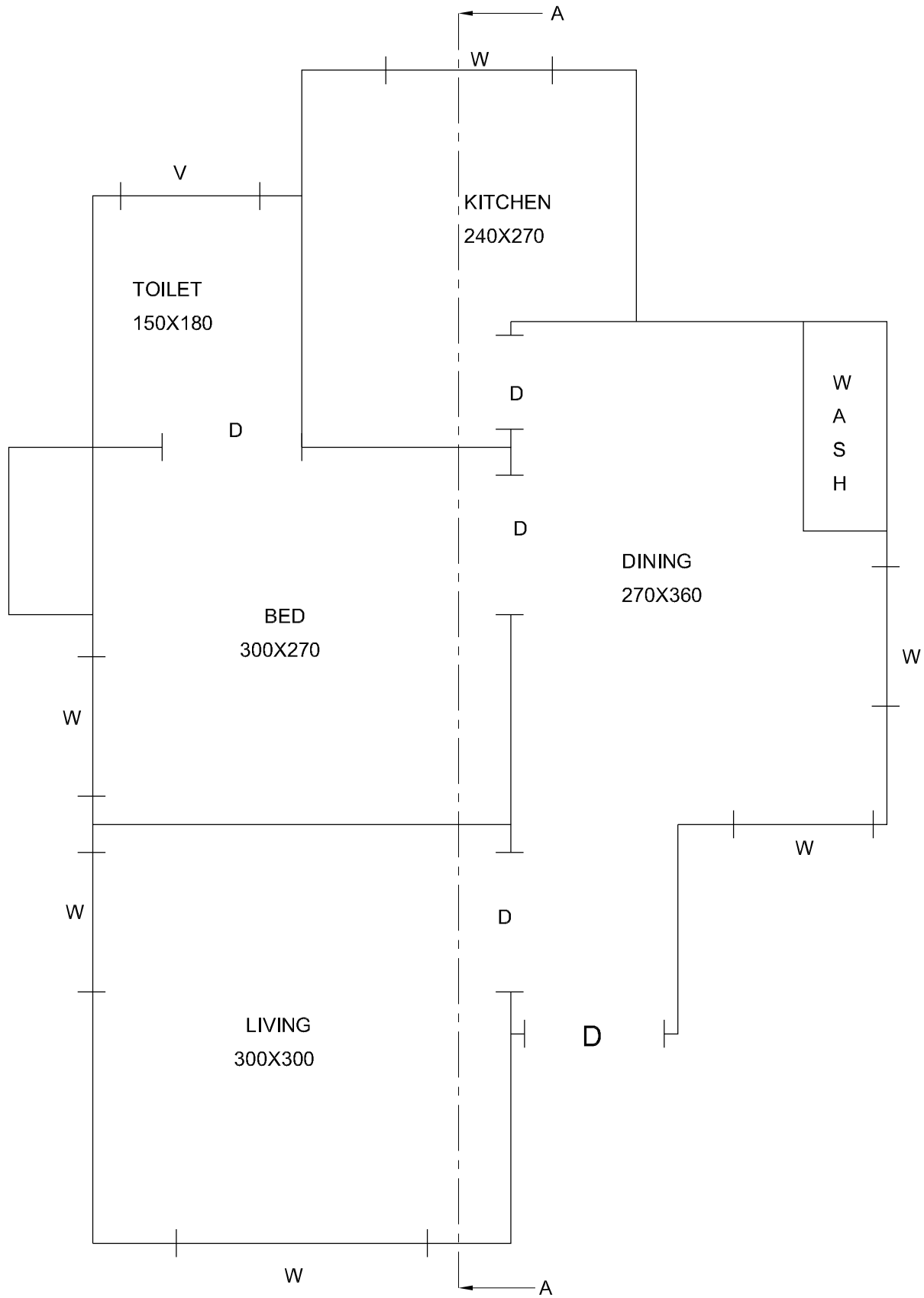
LINE DIAGRAM FOR A RESIDENCE

DCN3191E1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.1.91

Fig 2

ELEVATION

SECTION ON AA

RCC SLAB 1:2:4, 12CM THICK

WALLS OF BRICK MASONRY IN CM 1:5

RCC LINTELS & SUNSHADES

FLOORING

RAMMED EARTH FILLING

WALL FOOTING PCC 1:4:8

KITCHEN 240X270

TOILET 150X180

BED 300X270

DINING 270X360

LIVING 300X300

PLAN

SCHEDULE OF JOINERY

MARK	ITEM	SIZE	TYPE	NOS.
D	DOOR	110X210	PANELLED	1
D1	DOOR	100X200	PANELLED	2
D2	DOOR	90X200	PANELLED	1
W1	WINDOW	300X150	GLAZED	1
W2	WINDOW	120X150	GLAZED	1
W3	WINDOW	150X120	GLAZED	1
V	VENTILATOR	150X60	GLAZED	1

SPECIFICATIONS
1) FOUNDATION:-
2) WALLS:-
3) LINTELS:-
4) ROOF SLAB:-
5) PLASTERING:-
6) FLOORING:-
7) PAINTING:-

Note:- Provide Foundation according to the condition of soil

DCN3191E2

PLAN AND SECTION OF A BUILDING

Single storied residential building with attached bath (pitched roof)

Objectives : At the end of this exercise you shall be able to
• **draw the plan section and elevation of single storied residential building with attached bath**
• **prepare the working drawing of a building with pitched roof.**

PROCEDURE

TASK 1 : **Prepare the working of a single bed room residence with pitched roof**

• Draw the plan. (Fig 1a)

• Draw the rooms as per sizes given in the plan, with a wall thickness of 300mm for walls and 100mm for partition walls.

• Draw the plinth line and the pillar.

• Provide doors, windows, ventilators, and steps.

• Draw the roof line (pitched roof) in dashed lines as shown in (Fig 1a)

• Dimension the plan.

• Draw the section "AA". (Fig 1b)

• Draw the foundation basement and flooring as per given specification.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.1.91　　　3

- Above that draw the outer wall first. Draw the section of next wall (height 3600mm) 2500mm from that wall.

- Draw the section of other walls, doors and steps as per Figure.

- Draw the roof in 30°. Draw the wall plates on the wall.

- Draw the common rafters battens and ridge piece.

- Draw the side view of roof by drawing lines closely at top and spacely at bottom.

- Draw the proper symbols.

- Dimension the section fully.

- Print the specifications.

Draw elevation (Fig 1c)

- Project plan and section and develop the elevation as shown in Fig 1c.

Fig 1c

Fig 1b

MANGALORE TILED ROOF

ELEVATION

SECTION AA

Fig 1a

KITCHEN
3000x2000

BATH ROOM
1500x1500

LIVING
3500x3000

BED ROOM
3000x3500

VERANDAH
2000 WIDE

100x100

PLAN

REFERENCE:
FOUNDATION IN C.C 1:5:10
BASEMENT B.W IN C.M
SAND FILLING   350mm
FLOOR CONCRETE 1:4:10   100mm
FLOOR FINISH   20mm
R.C LINTEL   150mm
WALL PLATE   75x100
BRESUMMER   100x100
COMMON RAFTER 100x125 AT 400C/C
BATTENS 45x25 AT 350C/C
RIDGE PIECE   50x150
WOODEN POST   100x100
D - DOOR PANELLED   1000x2000   5 NOS.
W - WINDOW PANELLED   1000x1200   4 NOS.
W1 - WINDOW PANELLED   800x1000   1 NO.
V - VENTILATOR GLAZED   300x400   1 NO.

ALL DIMENSIONS ARE IN MILLIMETRES

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A MANGALORE TILED RESIDENCE

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.1.91

With the aid of line diagram of the building, prepare plan, elevation and section

Objectives : At the end of this exercise you shall be able to
• **identify the size of rooms wall thickness**
• **identify the number and positions of wall opening**
• **draw the line diagram of the residential building.**

PROCEDURE

TASK 1 : **Prepare the given line sketch of the pitched roof residence in a scale of 1:50 Fig 1**

1 Seclect a scale of 1:50.

2 Draw a right angled corner indicating the verandah.

3 Draw parallel and perpendicular lines as per the room arrangements, size of room etc.

4 By using outlines finish the positions of rooms.

5 Erase the unwanted construction lines, if any.

6 Furnish the details of rooms, positions of door, windows etc.

7 Draw the roof lines in dashed lines as shown.

8 Dimension the figure as per the datas given.

9 Specify the scale and related notes.

10 Complete the required line sketch.

Fig 1

PLAN OF PITCHED ROOF RESIDENCE

ALL DIMENSIONS ARE IN CMS

BUILDING DRAWING

5
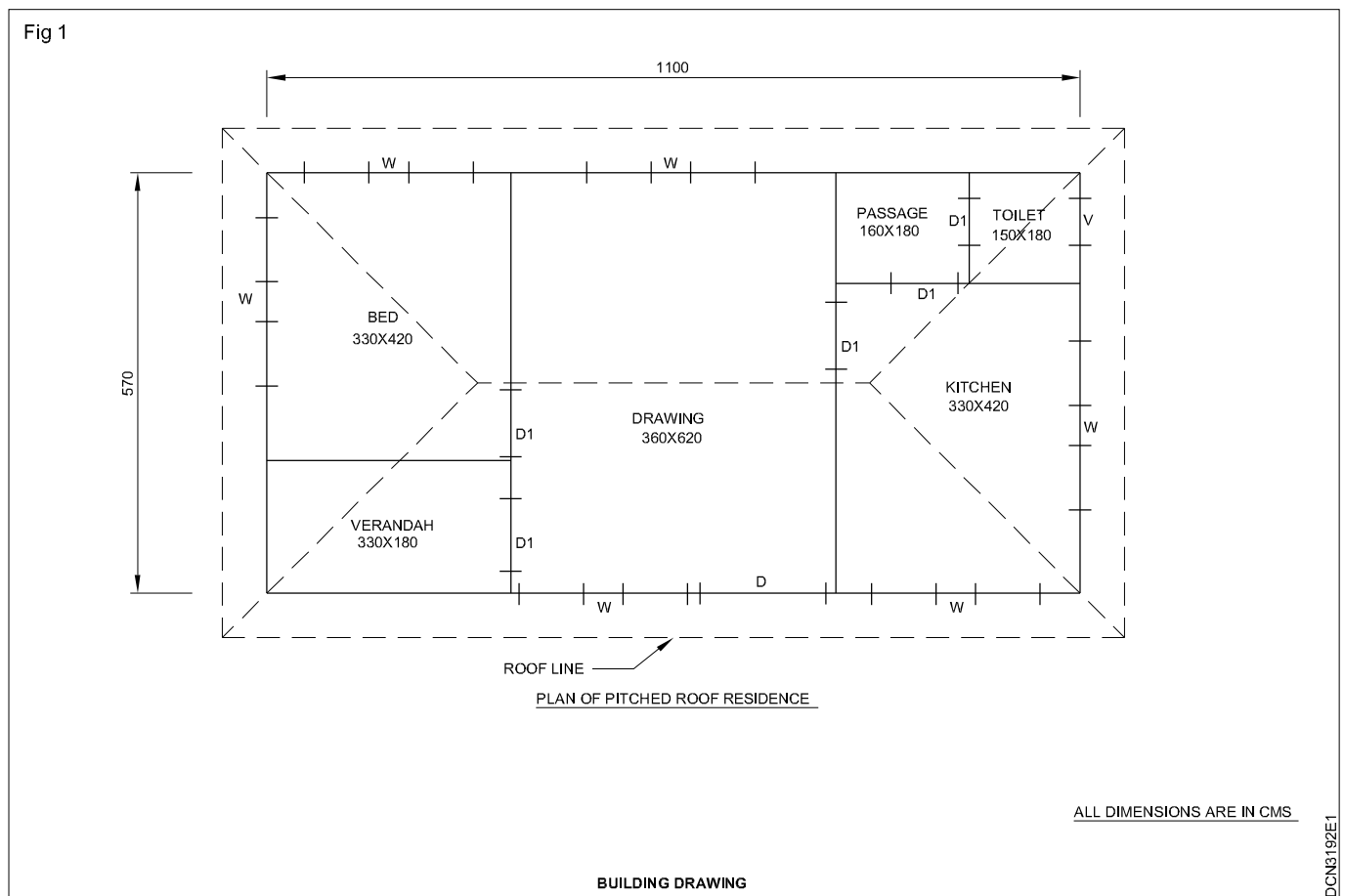
Detail of residential building with layout site plan

Objectives : At the end of this exercise you shall be able to
• **identify the various interior and exterior furnishings details of a residence**
• **practice the template for apt interior furnishings**
• **draw the layout and detailings a building.**

PROCEDURE

TASK 1 : **Prepare the given sketch using templates (Fig 1)**

• Draw the plan to a scale of 1:50.

• Select the template and create the furniture.

• Furnish the surrounding details as shown, for lawn. swimming pool, garden etc.

• Complete the drawing.

Fig 1

Architectural floor plan of a residence showing the following labeled areas:

- TOILET
- VERANDAH (270, 240)
- SWIMMING POOL
- TOILET 210X320
- BED 540X360
- BED 430X470
- +1.20
- +45
- FAMILY ROOM 460X1000
- UP (stairs)
- +30
- TOILET
- TOILET
- PORTICO 300X500
- KITCHEN 370X500
- DINING 400X500
- LIVING 500X430
- VERANDAH 150WIDE
- SITOUT 150WIDE

Dimensions (left side, top to bottom): 280, 350, 530, 1060
Right side dimension: 2220
Bottom dimensions: 330, 1390

Wall openings marked with W, D, V

ALL DIMENSIONS ARE IN CMS

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LAYOUT AND DETAILING A RESIDENCE

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.1.93   7

Site plan

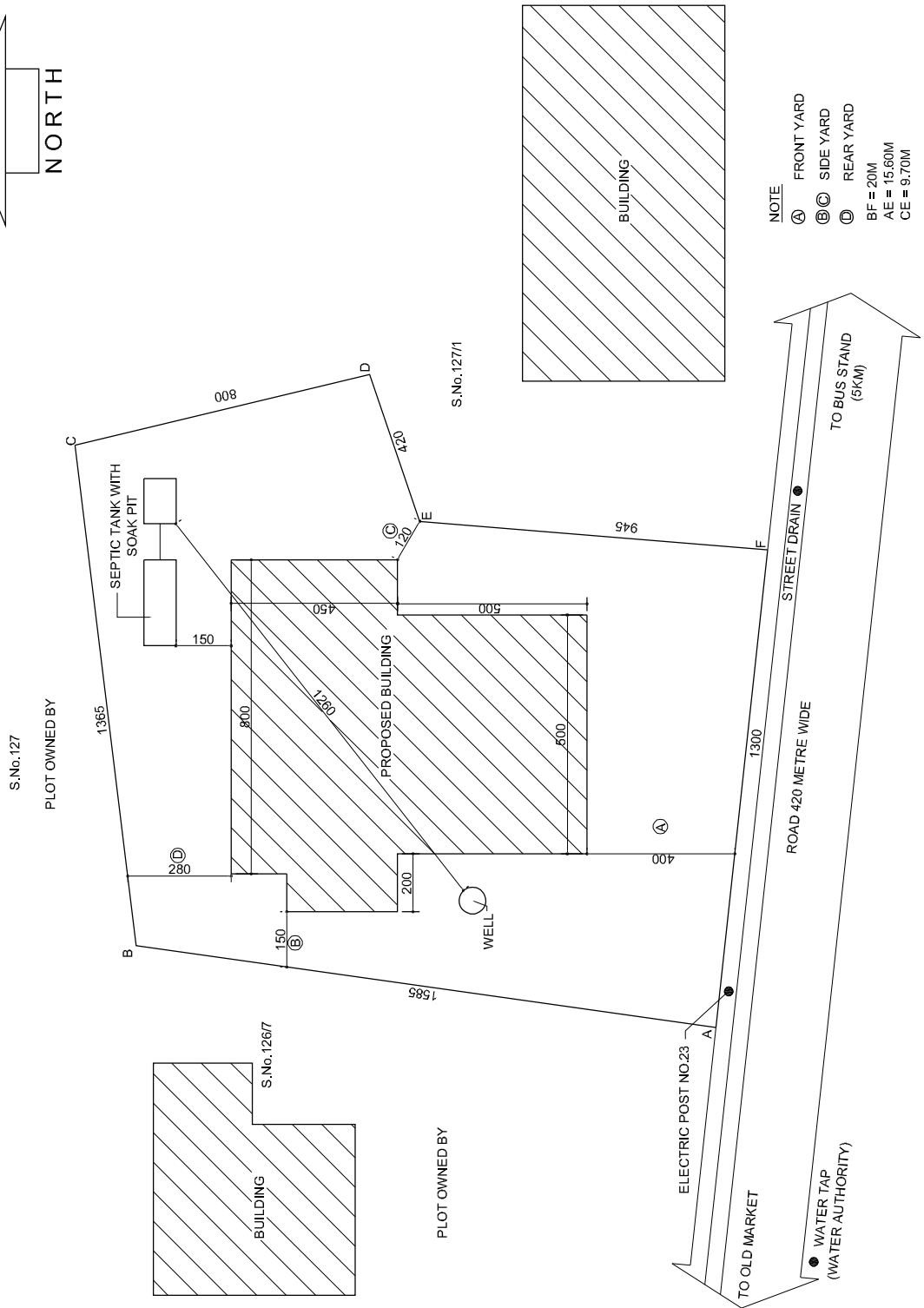**Objectives :** At the end of this exercise you shall be able to
• **identify the different set backs in a plot**
• **create a site plan showing details.**

PROCEDURE

TASK 1 **: Prepare the site plan as per given sketch (Fig 1)**

• Select a scale of 1:400 and draw the plan of the plot as per given dimensions.

• Draw a horizontal line from the front boundary at a convenient distance : say 4:10 m. (minimum 3.00m from boundary)

• Create the outer line of building by providing given set backs. (Fig 2)

• Create dimensions and other required notes as shown.

• Identify and mark the front, rear and side yards.

• Draw symbols for north direction.

• Complete the required drawing.

Fig 1
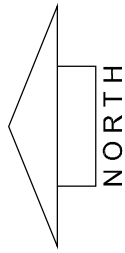
SITE PLAN

Create a drawing of building showing set back

Objectives : At the end of this excercise you shall be
• **draw a plan of able to single bed room residental building**
• **draw a set back layout of the building.**

TASK 1 : **Draw a plan of single bed room residental building**

DATA

• Bed Room   = 3.73m × 3.63m

• Living Room = 3.6m x 5.36m

• Verandah   = 3.83m x 2.27m

• Kitchen   = 3.6m x 2.7m

• Bath   = 2.3m x 1.5m

• WC   = 1.2m x 1.5m

— — — — — — — —

TASK 2 : **Draw a setback layout of the building (Fig 1)**

DATA

• Size of plot : 18.3m x 12.2m.

• Building frontage : $\frac{1}{2}$ Road width + 3m.

• Frontage (minimum 3m).

• Set Back (minimum $1\frac{1}{2}$ m).

• Left side back $1\frac{1}{2}$ m.

• Draw and complete set back layout.

Fig 1

12.2

D

1.0

THIRD LINE

C

P4

P7

P5 g

h P6

18.3

SECOND LINE

FOURTH line

KITCHEN

BATH

W.C.

1.0

1.0

LIVING

BED ROOM

0.5 1.0

1.5

VERANDAH

UP

2.0

P1 e

FIRST LINE (BASE LINE)

f

P2

P3

P8

A

B

5.0

5.0

BUILDING FRONTAGE
(½ ROAD WIDTH + 3.0 m)

ROAD CENTER LINE

R

M

Y1

Y2
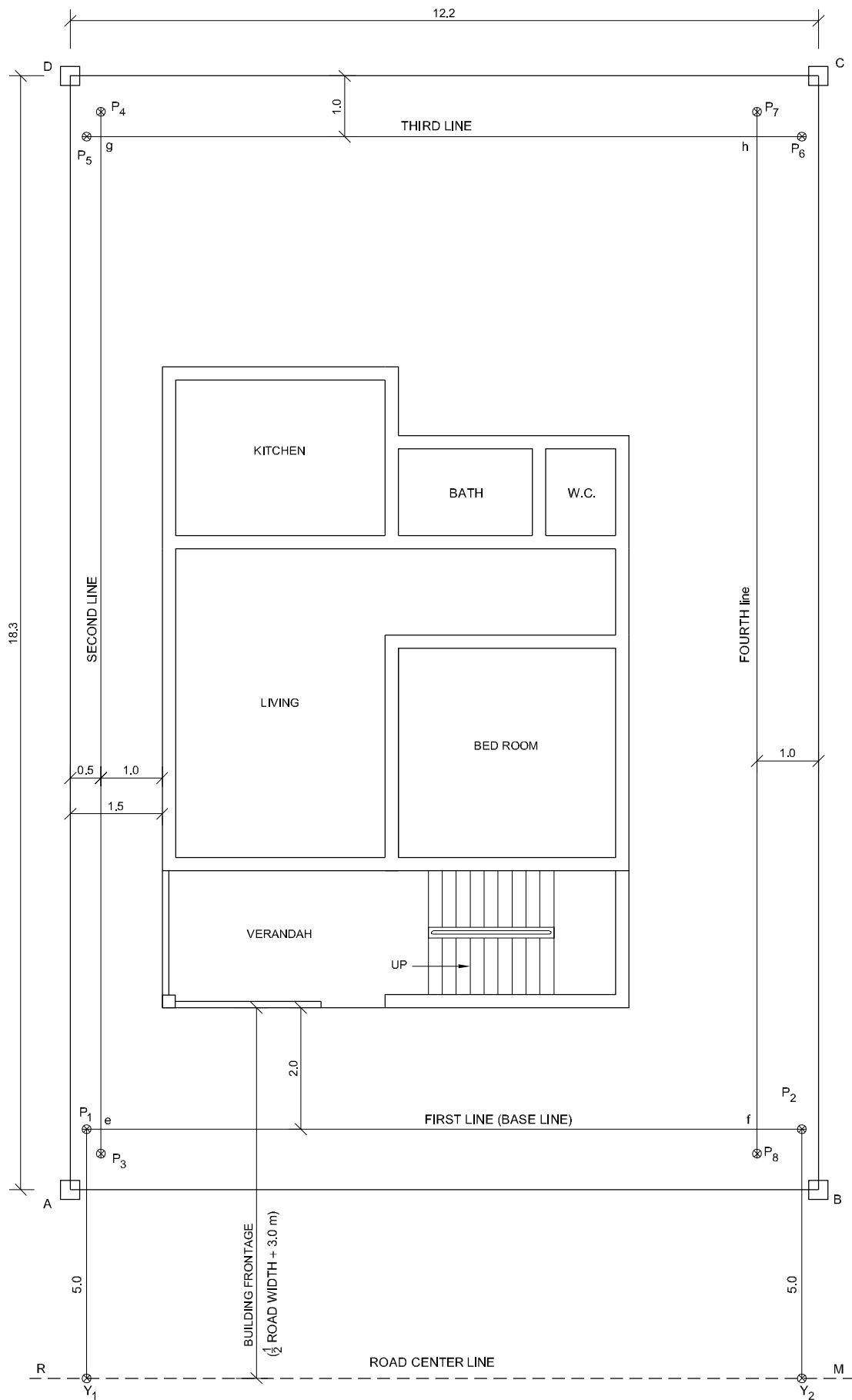
NOTE:
1. WIDTH OF ROAD INCLUDING WIDENING = 8.0 m
2. ALL DIMENSUINS ARE IN METRE

DCN3194E1

SET BACK LAYOUT

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.1.94

11

Showing the key plan

Objective : At the end of this exercise you shall be able to
• **preparing a key plan to your I.T.I from the nearest railway station/bus termunal.**

PROCEDURE

TASK 1

• Prepare a key plan to your I.T.I to display at the entrance.

• The key plan should be prepared from the nearest railway station.

• Bus termenal to your I.T.I Campus.

• Indicate the details of the surrounding of your I.T.I.

• To draw the key plan for you I.T.I refer the key plan shoun in Fig 1.

Fig 1

12

Function of keys and practice of base commands

Objectives : At the end of this exercise you shall be able to
• **identify basic computer terms**
• **start auto CAD four ways.**

Hardware

Microprocessor

The complex procedure that transforms raw input data into useful information for output is called "processing". The Processor is the "brain" of the computer. The processor interprets and carries out instruction. In personal computers the processor is a single chip plugged into a circuit board. This chip is called a microprocessor.

Central processing Unit (CPU)

The CPU is the term used for the computer's processor unit. The CPU contains the intelligence of the machine. It is where the calculations and decisions are made.

Memory (RAM)

Your CPU needs memory to hold pieces of information while it works. While this informations in memory, the CPU access it directly. This memory is called random access memory (RAM). RAM holds information only while the power is on. When you turn off or reset the computer, the information disappears.

The more RAM a computer has, the quicker it works and the more it can do.

The most common of measurement for computer memory is the byte. A byte can be described as the amount of memory it takes to store a single character. A kilobyte(KB) equals 1,024 bytes. A Megabyte (MB) equals 1,024 kilobytes, or 1,048,576 bytes. So a computer with 64 MB of memory actually has $(64 \times 1,048,576)$ 67,108,864 bytes. This is equal to approximately 1024 pages of information,

Input/output devices

Input devices accept date and instructions from the user. The most common input devices are the keyboard, mouse and scanner. Output devices return processed data back to the user. The most common output devices are the monitor, printer, speaker and plotter.

Storage

The purposes of storage is to hold data that the computer isn't using. When you need to work with a set of data, the computer retrieves the data from storage and puts it into memory. When it no longer needs the data, it puts it back into storage. There are 2 advantages to storage. First, there is more room in storage and second, storage retains its contents when the computer is turned off, Storage devices include: Hard disks (inside your computer), per drives, zip disks, CDR//w, pocket harddiscs, etc.

Software

Operating systems

When you turn on the computer, it goes through several steps to prepare itself for use.

The first step is a self-test. This involves:

a   Identifying the devices attached to it (such as the monitor, mouse and printer).

b   Counts the amout of memory available.

c   Checks to see if the memory is functioning properly.

The second step is searching for a specifal progarm called the operating system. When the computert finds the operating system, it loads it into memory (remember RAM), The operating system enables the computer to:

a   Communicate with you.

b   Use devices such as the disk drives, keyboard and monitor.

The oprating system is now ready to accept commands form you. The operating system continues to run until the computer is turned off. Exmples of opeating systems are: Windows 7,8 windows NT, ME, 2000, XP,OS/2, Unix and more.

Note: 1. Apple/Macintosh computers have their own operating system.

2 AutoCAD new version will not work with windows 98 or Apple/Macintosh.

Application software

The operating system is basically for the computer. The application Software is for the user. Application Software is designed to do a specific task.

There are basically four major categories:

Business. Utility,   Personal, and Entertainment.

Business application software would be desktop publishing, spreadsheet programs, database software and graphics, AutoCAD is a 'graphics' business application software.

Utility application software helps you maintain your computer. You would use a utility program to recover an accidentally deleted file, improve the efficiency of your computer and help you move, copy or delete files. Norton Utilities is an example of a 'utility application" software.

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Personal application software is basically what is sounds like. This software is designed for your personal needs, such as: balancing your checkbook, making an address book, creating a calendar and many more tasks.

Entertainment application software are video games, puzzles, filght simulators and even educational programs.
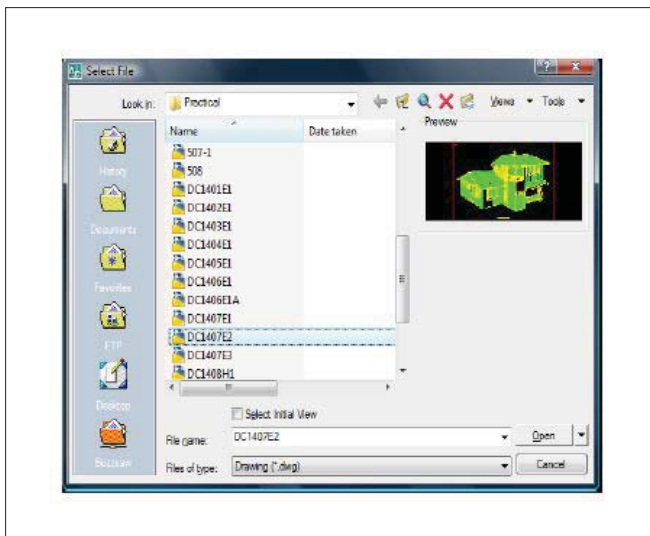
Starting AutoCAD

To Starat AutoCAD, select the START button/programs/AutoCAD. If one of the dialog boxes shown be low does not appear automatically. Select the system take to change your settings.

Prefer these dialog boxes for trainee new to AutoCAD. But after you become an "expert" you may disable this option.

Notice the four buttons located in the upper left corner of this dialog box. Each button provides a different way to start a drawing. A brief description of each is listed below.

Open a drawing

Allows you to select a drawing from a list of the most recently opened drawings or select the "Browse" button to search for more drawing files. After you select the file desired, select the OK button. The file selected will appear on your screen. (This option is only active when you first enter AutoCAD. Normally you will use **file/open.**

Start from scratch

Allows you to begin a new drawing from scratch. Starting from scratch means all settings are preset by AutoCAD.
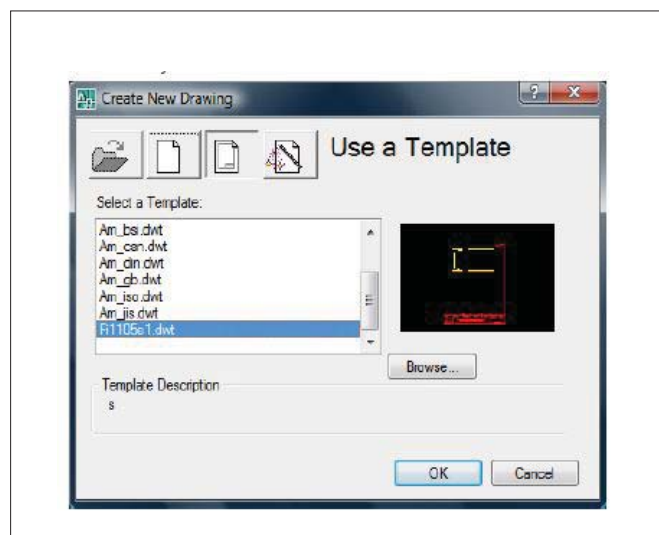
You must select the measurment system on which to base your new drawing; Imperial or Metric.
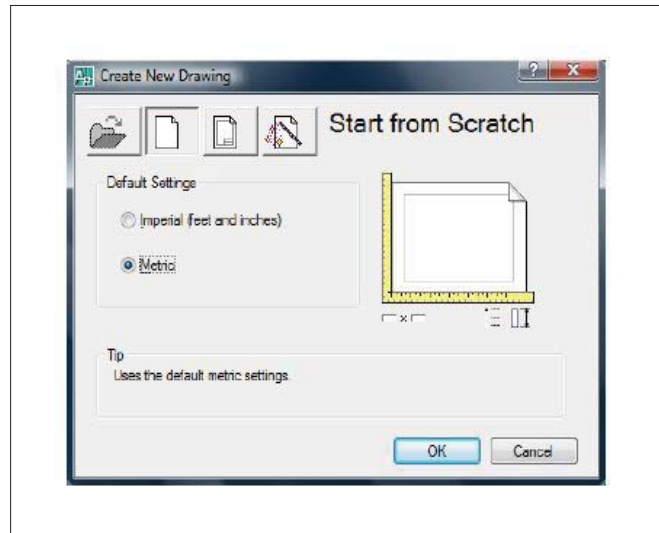

Use a template

Allows you to choose a previously created template. You can choose one of the templates supplied with AutoCAD or create your own.

We will be creating a template in exercise 6.03

Use of a wizard

Allows you to start new drawing using either the "Quick" or "Advanced" setup wizard sets the units, angle, angle measurement, angle direction and area for your new drawing.
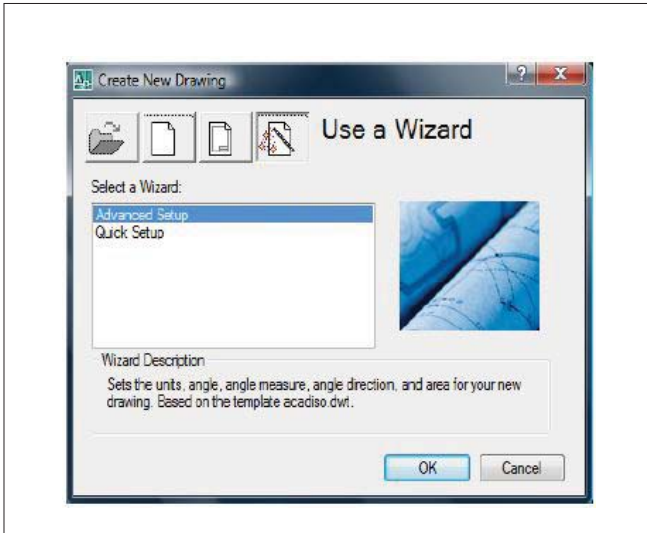
Opening AutoCAD

For starting Auto CAD, double click the Auto CAD icon on the desk top or CAD from start menu, if startup dialog box not shown in GUI, follow the following.
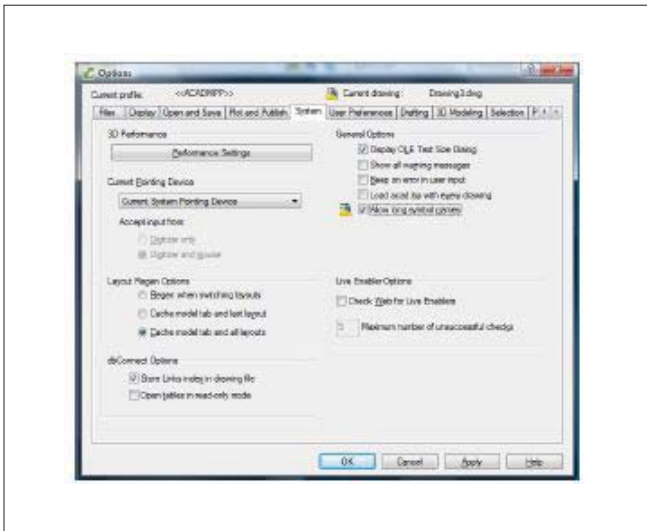
Procedure: right click on the screen

Select option.
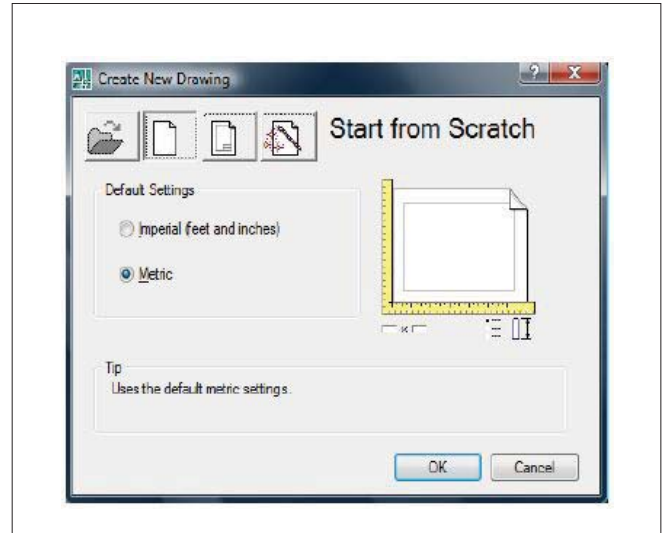
Option dialogue box.

Select system tab.

Click on the startup.

Select show startup dialogue box.

Startup dialogue box shown below. In the startup dialogue box, four options are available such as, open drawing, start from scratch, use a template and use a wizard.

1   Opening a drawing.

2   Start from scratch.

3   Use template.

4   Use a wizard.

1   **Open a drawing:** To open an already saved drawings.

2   Starts an empty drawing using default imperial or metric settings. Auto CAD stores this setting in the measurement system variable. You can change measurement system for a given drawing by using the measurement system variable.

   Imperial: Starts a new drawing based on the Imperial measurement system. The default drawing boundary (The drawing limits) is 12 x 9 inches.

   Metric: Starts new drawing based on the metric measurement system. The default drawing boundary (the drawing limits) is 420 x 297 millimeters.

3   **Use a template:** Starts a drawing based on a drawing template file.

4   **Use a Wizard:** Sets up a drawing using a step-by-step guide. You can choose from two wizards: Quick set up and Advanced Set up.
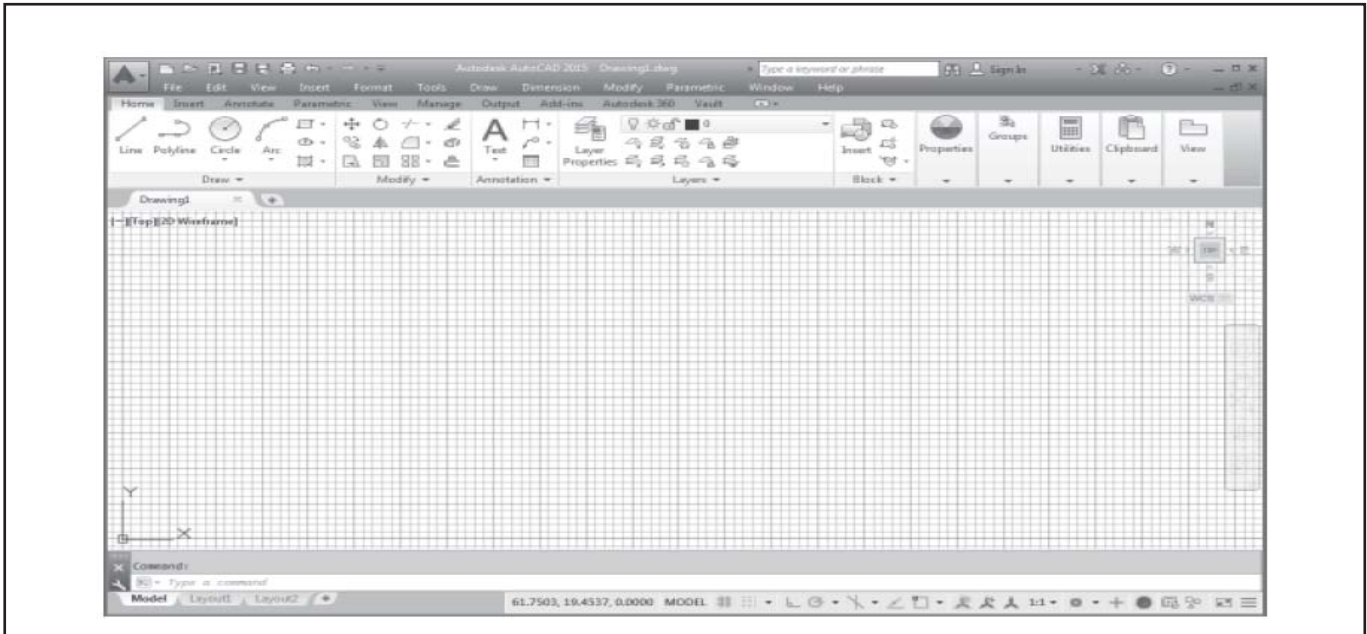
Starting up AutoCAD

Select AutoCAD option on the program menu or select the AutoCAD icon on the desktop.

Once one program is loaded into memory, the AutoCAD drawing screen will appear on the screen.

Note that AutoCAD automatically assigns generic name, Drawing X, as new drawings are created. In our example, AutoCAD opened the graphics window using the default system units and assigned the drawing name Drawing 1.


Getting famillar with the autocad window

Objectives : At the end of this exercise you shall be able to
• **identify basic computer terms**
• **identify function keys**
• **start auto CAD four way.**

Getting familiar with the autocad window

Before you can start drawing you need to get familiar with the AutoCAD window. In the following lessons, will be you referring to all of the areas described below.
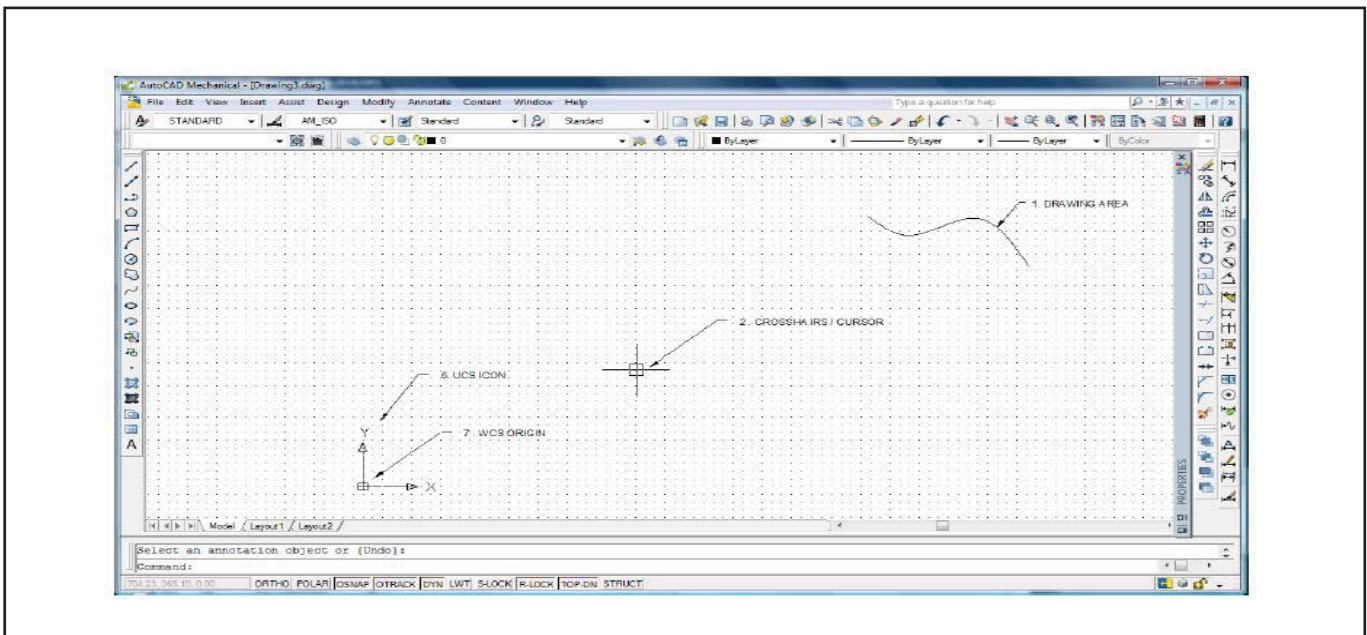
So it is important for you to understand each of them. But remember, this page will always be here for you.

Drawing area

Location: The large area in the center of the screen.

This is where you will draw. This area represents a piece of paper.

The color of this area can be changed using Tools/Option/Display Color.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.96

2 Crosshairs/cursor

Location: Can be anywhere in the drawing area. The movement of the cursor is controlled by the movement of the pointing device such as a mouse. You will use the cursor to locate points, make selections and draw objects. The size can be changed using Tools/Options/Display. Crosshair size.

3 Command line

Location: The three lines at the bottom of the screen. This is where you enter commands and Autocad will prompt you enter commands and Autocad will prompt you to input information.

4 Coordinate display (F6)

Location: Lower left corner.

In the Absolute mode (coords = 1) displays the location of the crosshais / cursor in reference to the origin. The first number represents the horizontal movement (X asix), the second number represents the vertical movement (Y axis) and the third number is the Z axis which is used for 3D.

In the relative polar mode (coords = 2) displays the distance and angle of the cursor from the last point entered. (Distance < Angle)

5 Status bar

Location: Below the command line.

Display your current settings. These settings can be turned on the and off by clicking on the word (snap, grid, ortho, etc.) or by pressing the function keys, F1, F2 etc. See button description below.

[Snap] (F9)

Increment snap controls the movement of the cursor. If it is off, the cursor will move smoothly. If it is ON, the cursor will jump in an incremental movement.

The increment spacing can be changed at any time using tools / Drafting Setting / Snap and Grid.

[Ortho] (F8)

When Ortho is ON, cursor movement is restricted to horizontal or vertical. When Ortho is OFF, the cursor moves freely.

[Polar] (F10)

Polar tracking creates "Alignment paths" at specified angles.

[Osnap] (F3)

Running object snap. Specific object snaps can be set to stay active untill you turn them off.

[Otrack] (F11)

Object Snap tracking

Creates Alignment paths at precise positions using objects snap locations.

[LWT]

Line weight. Displays the width assigned to each object. Model.

Switches your drawing between paperspace and model space.

6 UCS ICON (User coordinate system)

Location: Lower left corner of the screen. The UCS icon indicates the location of the Origin. The UCS icon appearance can be changed using: **View/ Display/ Icon / Properties.**

7 Origin

The location where the x,y, and Z axes intersect. 0,0,0

FUNCTION KEYS

F1	Help	Explanations of commands.
F2	Flipscreen	Toggles from Text Screen to Graphics Screen.
F3	Osnap	Toggles Osnap On and off.
F4	Tablet	Toggles the the tablet On ane Off.
F5	Isoplane	Changes the Isoplane fron Top to Right to Left.
F6	Coordinate display	Changes the display from ON/Off/
F7	Grid	Toggles the Grid On or Off.
F8	Ortho	Toggles Ortho On or Off.
F9	Snap	Toggles Increment Snap on or off.
F10	Polar	Toggles Polar Tracking On or Off.
F11	Otrack	Toggles Object Snap Tracking On and Off.

Special key functions

Escape key cancels the current command, menu or Dialog box.

Enter key ends a command, or will repeat the previous command if the command line is blank.

**Space bar** same as the enter key, except when entering text.

Pull-down "MENU BAR"

1   The pull-down "MENU BAR" is located at the top of the screen.

file edit view insert format tools draw dimension modify express window help.

by selecting any of the words in the **menu bar**, a **(2) pull down menu** appears. If you select a word from the pull down menu that has an **(3) arrow** a **(4) sub menu** if you select a word with **(5) ellipsis**.... a dialog box will appear.

(Example: draw/boundary....)
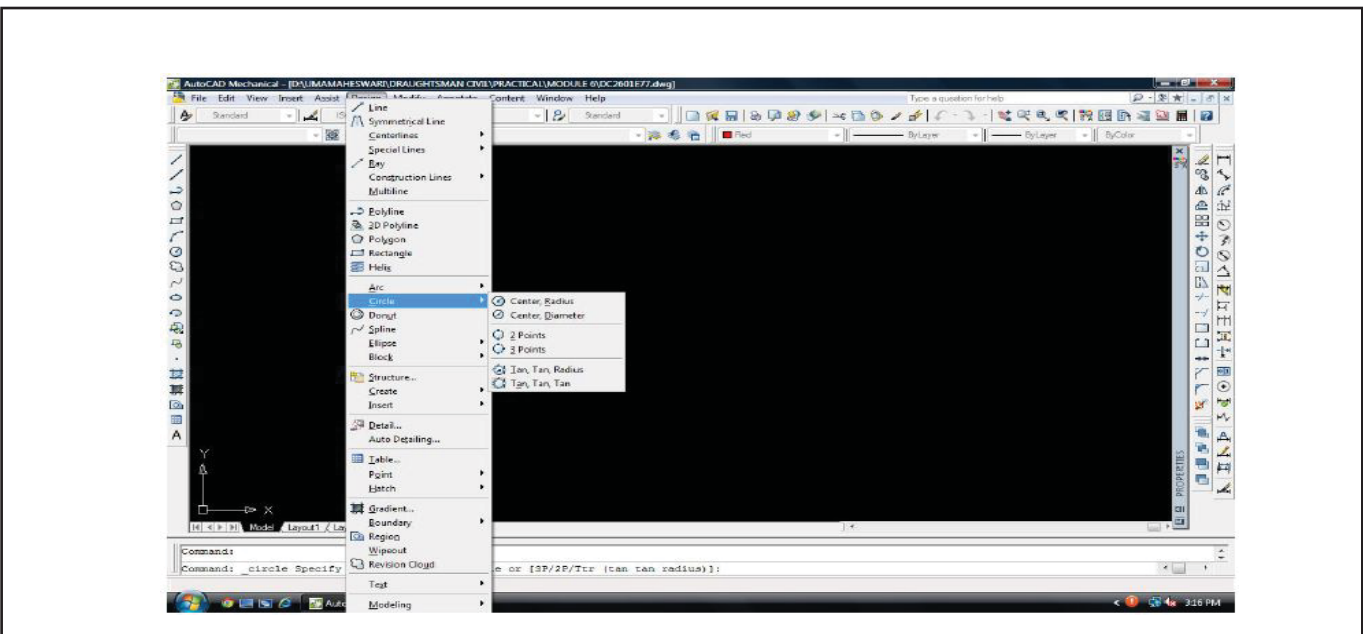
Dialog box

Many commands have **multiple options** and require you to make selections. These commands will display a dialog box. Dialog boxes, such as the **hatch** dialog box shown here, make selecting and setting options easy.

Tool bars

AutoCAD provides several toolbars to access frequently used commands.

The **standard, object properties, draw, and modify** toolbars are displayed by default.

Toolbars contain **icon buttons**

These icon buttons can be selected to draw or edit objects and manage files.

If you place the pointer on any icon and wait a second, a **tool tip** will appear and a **help message** will appear at the bottom of the screen.
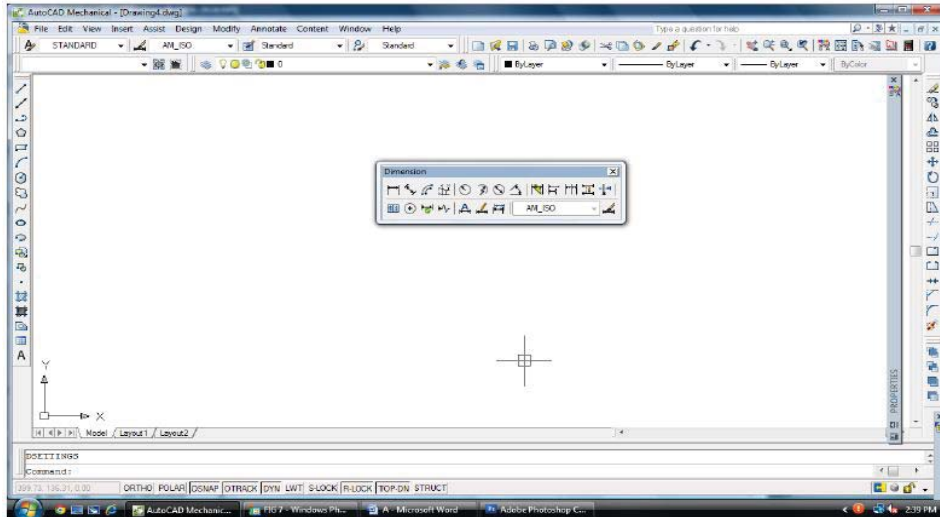
Elementary commands (starting a drawing)

Objectives : At the end of this exercise you shall be able to
• **starting a new drawing**
• **opening a template**
• **create a template.**

Starting a new drawing

Pulldown menu: file, new.

When you invoke this command Autocad displays the select template dialogue box.(If you selected "show startup dialogue box' from option dialogue box you cannot see the following dialogue box. Instead of this you can see the start up dialogue box itself)
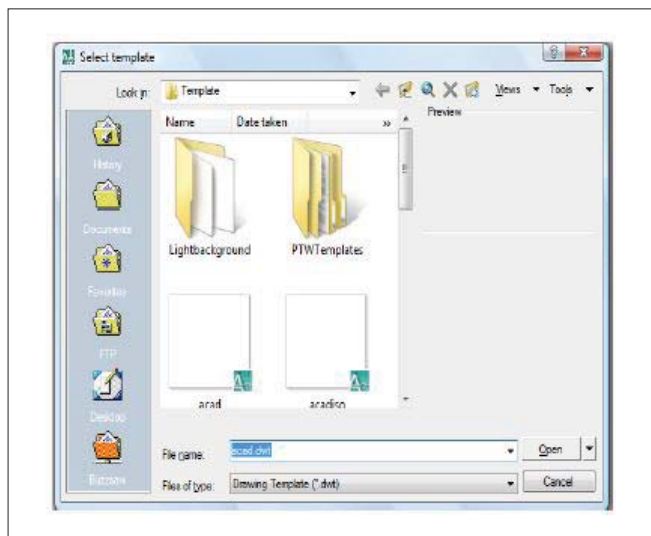
Opening a template

The template that you create by using F 8. It will appear as a blank screen, but there are many variables that have been preset. This will allow you to start drawing immediately. You will learn how to set those variables before you complete this workbook, but for now will concentrate on learing the AutoCAD commands and hopefully, have some fun.
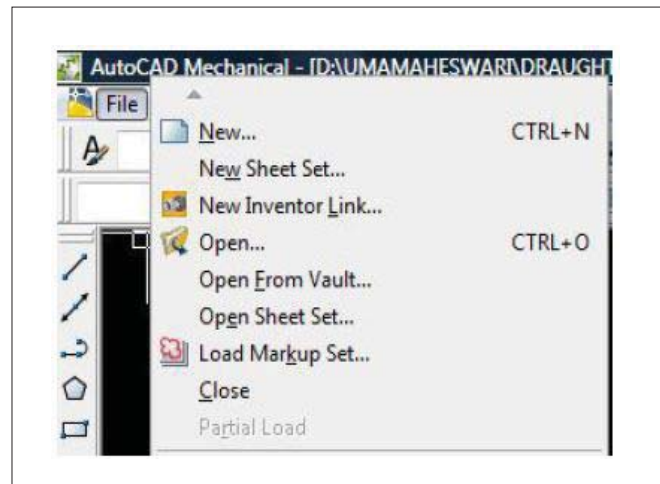
Let's start by opening the "1 Workbook"

1 Select file/new

2 Select use a template box (third from the left).

3 Select 1 workbook helper. dwt from the list of templates.
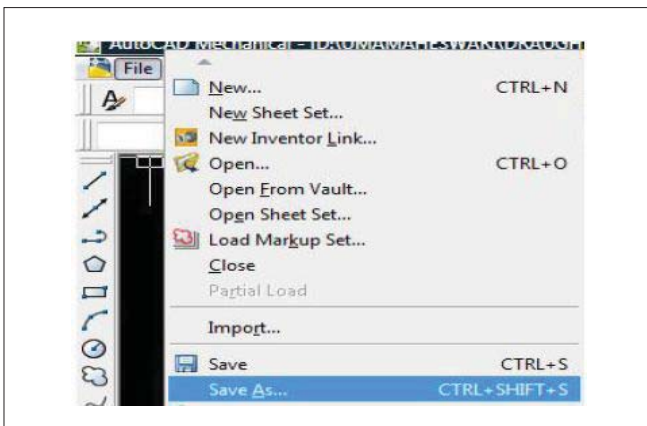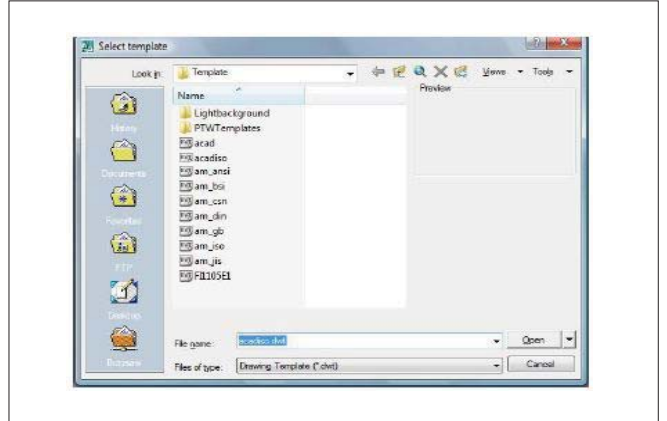
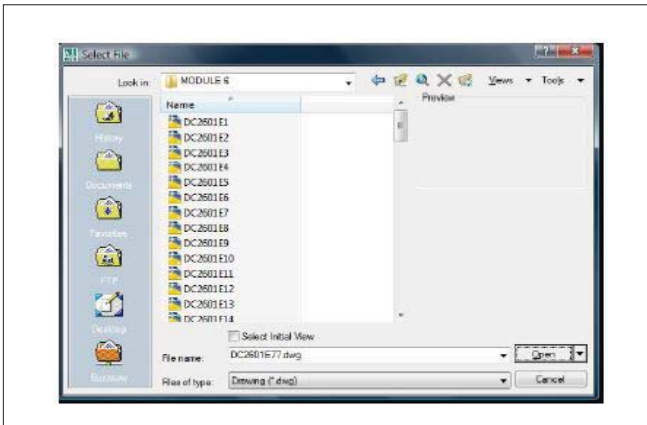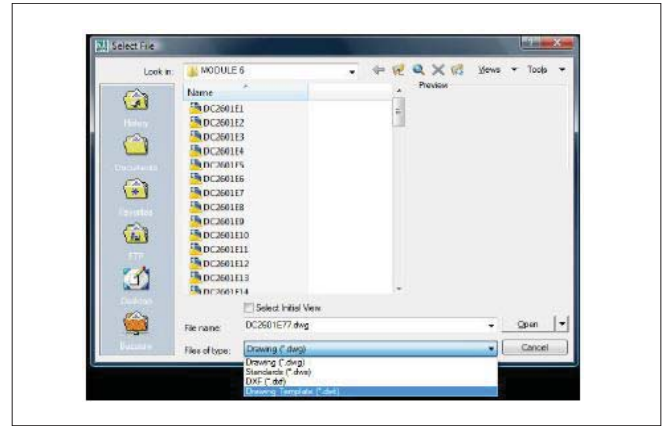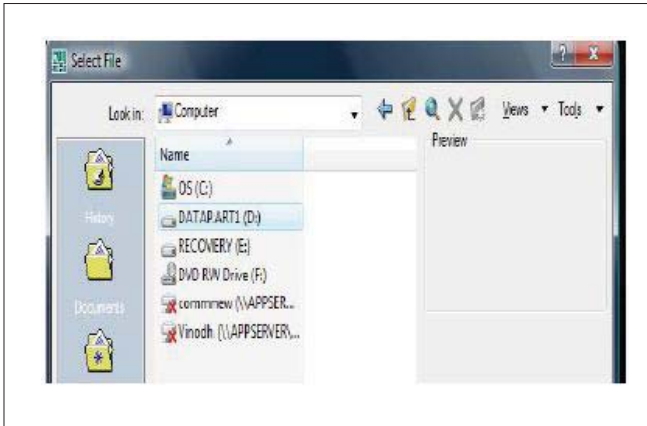4 Select the ok button.
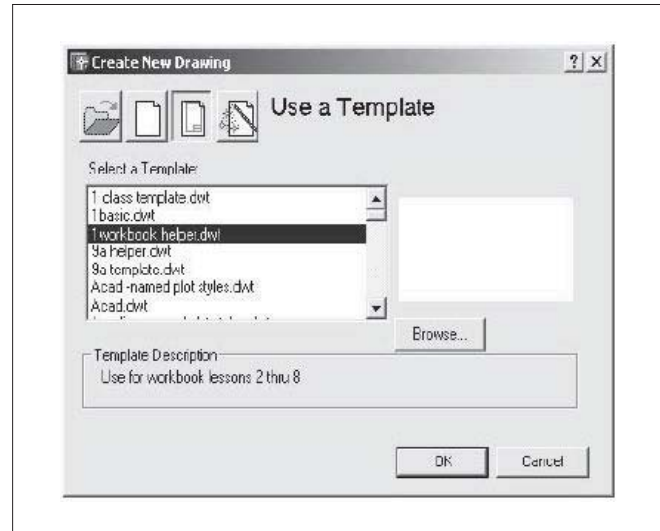
Create a template.

Now you can create a template. This will be a very easy task.

1 Start AutoCAD as follows.

Start button/programs/AutoCAD.

The 3 letter extension for drawing file is drawing If a dialog box appears select the "Cancel" Button.

2 Select **file/open.**

3 Select the **directory** in which the files located.(click on the)

8 Type a description and the select the "OK" button.

Now you have a template to use for lesson 2 through 8. At the beginning of each of the exercises you will be instructed to open this template.

Using a template as a master setup drawing is good CAD management.

4 Select the file **"Workbook** and then **"Open"** button.

5 Select **"File / save as"**

6 Select the **"File of type"** down arrow to display different saving formats. Select " Autocad drawing template (*.dwt)".

> **The 3 letter extension for template is "dwt".**

A list of all the AutoCAD templates will appear. (Your list may be different)

7 Type the new name "1 Workbook" in the file name". box and then select the save button.

The "1" before the name will place the file at the top of the list.

> **AutoCAD displays numerical first and then alphabetical.**
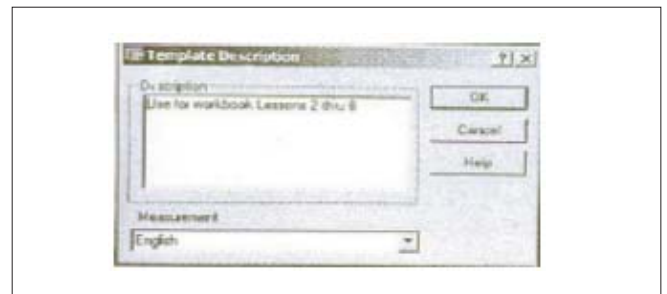
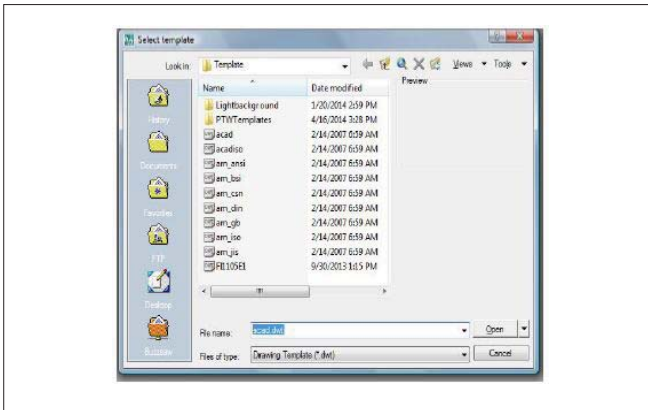**Creating a new drawing**

New command

Create 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 comand 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.

TIP: New drawings can also be created from template files.

Open existing drawings

| 1	Choose	File, open. or
2	Press	Ctrl + O
3	Click	The open icon. or
4	Type	Open at the command prompt.command: open
5	Press	Enter
6	Double click	The desired directory to find the drawing to open.
7	Click	the drawing name to open.
8	Click	The ok button.
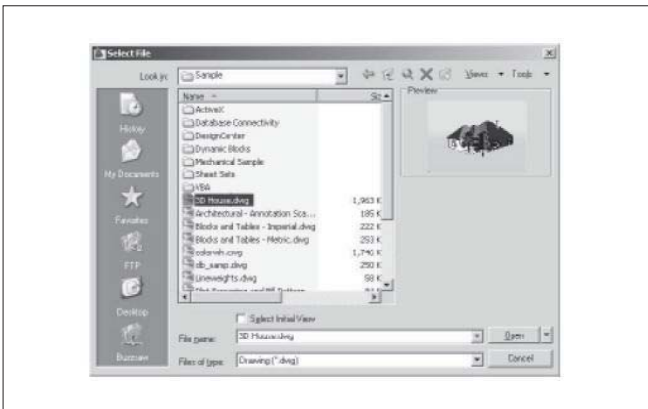
Preview shows a bitmap image of the drawing selected. This image is the view that was last saved in the drawing.

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
2	Type	Save or save as at the command prompt command: Save or Save as
3	Press	Enter
4	Type	A new drawing name or keep the existing drawing name.
5	Click	The ok button.
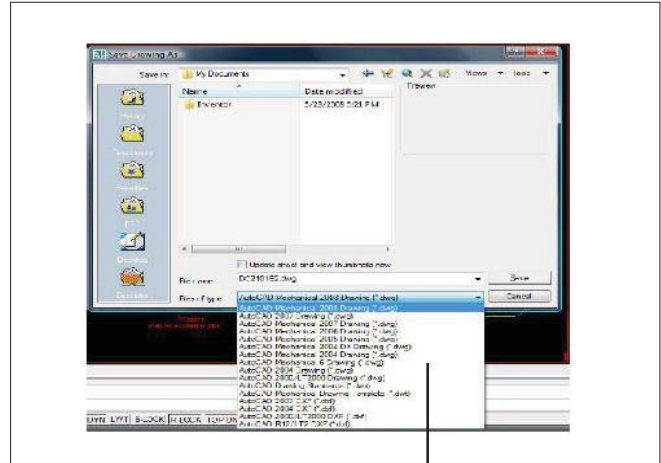
Various file type can be saved as

TIP: Clicking the dropdown list for file type changes the format that the drawing can be saved in.

Quick save

The Qsave command is equivalent to clicking Save on the file menu.

If the drawing is named, AutoCAD saves the drawing using the file fromat specified on the open and save tab of the Options dialog box and does not request a file name. If the drawing is unnamed, AutoCAD displays the save drawing. As dialog box **(see save as)** and saves the drawing with the file name and format you specify.
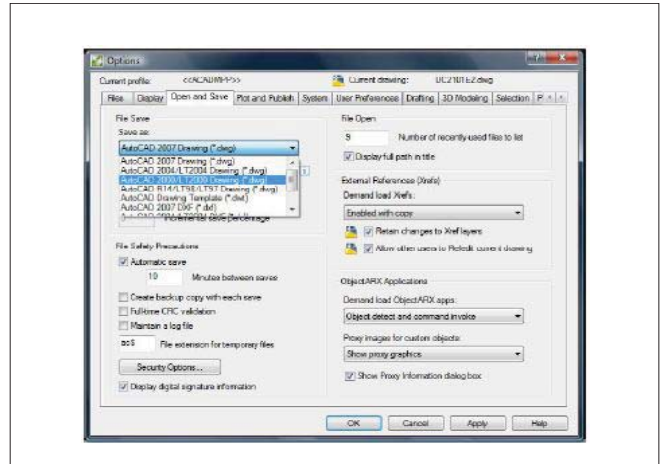
1. Press	Ctrl + S.
	or
2. Click	The save icon.
	or
3. Type	Qsave at the command prompt, Command: Qsave.

Tips: Drawings can be saved as different versions of AutoCAD (e.g. R13, R14, R2000, etc.)

AutoSave settings under Tools, options...

Existing 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.

Drawing area control

Objectives : At the end of this exercise you shall be able to
• **identify method of entering commands**
• **practice drowing command set up**
• **practice drawing area set up.**

Methods of entering commands

AutoCAD has 3 different methods of entering commands. All 3 methods will accomplish the same end result. AutoCAD allows you to use the method you prepare. The following are descriptions of all 3 methods and an example of how each one would be used to start command such as the line command.

1 Pull down Menu (Ex-6-02) (select draw / line).

a Move the cursor to the Menu Bar.

b Click on a Menu header such as "Draw".

c Slide the cursor down the list of commands and click to select.

2 Tool bars (Ex-6-2) (select the line icon from the draw tool bar).

Move the cursor to an icon on a toolbar and press the left mouse button.

3 Keyboard (Type L and <enter>).

Type the command on the command line.

What is a shortcut menu?

In addition to the methods listed above, AutoCAD has shortcut menus. Shortcut Menus give you quick access to command options. Shortcut Menus are available when brackets [] enclose the options, on the command line. (Example below) To activate a Shortcut Menu, press the right mouse button.

Example

Select: draw /circle / center, radius._circle specify center point for circle or **[3P / 2P/ Ttr (tan tan radius)]:**

If you press the right mouse button now, the shortcut menu on the left will appear. This allows you to select the options 3P, 2P, or Ttr with the mouse rather than typing your selection.

Drawing units setup

Every object we construct in a CAD system is measured in Units. We should determine the system of units within the CAD system before creating the first geometric entities.
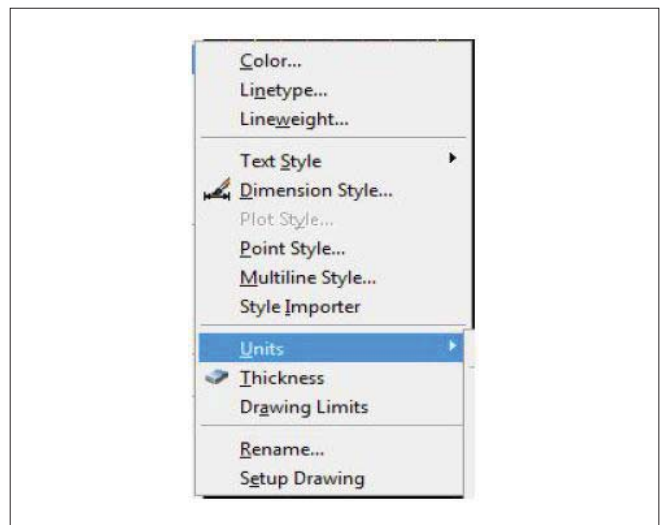
1 In the menu bar select:

[Format] [Units]

The AutoCAD menu bar contains multiple pull down menus, where all of the AutoCAD commands can be accessed. Note that many of the menu items listed in the pull-down menus can also be accessed through the Quick Access toolbar and / or Ribbon panels.

2 Click on the length type option to display the different types of length units available. Confirm the length type is set to decimal.

3 On your own, examine the other settings that are available.
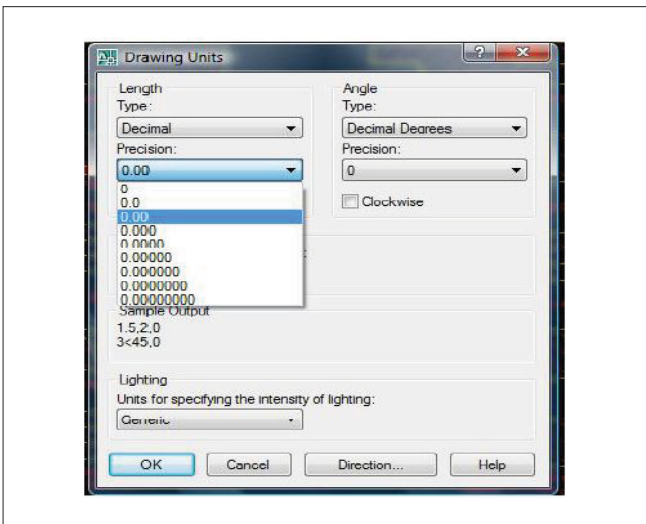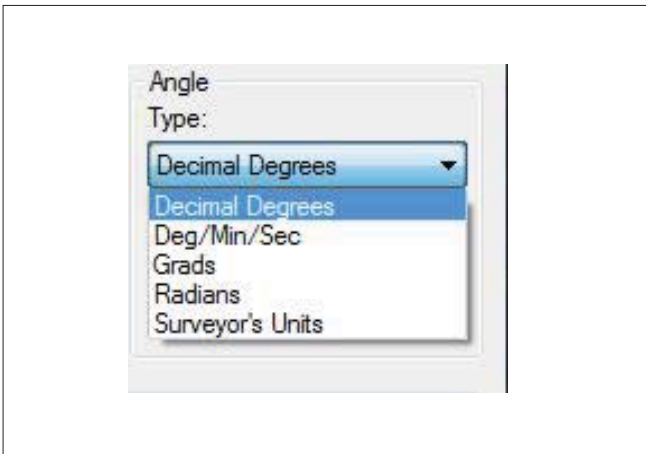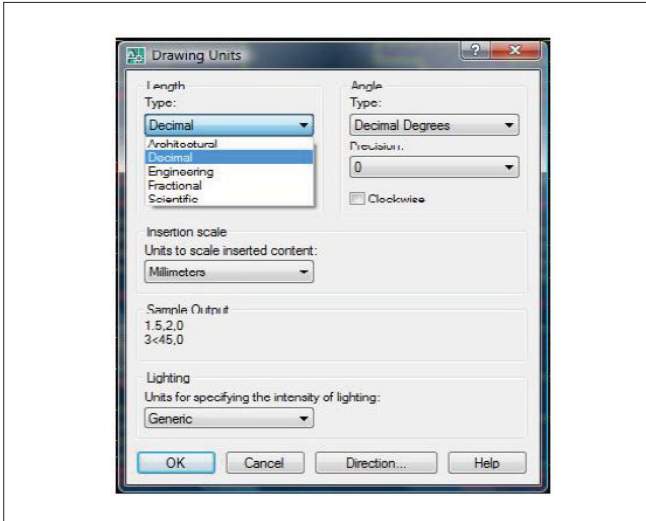
4   In the drawing Units dialog box, set the length type to decimal. This will set the measurement to the default english units, inches.

5   Set the precision to two digits after the decimal point as shown in the above Figure.

6   Pick ok to exit the drawing units dialog box.

Drawing area setup

Next, we will set up the **drawing limits** by entering a command in the command prompt area. Setting the Drawing Limits controls the extents of the display of the

grid. It also serves as a visual reference that marks the working area. It can also be used to prevent construction outside the grid limits and as a plot option that defines an area to be plotted / printed. Note that this setting does not limit the region for geometry construction.

1   In the menu bar select:

   [Format] [Drawing Limits]
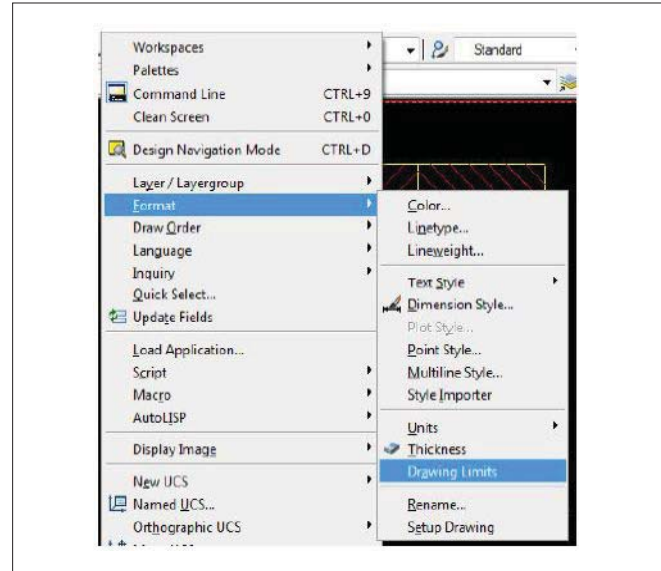
2   In the command prompt area, the message "Reset model space limits: Specify lower left corner or [on/off] <0.00,0.00>." is displayed. Press the **ENTER** key once to accept the default coordinates <**0.00,0.00**>.
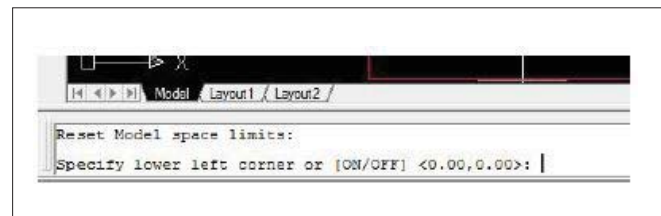
3   In the command prompt area, the messsage "specify upper right corner <12.00,9.00>" is displayed. Press the ENTER key again to accept the default coordinates <12.00,9.00>.

4   On your own, move the graphic cursor near the upper right corner inside the drawing area and note that the drawing area is unchanged. (The drawing limits command is used to set the drawing area, but the display will not be adjusted until a display command is used.)

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.97
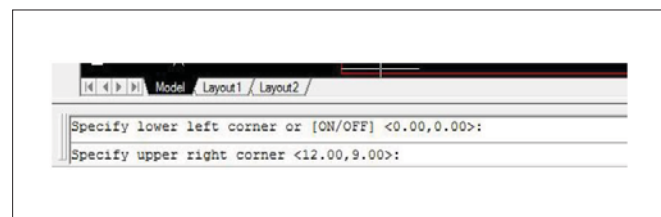
Setting limits of a drawing

In AutoCAD The drawing must be drawn in full scale. So limits are needed to size up a drawing area. The limits are determined by the following factor.

i   Size of drawing.

ii Space needed for dimensions, notes and other details.

iii Space between different views.

iv Space for the border and a title block etc.

Limits

Pull down: Format, drawing limits.

Command: Limits.

The command **LIMITS** allows you to change the upper and lower limits of the drawing.

Example: Set the drawing screen to A4 size (210 x 297)

Command: LIMIT.

Specify lower left corner or (ON/OFF) <0.000,0.000>:

Specify upper right corner <12.000,9.000>: 210,297

Give ZOOM command with ALL option to view all the drawing

area (A4 size)

MVSETUP = Multiview Setup

MVSETUP offers two different setup options depending on whether you are in Model Space or in a Layout (Paper Space).

In model space- you set the units type, drawing scale factor, and paper size at the command prompt using MVSETUP. Using the settings you provide, a rectangular border is drawn at the grid limits.

In Paper Space - you can insert one of several predefined title blocks into the drawing and create a set of layout viewports within the title blocks. You can specify a global scale as the ratio between the scale of the title block in the layout and the drawing on the Model tab. The model tab is most useful for plotting multiple views of a drawing within a single border.

MVSETUP commands

No (to not create a new layout tab - we will do this in another lesson)

A   (Metric units)

48 (Scale factor - common arch, scale factor is 1:1)

24 Width- see table below for paper size.

(example 210 x 297) Since we are printing in "land scape " mode, we enter the bigger number of the paper size first.

18 Length - Smaller number from the list below.

Once MVSETUP is finished, it will show a rectangle. This is the area where your grid wil show up if you have the grid on. This box is pretty much useless so just erase it. You will not need it.

From here, set up dimensions styles, text styles. layer.

If these settings will used in other drawings here are two suggestions, the first of which is recommended because it is less error prone.

1   After creating the desired settings, do a save-as and save t as a . dwt. All of the settings that you created will be saved.

2   After using this drawing, open it and erase all objects. The settings will remain but you will have to hunt down the objects that need to be erased in layouts.

2   Setting units of a drawing

Every object you create is measured in drawing units. Before you start to draw, you must decide what one drawing unit will represent based on what you plan to draw. Then you create your drawing at actual size with that convention. For example, a distance of one drawing unit typically represents one millimeter, one centimeter, one inch, or one foot in real - world units.

UNITS Command is used to set the units of measure, angle measurement, direction and precision.Pull down Menu: Format, UNITS

Command: UNITS

If you enter-units at the command prompt, UNITS displays prompts on the command line.There are five fundamental types of units i.e. Decimal, architectural, engineering, fractional & scientific.

The text window displays the following prompt.

There are five fundamental types of units i.e. Decimal, architectural, engineering, fractional & scientific.

There are five fundamental types of units i.e.

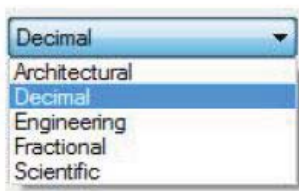| Icon/Button	Description
	Decimal, Architectural, Engineering, Fractional & Scientific.
	Report formats: (Examples)
	1 Scientific (1.55E + 01)
	2 Decimal (915.50)
	3 Engineering 1'-3.50"
	4 Architectural 1'-3 1/2"
	5 Fractional 15 1/2
	Enter choice, 1 to 5 <Current >: Enter a value (1-5) or press ENTER
	The following prompt for decimal precision is displayed if you specify the scientific, decimal, or engineering format. Enter number of digits to right of decimal point (0 to 8) <Current >: Enter a value (0-8) or press ENTER.
	The following prompt for the denominator of the smallest fraction is displayed if you specify the architectural or fraction format.
	Enter denominator of smallest fraction to display.
	(1,2,4,8,16,32,64,128,or 256) <current>: Enter a value (1,2,4,8,16,32,64,128,or 256) or press ENTER
	Inserting scale
	Controls the units of measurement for blocks and drawings that are inserted into the current drawing. A block or a drawing that is created with units that are different from the units specified with this option is scaled when inserted. The insertion scale is the ratio of the units used in the source block or drawing and the units used in the target drawing and the units used in the target drawing. Select Unitless to insert the block without scaling it to match the specified units.
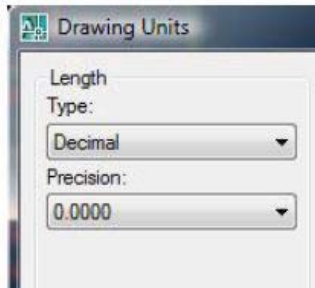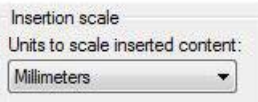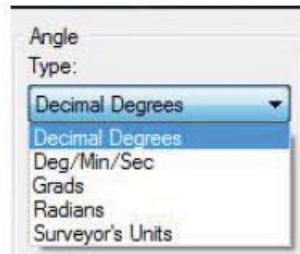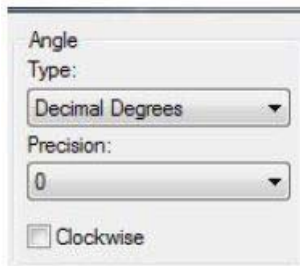
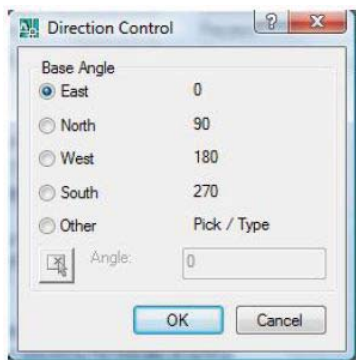|	
	The next prompts is for angle formats and precision. System of angle measure: (Exmaple) 1 Decimal degree 45.000 2 Degree/minutes/seconds 45d0'0. 3 Grads 50.000g. 4 Radians 0.78454r. 5 Surveyor's units N 45d0'0"E. Enter choice ,1 to 5< Current>:Enter a value (1-5) or press ENTER. Enter number of fractional places for display of angles (0-8) <Current>:Enter a value (0-8) or press ENTER.
	The next prompt is for the direction for angle 0. **Direction for angle 0:** **East 3 o'clock = 0.** **North 12 o'clock = 90.** **West 9 o' clock = 180.** **South 6 o' clock = 270.** Enter direction for angle 0<current>: Enter a value or press ENTER. The default direction for 0 degrees is to the east quadrant, or 3 o' clock. The default direction for positive angular measurement is counterclockwise. Measure angles clockwise? [Yes/No] <current>: Enter y or n or press ENTER. Select the unit you want from the dialogue box. This unit is used for dimensioning of the drawing. Input from the user accepted in this unit only.

Drafting setting a display commands

Objectives : At the end of this exercise you shall be able to
• **practice the drafting setting**
• **identify the visual reference**
• **identify esc, undo, redo**
• **practice display commands.**

Drafting Settings

Drafting settings includes the commands for initial setting of a drawing. Some of the drafting settings are **snap, grid, polar tracking, osnap.**

Switches the grid on/off

Set the size of the grid in the current drawing units

Snap: Snap is used to move the cursor at a defined value. This will set a position on the drawing quickly and accurately. The snap mode can be switched ON / OFF by pressing function key F9.
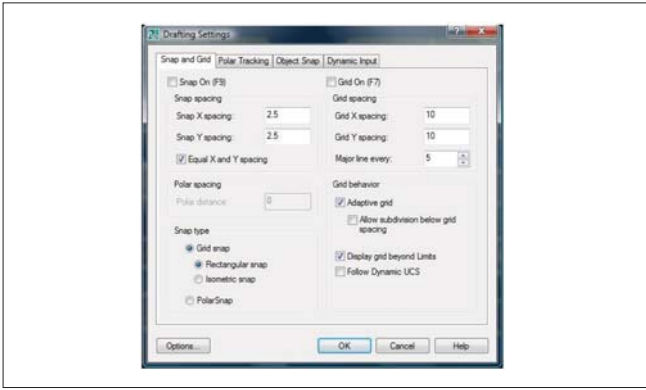
Grid: Grid command is used to display dots, which is easy for us to fix the points. But these dots were not

printed. Grid points have default spacing of one unit. We can change the spacing too. This mode can be ON / OFF by using the function key F7.

Object snap settings

Object snap settings are used to pick a geometric point on an object. Object snap mode can be ON / OFF by using the function key F3 or by clicking O snap button on the status bar. There are various options for object snap settings such as end point, mid point, centre, quadrent etc.

Ortho: Ortho command forces lines to be drawn exactly perpendicular directions. While using this command we have to turn ortho ON/OFF (otherwise press F8 according to our need

The grid and snap mode option can be turned ON or OFF through the status bar. The status bar area is located at the bottom left of the AutoCAD drawing screen, next to the cursor coordinates.
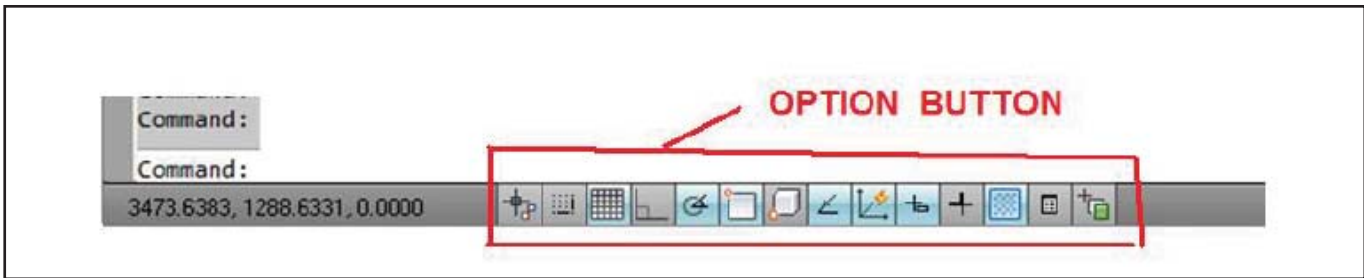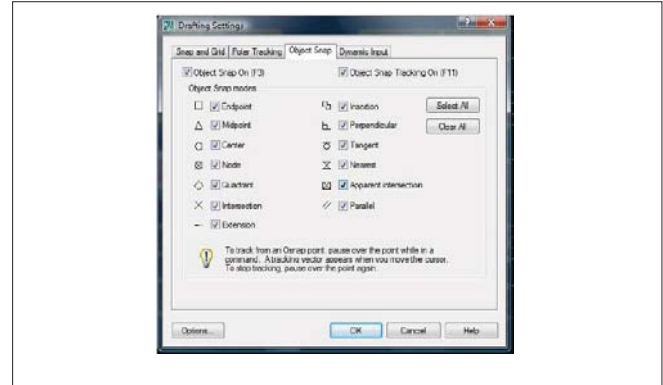
The second button in the status bar is the snap mode option and the third button is the grid display option. Note that the buttons in the status bar area serve two functions: (1) the status of the specific option, and (2) as toggle switches that can be used to turn these special options on and off. When the corresponding button is highlighted, the specific option is turned on. Using the buttons is quick and easy way to make changes to these drawing aid options. Another aspect of the buttons in the Status Bar is these options can be switched on and off in the middle of another command.

2 Move the cursor inside the graphics window, and estimate the distance in between the grid lines by watching the coordinates display at the bottom of the screen.

The grid option creates a pattern of llines that extends over an area on the screen. Using the grid is similar to placing a sheet of grid paper under a drawing. The grid helps you align objects and visualize the distance between them. The grid is not displayed in the plotten drawing.

Grid on

1 Left-click the grid button in the status bar to turn on the **grid display** option. (Notice in the command prompt area, on the massage "<Grid on>" is also displayed.)

The default grid spacing. Which means the distance in between two lines in the screen, is 0.5 inches. We can see that the sketched horizontal line in the sketch is about 4.5 inches long.
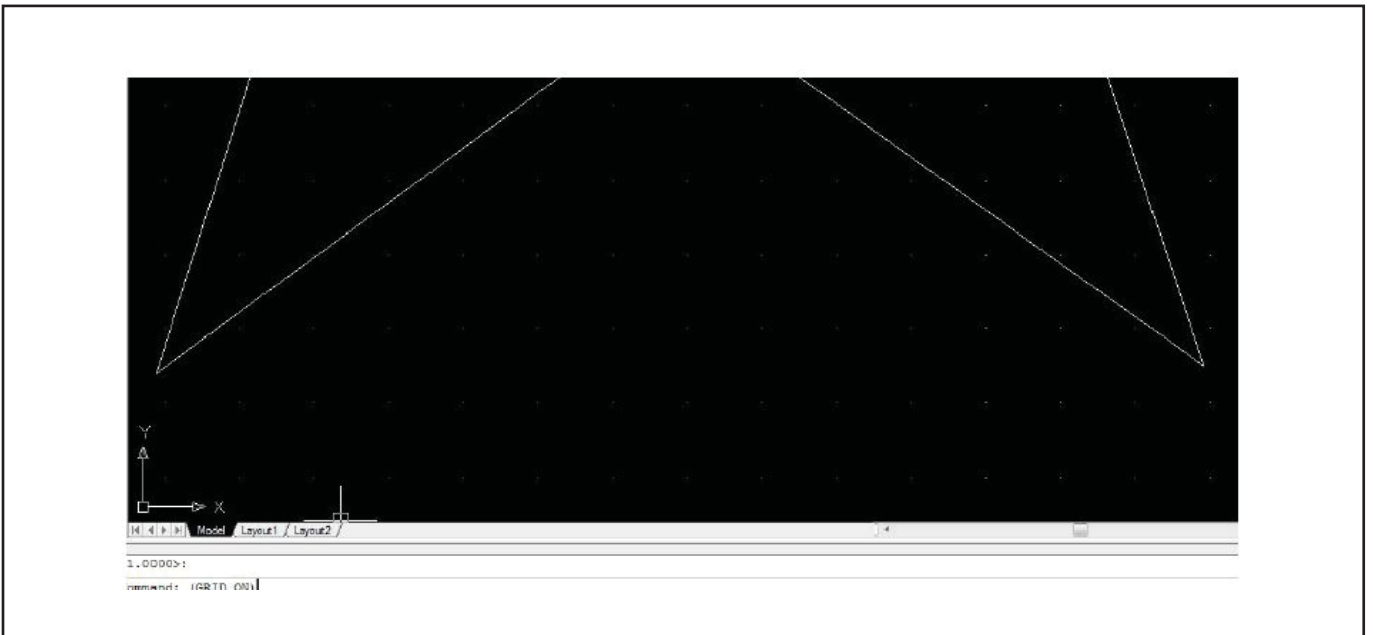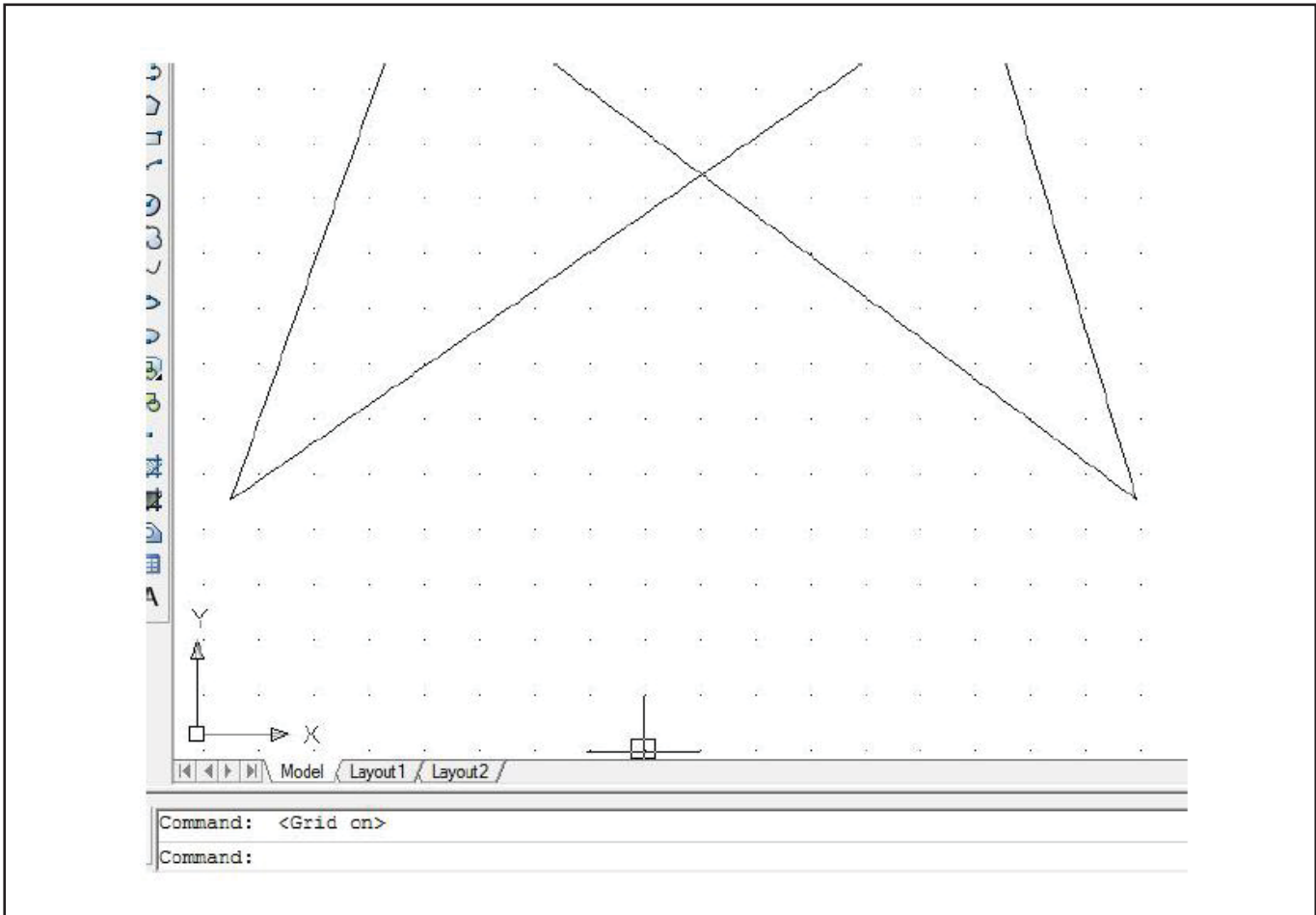
Snap mode on

1 Left- click the snap mode button in the status bar to turn on the snap option.

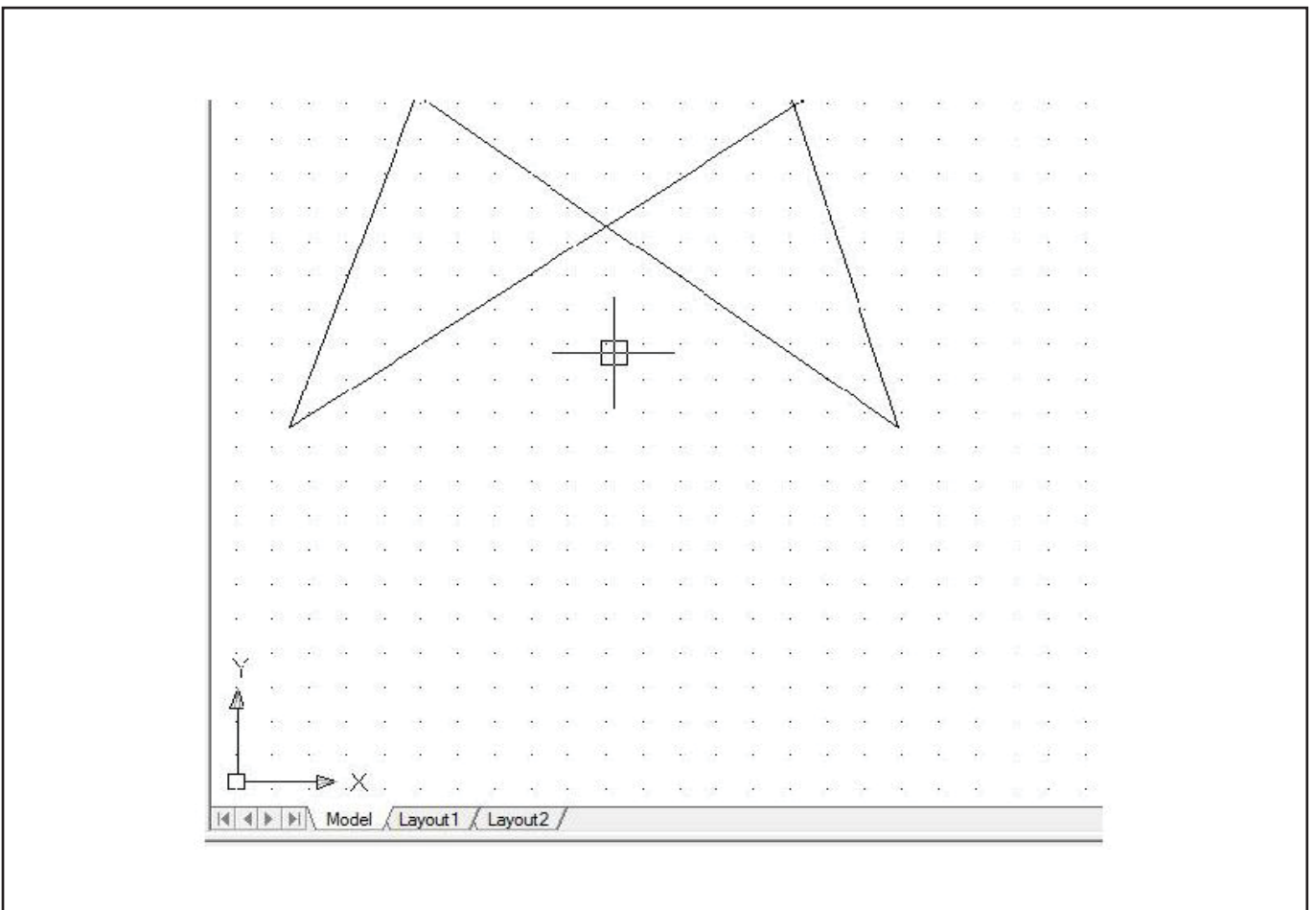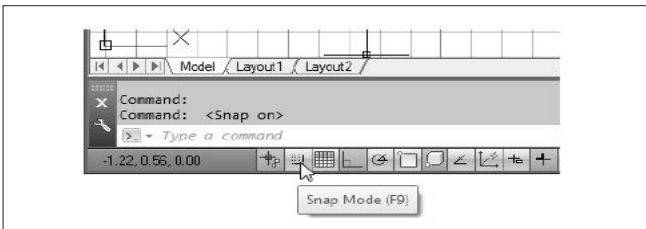2 Move the cursor inside the graphics window, and move the cursor diagonally on the screen. Observe the movement of the cursor and watch the coordinates display at the bottom of the screen.

SNAP mode is on, the screen cursor and all input coordinates are snapped to the nearest point on the grid. The default snap interval is 0.5 inches, and aligned to the grid points on the screen.

In case of any mistake

Pressing the ESC key

The Esc key at the top of the key board will get you out of most problems you encounter using AutoCAD. Here are some examples of the times you would press Esc key.

- If a command is not responding the way you expect.

- If you want to cancel a command you started.

- If you clicked a point on the screen unintentionally.

- If a dialogue box appears on the screen accidently.

In all these cases above, pressing Esc once will free the command line.

Example

Issue the line command, click a point on the screen and then press the esc key to cancel the command.

Using undo

You can undo the last command by typing U at the command line and pressing the enter key, or by clicking on the Undo icon on the tool bar.

Using redo
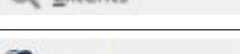
The Redo command will reinstate the last command you applied undo to. You may undo as may commands as like you, but you may only redo once.

Display commands

Zoom

Zoom command enlarges or reduces the view of the drawing. When we are working on a drawing it is always required to bring the area of our interest to focus on to the screen. The zoom tool bar may be accessed from the standard tool bar at the top of the screen or from the dropdown menu > view >Tool bars....> Zoom. The icons are

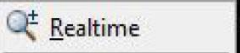| Icon	Function
Realtime	This allow you to select a window or box around the area you want to magnify.
Dynamic	This is both zoom and pan. When the command is issued a view box will be displayed with the drawing inside. The view box can be resized (Zoom) and moved around pan.
Scale	The drawing is at a scale of 1.A zoom scale of 2 doubles the magnification of the drawing, while 0.5 halves it.
Center	Allows you to pick a point which will be the center of the zoom area.
In	Just click on it zoom in on the drawing. You may preset the amount it zooms in a the command line.
Out	Just click on it zoom out from the drawing. You may preset the amount it zooms out at the command line.
All	This zooms to show the complete electronic page you set up. It zooms out to the electronic sheet limits.
Extents	This will zoom to fit the complete drawing on the screen.
Previous	This displays the last view created by zoom, pan or view command.

Pan

Pull down menu: view, pan.

The cursor changes to a hand cursor.
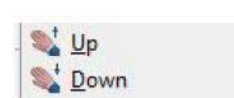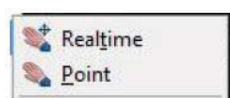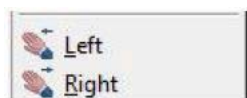
By holding down the pick button on the pointing device, you lock the cursor to its current location relative to the view port coordinate system. Graphics within the window are moved in the same direction as the cursor.

when you reach a logical extent (edge of the drawing space), bar is displayed on the hand cursor on the side where the extend has been reached. Also a message is displayed in the status bar as "already bottom most extent". Depending upon whether the logical extent is at the top, bottom, or side of the drawing, the bar is either horizontal (top or bottom) or vertical (left or right side).

When you release the pick button, panning stops. You can release the pick button move the cursor to another location in the drawing, and the press the pick button again to pan the display from that location.

On your own, move the graphic cursor near the upper-right comer inside the drawing area and note that the drawing area is unchanged. (The Drawing Limits command is used to set the drawing area, but the display will not be adjusted until a display command is used.)

Inside the Menu Bar area

Select: **[View] [Zoom] [All]**

Zoom All command will adjust the display so that all objects in the drawing are displayed to be as large as possible. If no objects are constructed, the Drawing Limits are used to adjust the current viewport.

Move the graphic cursor near the upper - right comer inside the drawing area and note that the display area is updated.

In the menu bar area select: [View] [pan] [Realtime]

The available pan commands enable us to move the view to a different position. The pan - realtime function acts as if you arre usisng a video camera.

Move the cursor, which appears as a hand inside the graphics window, near the center of the drawing window, then push down the left - mouse - button and drag the display toward the right and top side until we can see the sketched line. (Notice the scroll bars can also be used to adjust viewing of the display.)
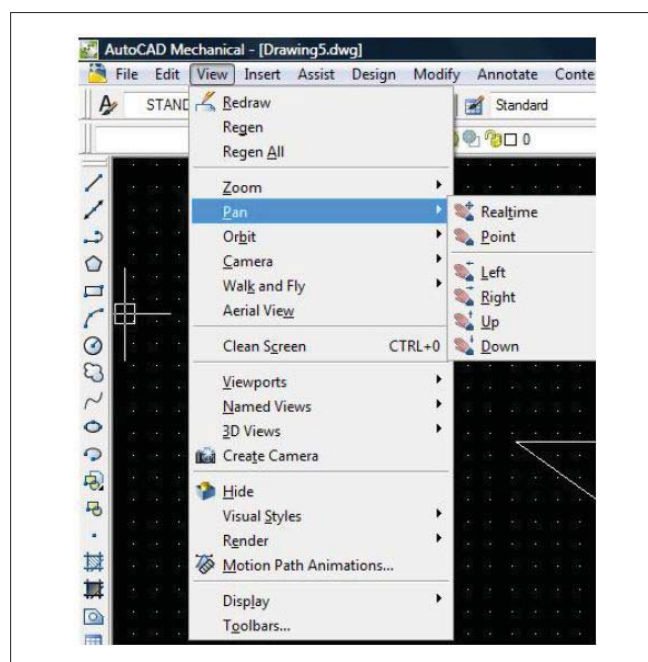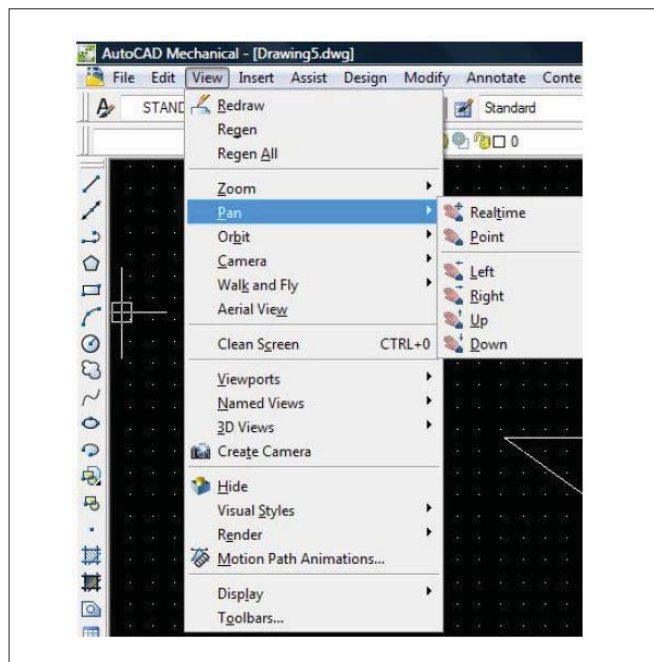
Commands & co-ordinate system

Objectives : At the end of this exercise you shall be able to
• **use draw command line**
• **practice co-ordinate system**
• **use modify command erase.**

Draw commands Line

From tool bar: Line

Draw menu: Line

Command : Line, L

Example:

Command: L - Line

Specify first point: Select one point on the screen

Specify next point or [Undo]: Select second point on the screen

Specify next point or [Undo]:

Continue

Continue a line from the end point of the most recently drawn line

If the most recently drawn line is an arc, its end point defines the starting point of the line, and the line is drawn tangent to the arc.

Close

Ends the last line segment at the beginning of the first line segment, which forms a closed loop of line segments.You can close after you have drawn a serious of two or more segments.

Undo

Erase the most recent segment of a line sequence. Entering "U" more than once back tracks through line segments in the order you created them.

Co-ordinate system in autocad

All drawings are superimposed on an invisible grid, or co-ordinate system, with a horizontal X-axis and a verticasl Y-axis.

You can establish grid and snap setting that match the units of the co-ordinate system or some multiple or fraction of it.

1 Absolute co-ordinate system (X, Y): To enter an absolute coordinate, specify a point by entering its X and Y values in the format X,Y. (Fig 1)

Use absolute coordinate when you know the precise X and Y values in the point from the origin. The following sequence of coordinates draw a triangle, as shown below.

Command _ Line specify first point: 2,2

Specify next point or [undo]: 8,2

Specify next point or [undo]: 8,6

Specify next point or [undo]: 5,6

Specify next point or [undo]: 5,4

Specify next point or [undo]: 2,4

Fig 1

ABSOLUTE CO-ORDINATE SYSTEM
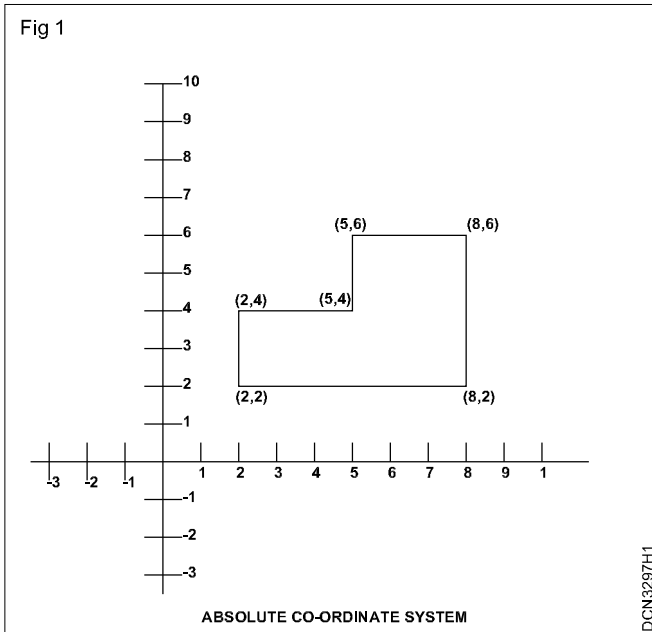
Relative rectangular co-ordinate system @ X distance, Y distance (Fig 2)

Use relataive coordinates when you know the position of a point with respect to the previous point, the relative rectangular coordinate is represented in the following format.

Fig 2

RELATIVE RECTANGULAR CO-ORDINATE SYSTEM
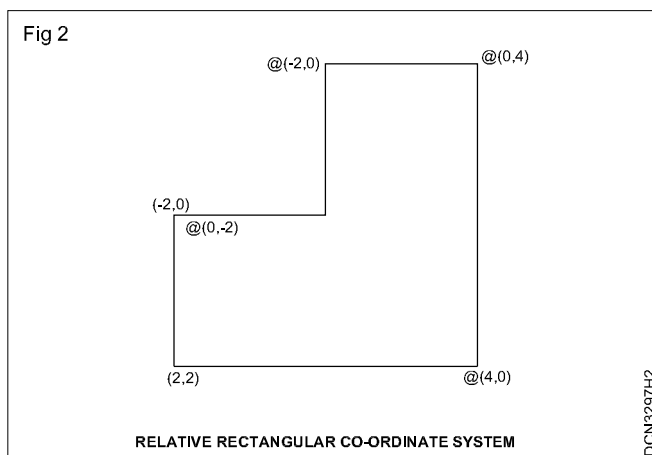
X displacement, Y-displacement

Command:_ line specify first point:2,2

Specify next point or [undo]: @ 4,0

Specify next point or [undo]: @ 0,4

Specify next point or [Close/ undo]: @ 0,-2

Specify next point or [Close/ undo]: @ -2,0

Specify next point or [Close/ undo]: @ c

Relative polar co-ordinate system @ distance angle (Fig 3)

Polar co-ordinate system uses a distance and an angle with reference to the previous point to locate a point. Angle is measured in anti-clock direction, taking 0° towards right.

The relative polar coordiante is representing in the following format.

Fig 3

RELATIVE POLAR CO-ORDINATE SYSTEM
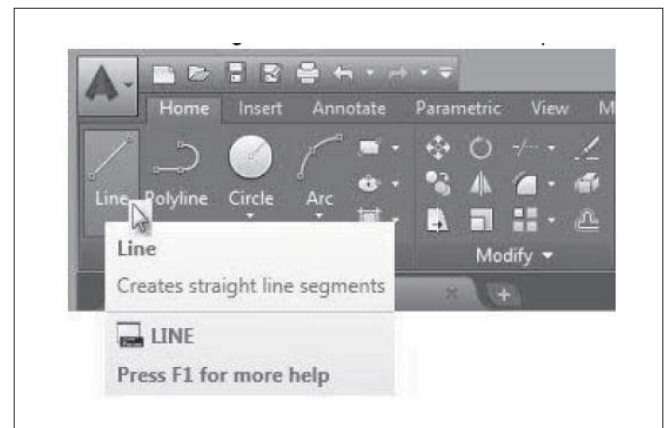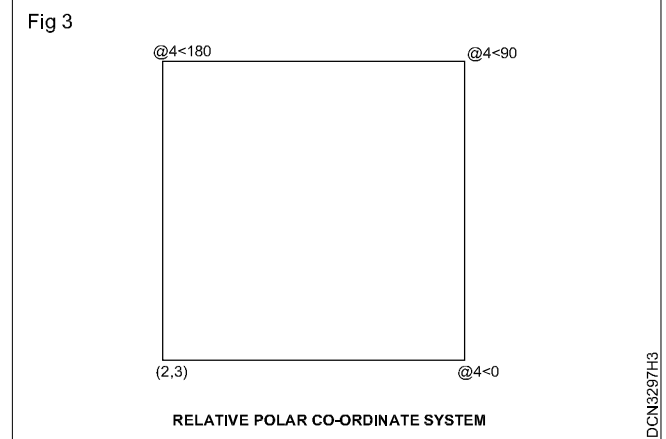
@Distance<angle

Command: _ line specify first point:2,3.

Specify next point or [undo]: @ 4<0.

Specify next point or [undo]: @ 4<90.

Specify next point or [close / undo]: @ 4<180.

Specify next point or [close / undo]:c.

Drawing lines with the line command

1 Move the graphics cursor to the first icon in the draw panel. This icon is the **line** icon. Note that a brief description of the line command appears next to the cursor.

2 Select the icon by clicking once with the **Left - mouse-button,** which will activate the line command.

3 In the command prompt area, near the bottom of the AutoCAD drawing screen, the message " - line specify point:" is displayed. AutoCAD expects us to identify the starting location of a straight line. Move the graphics cursor inside the graphics window and watch the display of the coordinates of the graphics cursor at the bottom of the AutoCAD drawing screen. The three numbers represent the location of the cursor in the X,Y, and Z directions. We can treat the graphics window as if it was a piece of paper and we are using the graphics cursor as if it were a pencil with which to draw.

We will create a freehand sketch of a five - point star using the Line command. Do not be overly concerned with the actual size or the accuracy of your freehand sketch.

4   We will start at a location about one - third from the bottom of the graphics window. Left - click once to position the starting point of our first line. This will be point 1 of our sketch. Next move the cursor upward and toward the right side of point 1. Notice the rubber band line that follows the graphics cursor in the graphics window. Left - click again (pint 2) and we have created the first line of our sketch.


```
x  Command: _line
/ - LINE Specify first point:
Model   Layout1   Layout2   *          0.81, 3.04, 0.00   MODEL
```



```
x  Resuming LINE command.
/ - LINE Specify next point or [Undo]: @0,2.5
Model   Layout1   Layout2   *
```

5   Move the cursor to the left of point 2 and create a horizontal line about the same length as the first line on the screen.

6   Repeat the above steps and complete the freehand sketch by adding three more lines (from point 3 to point 4, point 4 to point 5, and then connect to point 5 back to point 1).

7   Notice that the Line command remains activated even after we connected the last segment of the line to the starting point (point 1) of our sketch. Inside the graphics window, **Click once** with the **right - mouse-button** and a popup menu appears on the screen.
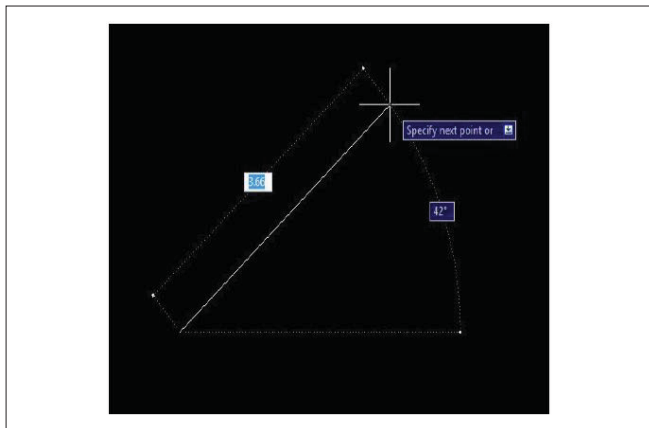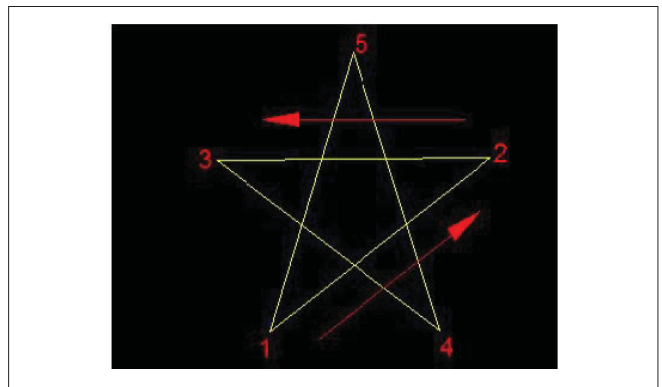
8   Select enter with the left - mouse - button to end the line command. (This is equivalent to hitting the [ENTER] key on the keyboard.)

9   Move the cursor near point 2 and point 3, and estimate the length of the horizontal line by watching the displayed coordinates for each point.
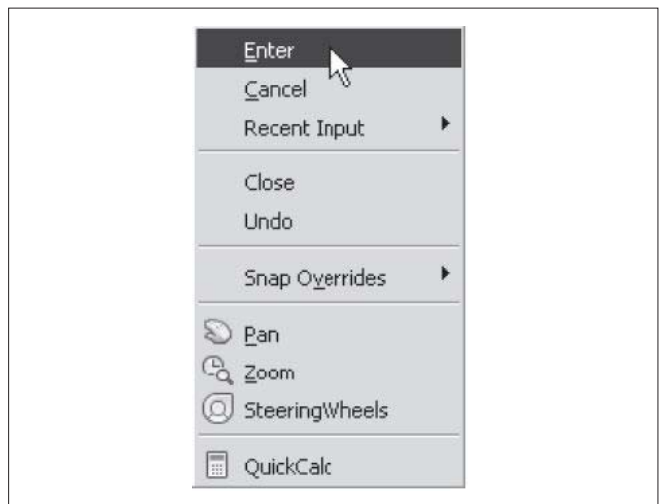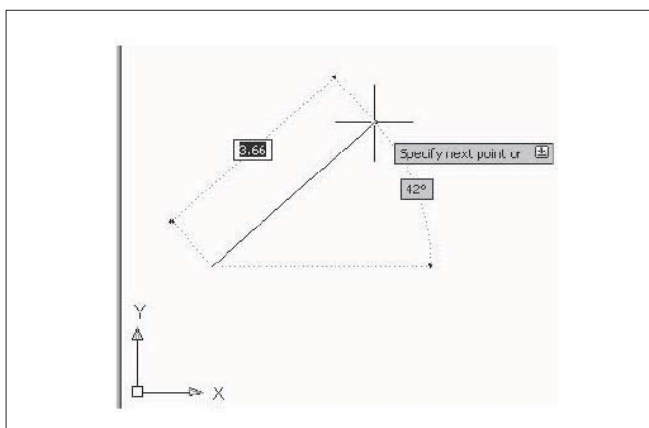
ERASE

There are 3 methods to **erase** (delete) objects from the drawing. You decide which one you preper to use. They all work equally well.

METHOD 1

Select the Erase command first and then select ther objects

1   Start the Erase command by using one of the following.

TYPING = E <enter>.

PULLDOWN = MODIFY / ERASE

TOOLBAR = MODIFY

2   Select objects: **Pick one or more objects**

Select objects: **Press <enter> and the objects will disappear.**

METHOD 2

Select the objects first and then the Erase command from the shortcut menu

1   Select the object (s) to be erased.

2   Prees the right mouse button.

3   Select **"Erase"** from the short - cut mentu.

METHOD 3

Select the objects first and then the delete key

1   Select the object (s) to be erased.

2   Press the delete key.

Very important : If you want the erased objects to return, press U <enter> or Ctrl + Z or the Undo arrow icon. This will "Undo" the effects of the last command.

Using the ERASE command

One of the advantages of using a CAD system is the ability to remove entities without leaving any marks. We will erase two of the lines usisnsg the Erase command.

1   Pick Erase in the modify toolbar. (The icon is a picture of an eraser at the end of a pencil.) The message "Select objects" is displayed in the command prompt arrea and AutoCAD awaints us to select the objects to erase.

2   Left - cllick the SNAP MODE button on the status bar to turn OFF the SNAP MODE option so that we can more easily move the cursor on top of objects. We can toggle the Status Bar options ON or OFF in the middle of another command.

3   Select any two lines on the screen; the selected lines are displasyed as dashed lines as shown in the figure below.

To deselect an object from the selection set, hold down the [SHIFT] keyand select the object again.
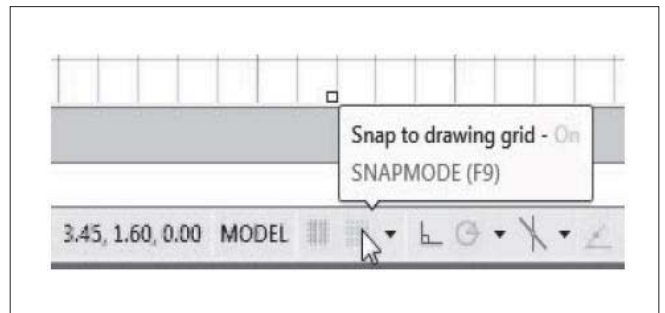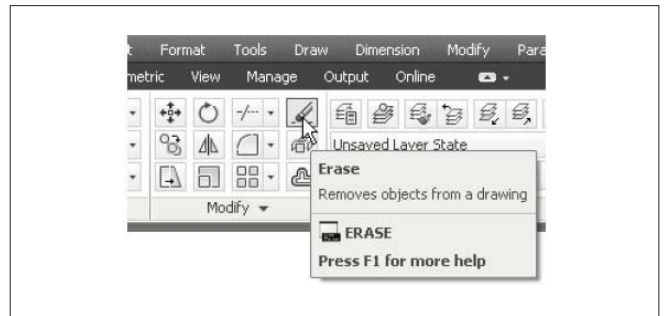
4   Right - mouse - click once to accept the selections. The selected two lines are erased.

The last command

1   Inside the graphics window, click once with the right-mouse-button to bring up the popup option menu.

2   Pick repeat erase, with the left - mouse - button, in the popup menu to repeat the last command. Notice the other options available in the popup menu.

3   Move the cursor to a location that is above and toward the left side of the entities on the screen. Left - mouse - click once to start a corner of a rubber - band window.

Move the cursor toward the right and below the entities, and then left-mouse-click to enclose all the entities inside the selection window. Notice all entities that are inside the window are selected.
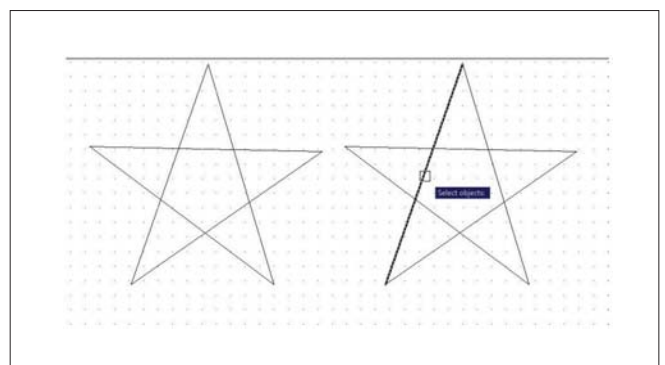
Inside the graphics window, right-mouse-click once to proceed with erasing the selected entities.

When your own create a free hand sketch of your chice using the line comman. Experiment with using the different commands we have discussed so far, Reset the satusbutton so that only the GRID DISPLAY option is turned ON as shown.

Fig 4

PRACTICE ON LINE COMMANDS

DCN3297H4

Practice - III (Fig 5)

Fig 5

PRACTICE ON ERASE COMMAND

DCN3297H5

Instructions

1 Start a **New** file. **(Fig 6)**

2 **Draw** the objects below using.

Draw / Line.

Ortho (f8) **ON** for **Horizontal** and **Vetical** Lines.

Ortho (f8) **OFF** for lines drawn on an **Angle**.

Increment Snap (f9) **ON**

Osnap (f3) **OFF**

Fig 6

PRACTICE ON LINE & ERASE COMMANDS

DCN3297H6
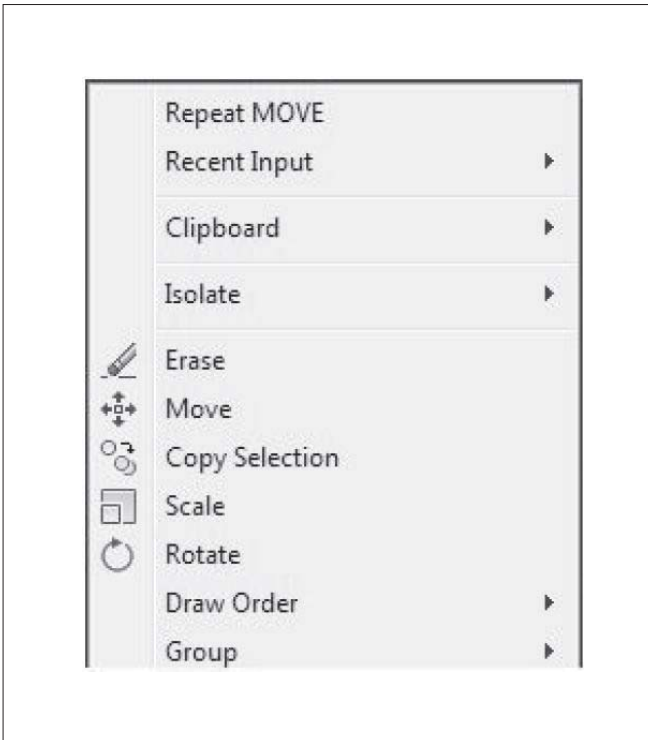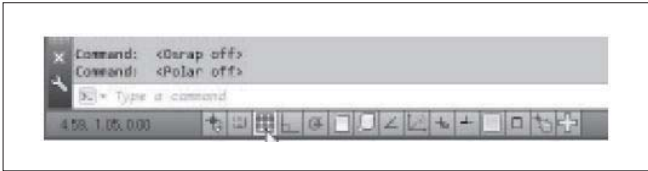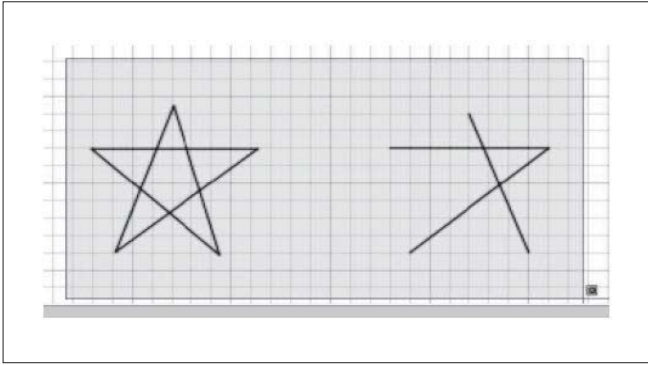
Practice - I

Instructions

1 Start a **New file**

2 **Draw** the objects below using

LINE command.

Ortho (f8) **ON** for **Horizontal** and **Vertical** lines.

Ortho (f8) **OFF** for lines drawn on an **Angle.**

Increment Snap (f9) **ON** Osnap (f3) **OFF.**

3 **Save** this drawing using:

Practice - II (Fig 4)

Instructions

1 Using drawing DRG NO **ERASE** the missing lines.

2 **Save** this drawing using:
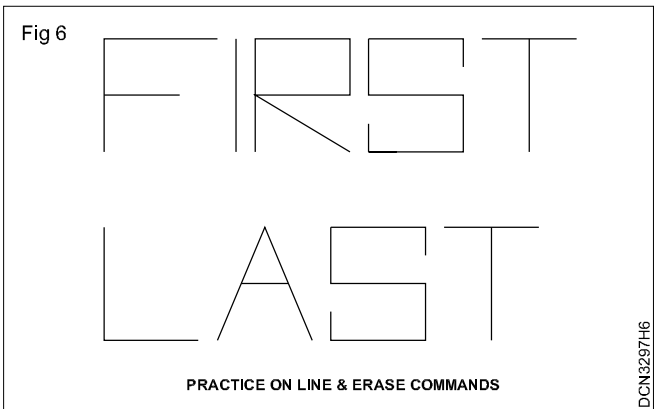
File / Save as / DRG NO.

3 **Save** this drawing using.

File / Save as DRG NO.

Practice - IV (Fig 7)

Instructions

1 Start a New file.

2 **Draw** the objects below using

Draw / Line.

Osnap (f3) **OFF.**

3 **Save** this drawing using.

File / Save as (give file name).

Fig 7

PRACTICE ON LINE COMMANDS

DCN3297H7
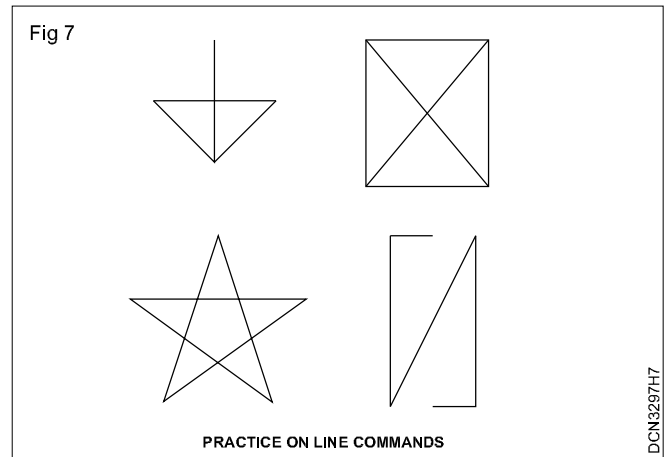
Basic commands - I

Objectives : At the end of this exercise you shall be able to
• **create circle**
• **create arcs**
• **creat polygon.**

Creating circles

The menus and toolbars is **AutoCAD 2013** are designed to allow the CAD operators to quickly activate the desired commands.
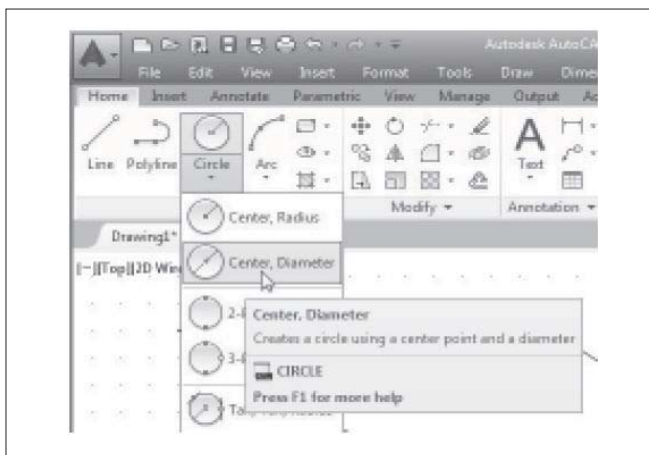
1 In the Draw toolbar, click on the little triangle below the circle icon. Note that the little triangle indicates additional options are available.

2 In th aws a circle based on two endpoints of the diameter.

Notice the different options available under the circle submenu.

• **Center, radius:** Draws a circle based on a center point and a radius.

• **Center, diameter:** Draws a circle based on a center point and a diameter.

• **2 points:** Draws a circle based on two.

• **3 Points:** Draws a circle based on three points on the circumference.

• **TTR - Tangent, Tangent, Radius:** Draws a circle with a specified radius tangent to two objects.

• **TTT - Tangent, Tangent, Tangent:** Draws a circle tangent to three objects.

Circle

AutoCAD provides the following ways of drawing circles.
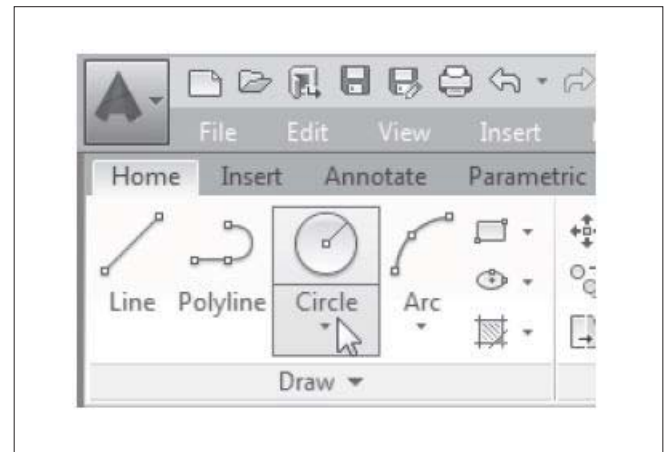
1 Centre and radius (Fig 1)

This is the classical method. The first point define the circle's center,

The second one radius

Example

Command.	: Circle or C.
3P / 2P / TTR /<Center point>.	: 200,200.
Diameter / <Radius>.	: 150.

Fig 1

PRACTICE ON CIRCLE COMMAND
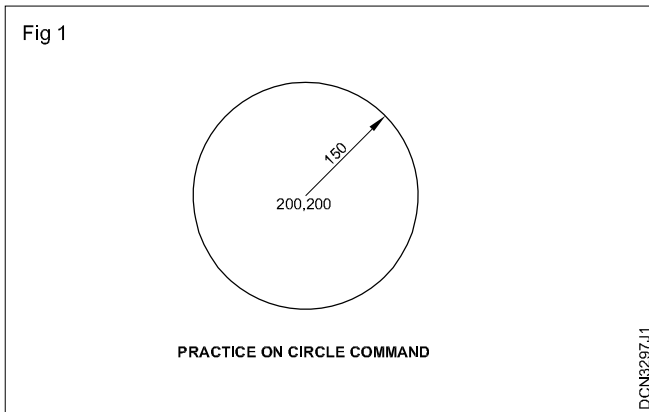
2 Centre and diameter (Fig 2)

After the circle's center has been defined the diameter can be given

Example

Command	: Circle or C
3P/2P/TTR/<Center Point>	: 200, 200
Diameter/<Radius>	: D
Diameter	: 300

Fig 2

PRACTICE ON CIRCLE COMMAND
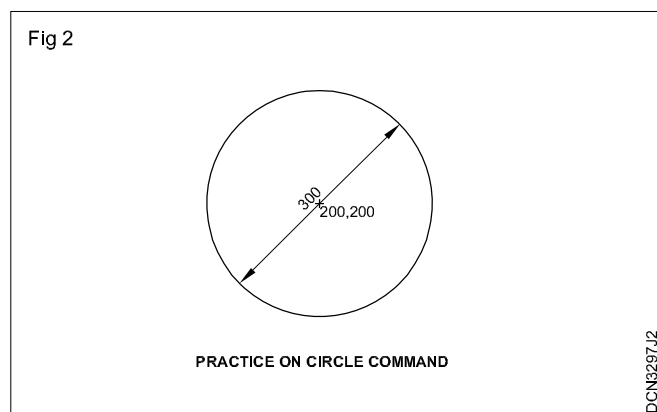
3 2 Points (Fig 3)

With this option, the user can specify two points constituting the end points of the circles diameter.

Example

Command	: Circle or C
3P/2P/TTT/<Center point>	: 2P
First point on Diameter	: 200,200
Second point on Diameter	: 400,400

Fig 3

PRACTICE ON CIRCLE COMMAND
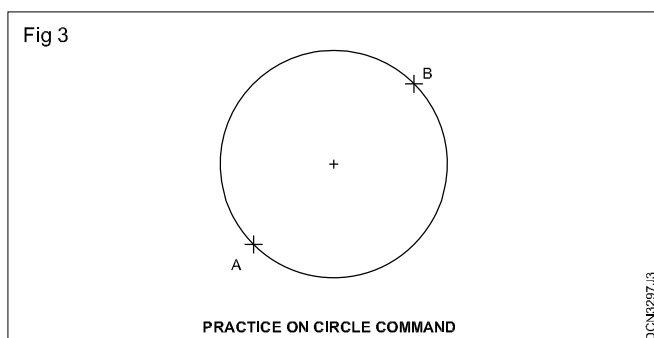
4 3 Points (Fig 4)

With this option the user can specify two points constituting the end points of the circles diameter.

Example

Command	: Circle or C
3P/2P/TTR/<Center point>	: 3P
First point on Diameter	: 200,200
Second point on Diameter	: 400,400
Third point on Diameter	: 300,350

Fig 4

PRACTICE ON CIRCLE COMMAND
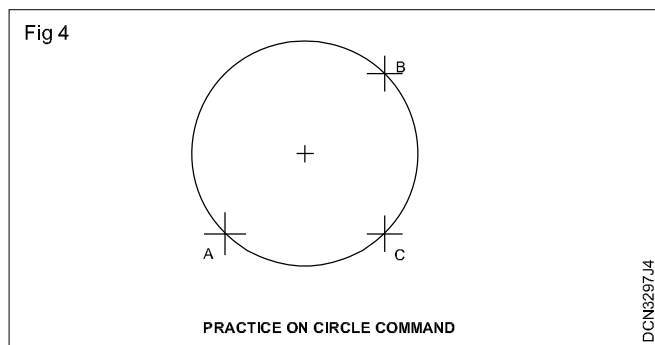
5 Tangent, tangent and radius (Fig 5)

This option allows the user to define two tangential points and then the circle's radius. In order to invoke this option it should have two entities draw. The circle can be drawn between Tangentially to two lines, two circles, or two Arc's or combination of any two.

Example

Command	: Circle or C
3P/2P/TTR/<Center point>	: TTR.
Enter Tangent Space	: Pick by using mouse on the entity drawn already.
Radius	: 100

AutoCAD procides 11 different ways of drawing Arcs.

Fig 5

PRACTICE ON CIRCLE COMMAND
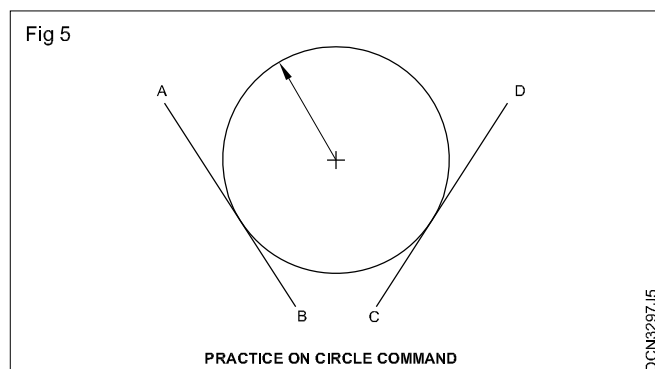
1 3 Points (Fig 6)

In this method three points define the Arc's Start point, Second point that the Arc passes through, and the arc's end point.

Fig 6

PRACTICE ON ARC COMMAND

175,225

125,220

200,200

Center refers to the center point of the circle of while the arc is a part.

Example

Command	: Arc or A
Center/<Start point>	: 400,400.
Center/End<Second point>	: C.
Center point	: 350,400.
Angle/Length of chord/<End point>	: 50,450.

3 Start point, centre, included angle (S,C,A) (Fig 8)

In this method first specify the start point of the arc, then the center point or the arc, and then the include angle between the start point and the end point of the arc.

Example

Command	: Arc or A
Center/<Start point>	: 400,400.
Center/End<Second point>	: C.
Center point	: 350,400.
Angle/Length of Chord/<End point>	: A.
Included Angle	: 90.

Fig 8

90°

(350,400)
(C.P)

(400,400)
(S.P)

PRACTICE ON ARC COMMAND
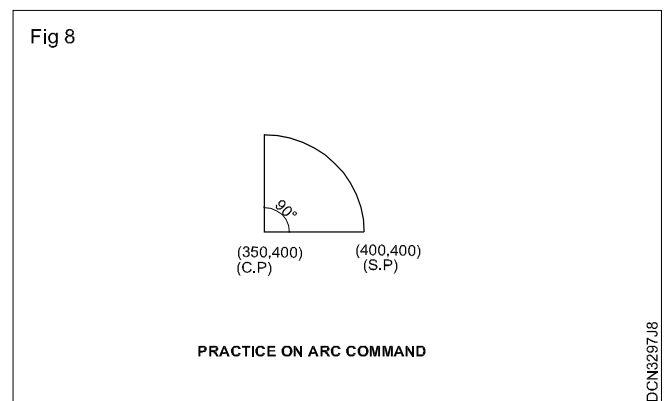
4 Start point centre, length of chord (S,C,L) (Fig9)

In this method first specify the start point of the arc, then the center point of the arc and then the chord length.

Example

Command	: Arc or A.
Center/<Start point>	: 400,400.
Center/End<Second point>	: C.
Center Point	: 350,400.
Angle/Length of Chord/<End point>	: L.
Length of Chord	: 80.

5 Start point, end point, radius (S,E,R) (Fig 10)

In this method first specify the start point of the arc, then the end point and finally the radius of the arc.

2 Start point, centre, end point (S,C,E) (Fig 7)

Fig 7

(350,450)
(E.P)

(350,400)
(C.P)

(400,400)
(S.P)

PRACTICE ON ARC COMMAND

Example

Command	: Arc or A.
Center/<Start point>	: 400,400.
Center/End<Second point>	: E.
End point	: 350,450.
Angle/Direction/Radius/<Center point>	: R.
Radius	: 75.

Fig 9

PRACTICE ON ARC COMMAND

(350,400) (C.P) L-80 (400,400) (S.P)

DCN3297J9

Fig 10

(350,450) (C.P) R-75 (400,400) (S.P)

PRACTICE ON ARC COMMAND

DCN3297JA
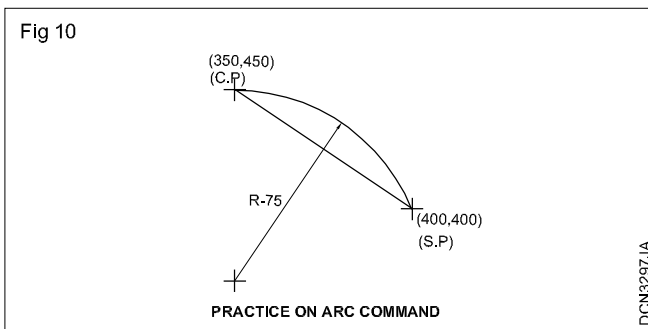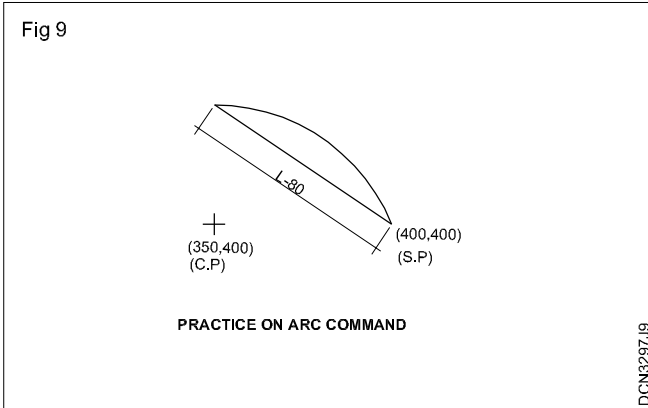
6 Start point, end point, included angle (S,E,A) (Fig 11)

In this method first specify the start point of the arc, then the end point and finally the included angle of the arc.

Example

Command	: Arc or A.
Cener/<Start Point>	: 400,400.
Center/End<Second point>	: E.
End point	: 350,450.
Angle/Direction/Radius/<Center poinmt>	: A.
Included angle	: 90.

7 Start point, end point, starting direction (S,E,D) (Fig 12)

In this method first specify the start point of the arc, then the end point and finally the starting direction of the arc from the start point.

Example

Command	: Arc or A.
Center/<Start point>	: 400,400.

Center/End<Second point>	: E.
End point	: 350,450.
Angle/Direction/Radius/<Center point>	: D.
Direction from start point	: 90.

Fig 11

(350,450) (E.P) 90° (400,400) (S.P)

PRACTICE ON ARC COMMAND

DCN3297JB

Fig 12

(350,400) (E.P) 90° (400,400) (S.P)

PRACTICE ON LINE COMMANDS

DCN3297JC
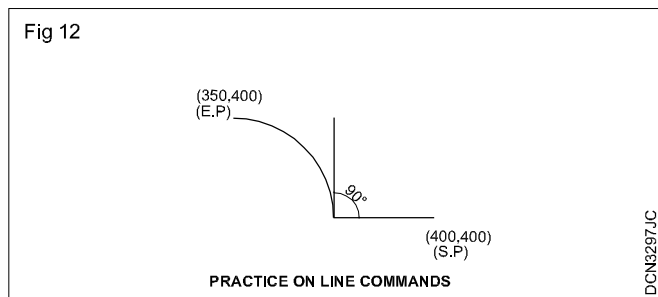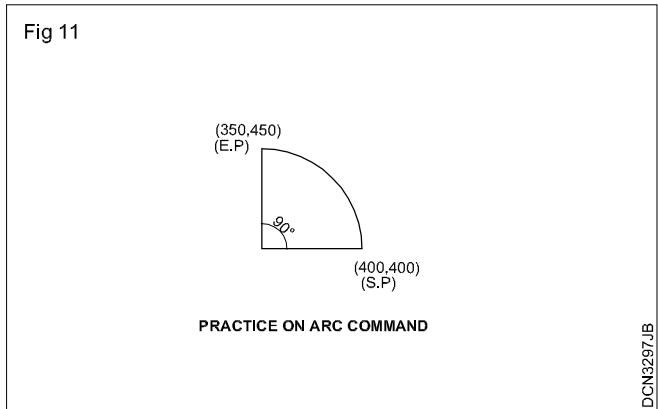
8 Start point, end point, centre point (S,E,C) Fig 13

In this method first specify the start point of the arc, then the end point and finally the center point of the arc.

Example

Command	: Arc or A.
Center/<Start Point>	:400,400.
Cener/End<Second point>	: E.
End point	: 250,450.
Angle/Direction/Radius/<Center point>	: 350,400.

Fig 13

(350,450) (E.P) (400,400) (S.P) (350,400) (C.P)

PRACTICE ON ARC COMMAND

DCN3297JD
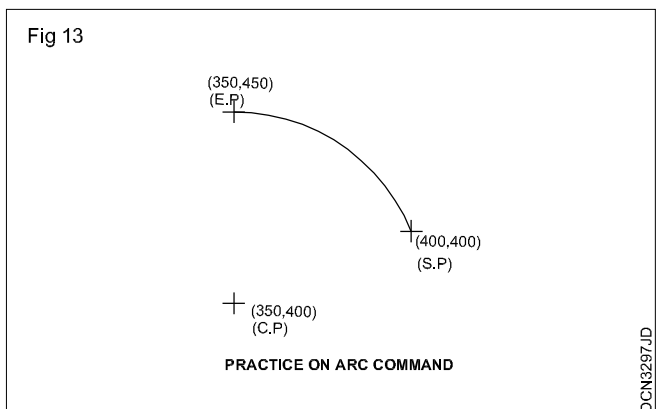
9 Centre point, start point, end point (C,S,E) (Fig 14)

In this method first specify the center point of the arc, then the start point and finally the end point of the arc.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.97

Example

Command	: Arc or A.
Center/<Start point>	: C.
Center point	: 350,400.
Stat point	: 400,400.
Angle/Length of chord/<End point>	: 350,450.

Fig 13

(350,450)
(E.P)

(350,400)
(C.P)

(400,400)
(S.P)

PRACTICE ON ARC COMMAND

DCN3297JE
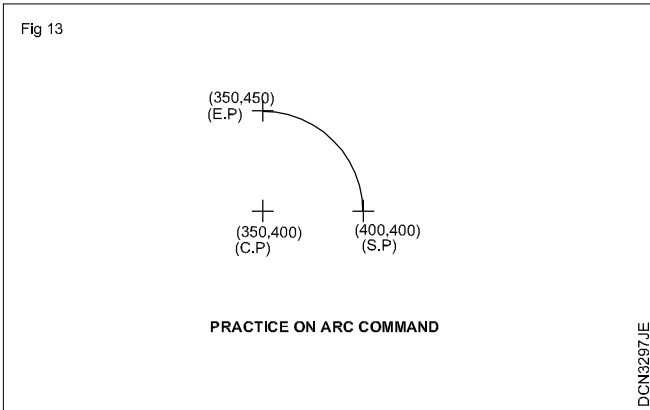
10 Centre point, start point, length of the chord (C,S,L) (Fig 15)

In this method first specify the center point of the arc, then the start point and finally the length of chord.

Example

Command	: Arc or A.
Center/<Start point>	: C.
Center point	: 350,400.
Stat point	: 400,400.
Angle/Length of chord/<End point>	: L.
Length of chord	: 75.

Fig 15

L-75

(350,400)
(C.P)

(400,400)
(S.P)

PRACTICE ON ARC COMMAND

DCN3297JF
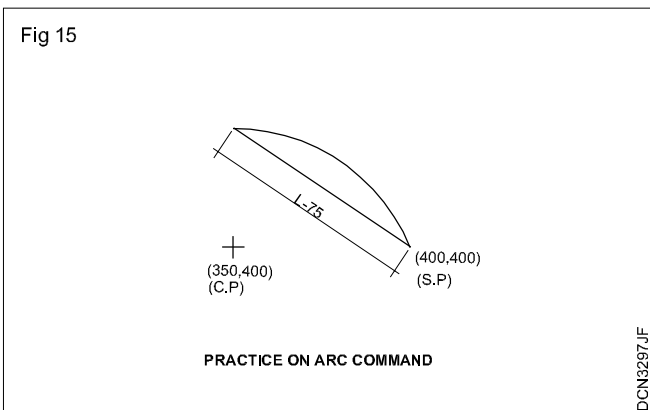
11 Centre point, start point, included angle (C,S,A) (Fig 16)

In this method first specify the center point of the arc, then the start point and finally the included angle.

Example

Command	: Arc or A.
Center/<Start point>	: C.

Center point	: 350,400.
Stat point	: 400,400.
Angle/Length of chord/<End point>	: A.
Included angle	: 90.

Fig 16

(350,450)
(E.P)

90°

(350,400)
(C.P)

(400,400)
(S.P)

PRACTICE ON ARC COMMAND

DCN3297JG
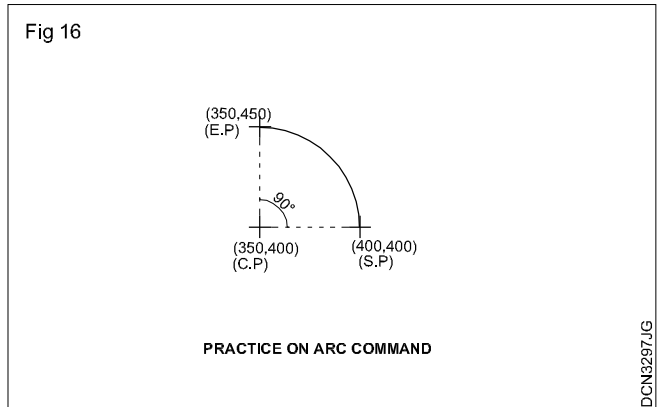
Ellipse

This command approximates an ellipse is to choose the default options:

1 Ellipse by axis and eccentricity (Fig 17)

Example

Command	: Ellipse or EL.
Axis end point of ellipse or (Arc/Center)	: 400,400.
Other end point of axis	: 500,400.
Distance to other axis or [Rotation]	: 75.

Fig 17

(400,400)   (500,400)

75

PRACTICE ON ELLIPSE COMMAND

DCN3297JH
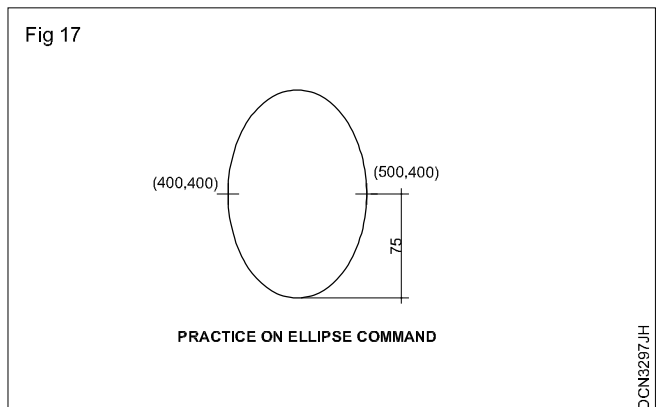
2 Ellipse by axis and rotation (Fig 18)
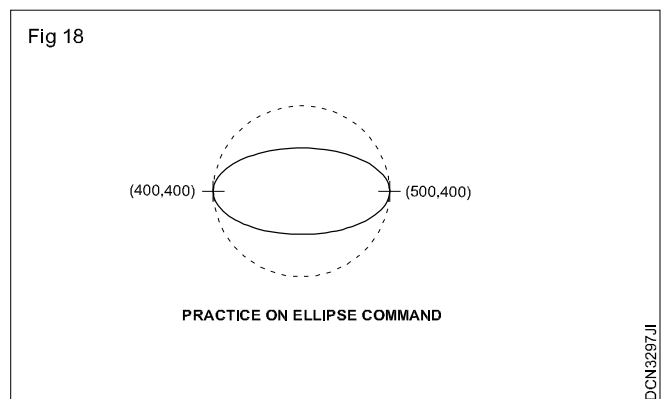
Fig 18

(400,400)   (500,400)

PRACTICE ON ELLIPSE COMMAND

DCN3297JI

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.97

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Example

Command	: Ellipse or EL.
Axis end point of ellipse or (Arc/center)	: 400,400.
Other end point of axis	: 500,400.
Distance to other axis or [Rotation]	: R.
Rotation around major axis	: 60.

3 Ellipse by centre and two axes (Fig 19)

Example

Command	: Ellipse or EL.
Axis end point of ellipse or (Arc/center)	:400,400.
Center of ellipse	: 400,400.
Axis end point	: 500,400.
Distance to other axis or [Rotation]	: 75.

Fig 19

PRACTICE ON ELLIPSE COMMAND

DCN3297JJ
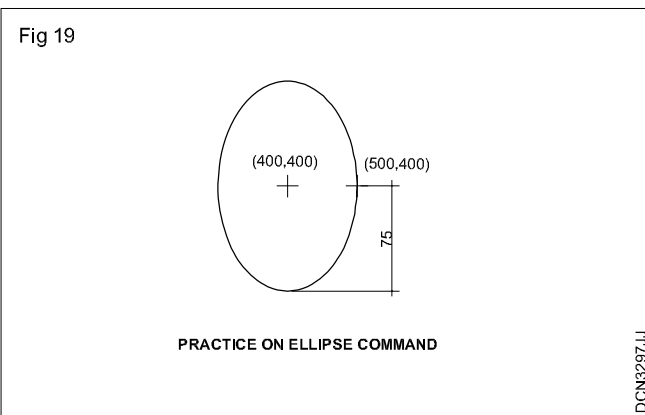
4 Ellipse by centre, one axis, and rotation (Fig 20)

Example

Command	: Ellipse or EL.
Axis end point of ellipse or (Arc/center)	: C.
Center of ellipse	: 400,400.
Axis end point	: 500,400.
Distance to other axis or [Rotation]	: R.
Rotation around major axis	: 60.

Fig 20

PRACTICE ON ELLIPSE COMMAND

DCN3297JK
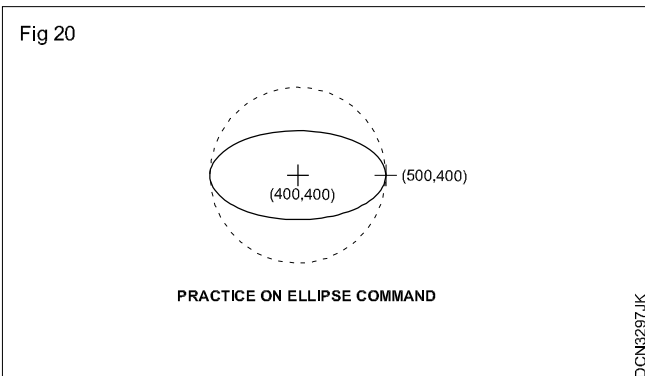
Polygon

This command allows the user to draw regular 2D polygons.

1 Centre of polygon, inscribed circel, radius (Fig 21)

Example

Command	: POL.
POLYGON Enter number of sides <default>	: 6.
Center of polygon or [Edge]	: 400,400.
[Inscribed in circle/ Circumscribed about circle]<I>	: I.
Specify radius of circle	: 50.

Fig 21

PRACTICE ON POLYGON COMMAND

DCN3297JL
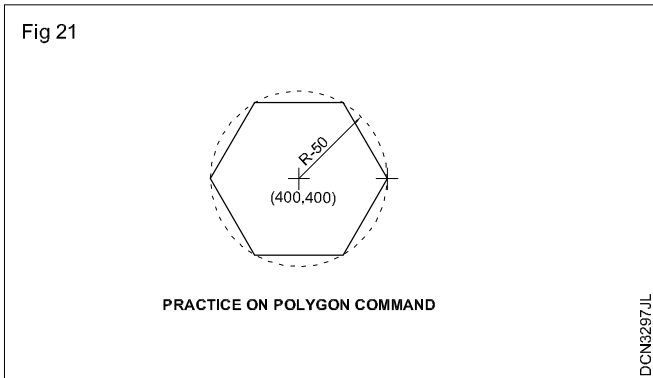
2 Centre of polygon, circumscribed about circle radius of circle (Fig 22)

Example

Command	: Polygon/POL.
POLYGON Enter number of sides<default>	: 6.
Center of polygon or [Edge]	: 400,400.
[Inscribed in circle/ Circumscribed about circle]<I>	: C.
Radius of circle	: 50.

Fig 22

PRACTICE ON POLYGON COMMAND

DCN3297JM
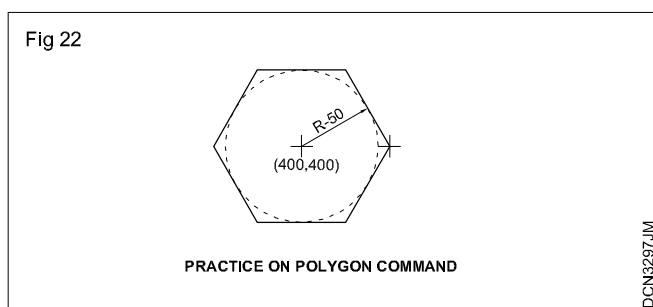
3 Edge option (Fig 23)

Example

Command	: Polygon/POL
POLYGON Enter number of sides <default>	: 6.
Center of polygon or [Edge]	: E.
First end point of edge	: 400,400.
Second end point of edge	: 400,500.

PRACTICE ON POLYGON COMMAND

Fig 23

(400,500)
(400,400)

PRACTICE ON DOUGHNUT COMMAND
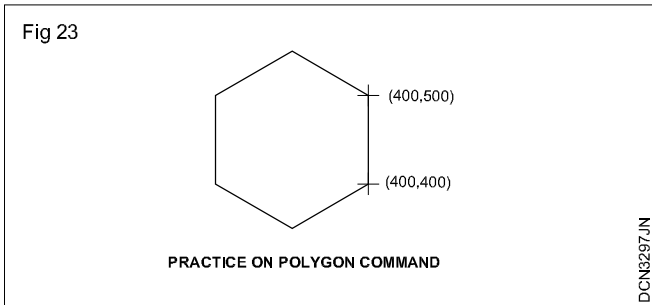
Fig 25

Doughnut (Donut) (Fig 24)

This command allows the user to draw filled circles and rings

Example of filled circle option

Command	: Donut.
Inside diameter <default>	: 0.
Out side diameter <default>	: 50.
Center of doughnut	: 100,100.

PRACTICE ON DOUGHNUT COMMAND

Fig 24
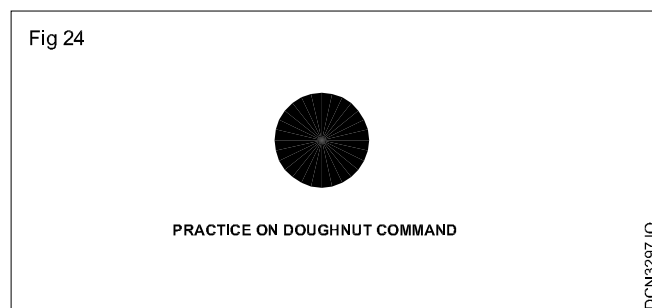
Example for rings (Fig 25)

Command	: Donut.
Inside diameter <default>	: 30.
Out side diameter <default>	: 50.
Center of doughnut	: 100,100.

Fig 26
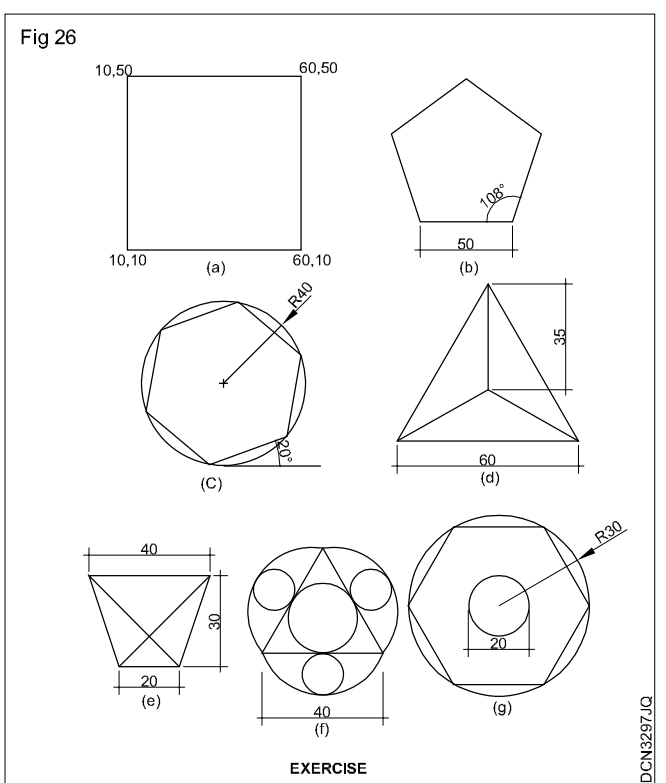
EXERCISE

Basic commands - II

Objectives : At the end of this exercise you shall be able to
• **erase oops move copy offset rotate**
• **scale fillet trim champer extend break**
• **join mirror array strech lengthen explode.**

Modifying commands

Modifying commands are used for modifying the existing drawings. Thus it helps to prepare a final drawing incorporating the necessary changes and a lot of time is saved. Modifying commands are properties, erase, copy, mirror, offset, array,move,rotate, scale, trim, extend, explode etc.

1 Erase (Fig 1)

This command allows the user to specify entities permanently removed from the drawing. The selection can be made with any of the standard SELECT OBJECT method.

Fig 1

BEFORE ERASE   AFTER ERASE
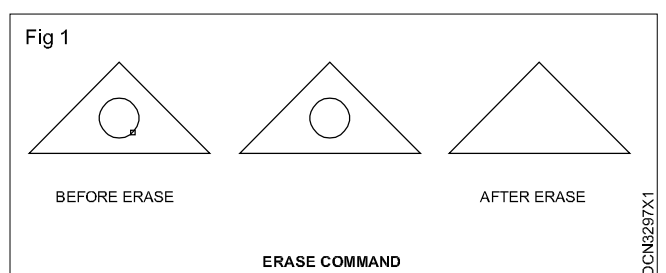
ERASE COMMAND

Tool bar	: Modify, Erase.
Pull down	: Modify, Erase.
Command	: Erase./ E.

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Example

Command   : Erase or E.

Select objects   : Select the objects using mouse.

Select objects   :

2 Oops (Fig 2)

This command restore objects that have been unexpectedly erased by the previous ERASE command

Example

Command   : Erase or E

Select objects   : Select the objects using mouse

Command   : Oops

Fig 2

BEFORE ERASE   AFTER ERASE   AFTER OOPS
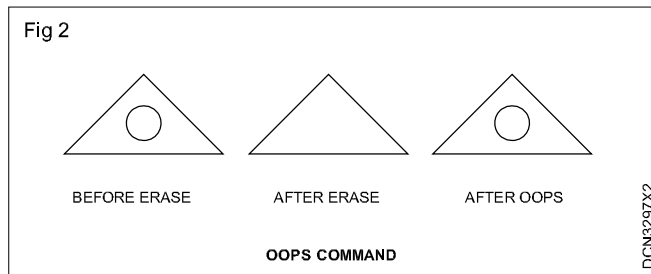
OOPS COMMAND

3 Move (Fig 3)

This command is used to move a single or a set of objects to a new location on a drawing.

Tool bar	: Modify, Move.
Pull down	: Modify, Move.
Command	: Move / M.

Example

Command	: Move or M.
Select objects	: Select circle.
Select objects	: One found.
Select objects	:
Base point or displacement	: Click A as basepoint.
Second point of displacement	: Select B.

Fig 3

BEFORE MOVE

AFTER MOVE
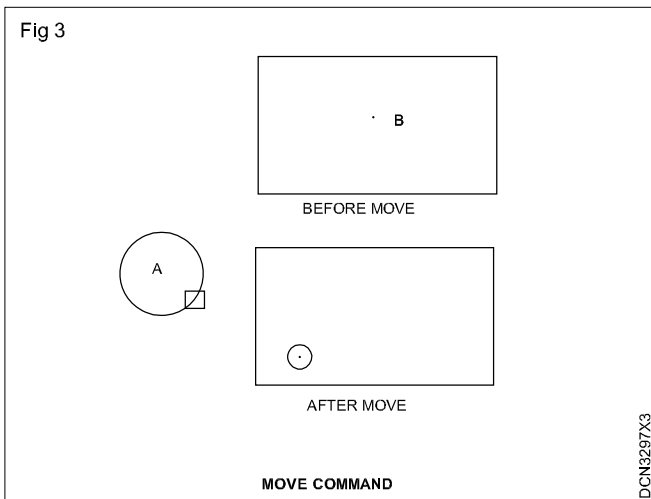
MOVE COMMAND

4 Copy (Fig 4)

Tool bar	: Modify, Copy.
Pull down	: Modify, Copy.
Command	: Copy.

This command is used to copy the existing drawing to another place.

Example

Command	: Copy or Co or CP
Select objects	: Select object to Copy
Select objects	: One found
Base point or displacement	: Select a base point.
Second point of displacement	: Drag cursor at desired place and click mouse.

Fig 4

A   B   A   B

D   C   D   C

BEFORE COPY   AFTER COPY

COPY COMMAND
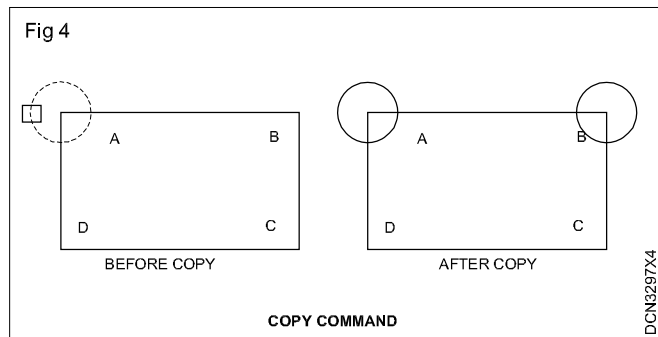
5 Offset (Fig 5)

Tool bar	: Modify, Offset.
Pull down	: Modify, Offset.
Command	: Offset / O.

Fig 5

BEFORE OFFSET

10

AFTER OFFSET
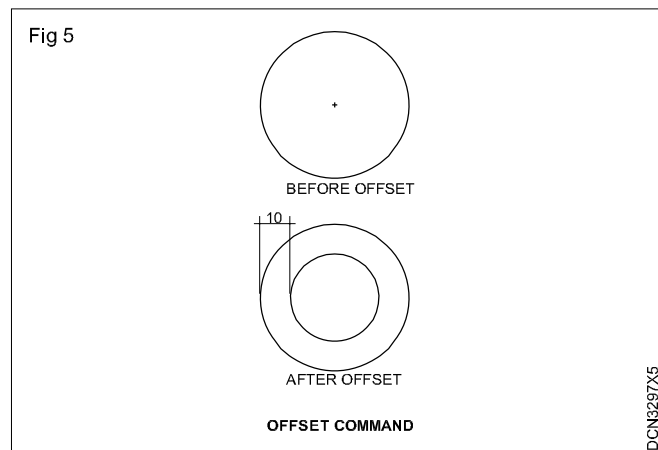
OFFSET COMMAND

This command is used to draw parallel lines, concentric circle, arcs etc. When offset is used, it is necessary to specify the offset distance and side of offset.

Command	: Offset or O.
Offset distance or through <current>	: 10.
Select the object	: Select the circle.
Side to offset	: Specify the side for offsetting.

6 Rotate (Fig 6)

This command is used to rotate an object or set of objects to a specified angle.

Tool bar	: Modify, Rotate.
Pull Down	: Modify, Rotate.
Command	: Rotate / Ro.
Example	
Command	: Rotate / Ro.
Select objects	: Select the object by window.
Select objects	: Three found.
Select objects	:

Specify base point or displacement: Click A as basepoint.

Specify rotation angle or [Copy / Reference] < default>:

Specify rotation angle or [Copy / Reference] < default>: 20.

Fig 6

ROTATE COMMAND
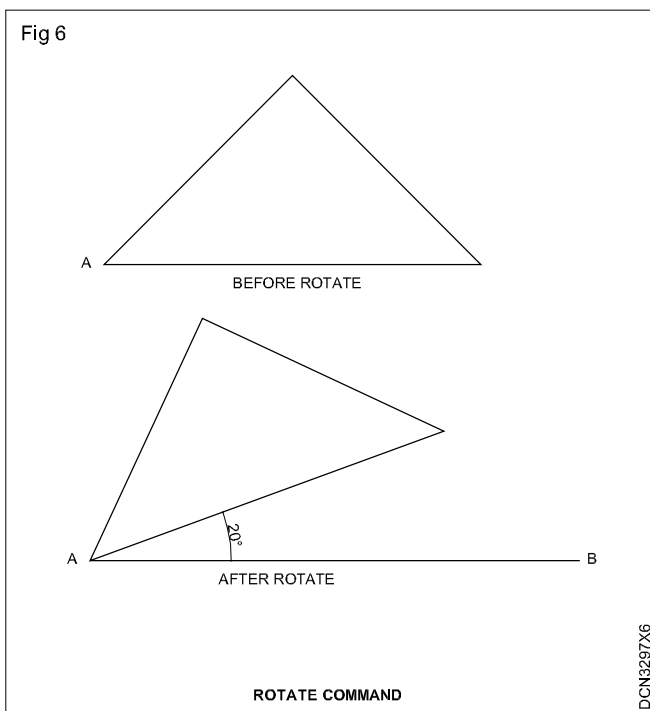
7 Scale (Fig 7)

This command is used to change the size of an object

Tool bar	: Modify, Scale
Pull down	: Modify, Scale
Command	: Scale / SC
Example	
Command	: Scale / SC
Select objects	: Select the object by window.
Select objects	: Three found.
Select objects	:
Specify scale factor or [Copy/Reference]<Default>	: 2.

Fig 7
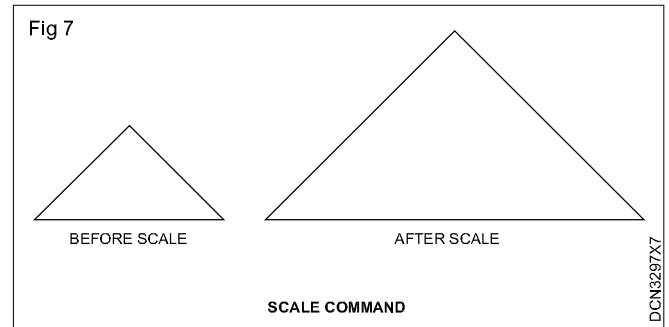
SCALE COMMAND

8 Fillet (Fig 8)

This command is used to connect two parallel lines, arcs etc., smoothly by a curve of specified radius.

Tool bar	: Modify, Fillet.
Pull down	: Modify, Fillet.
Command	: Fillet or F.
Example	
Command	: Fillet or F
Current settings	: TRIM, Radius = 0,0000

Select first object or [Undo/Polyline/Radius/Trim/Multiple]: R

Specify fillet radius<0.0000>

Select first object or [Undo/Polyline/Radius/Trim/Multiple]: Select A

Select second object or shift - selected to apply corner: Select B

Fig 8

FILLET COMMAND
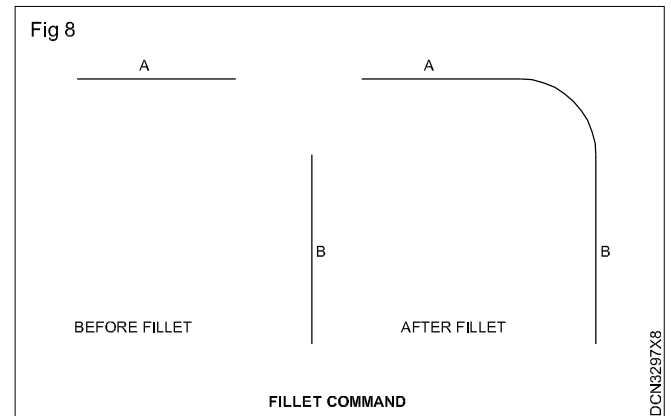
9 Trim (Fig 9)

This command is used to removed a part of a line, circle or arc based on a cutting edge.

Tool bar.	: Modify, Trim.
Pull Down.	: Modify, Trim.
Command	: Trim or TR
Example	
Command	: TR TRIM.

Select objects or <Select all>: Select cutting edge, 1 found

Select objects:

Fig 9

CUTTING EDGE

BEFORE TRIM

AFTER TRIM
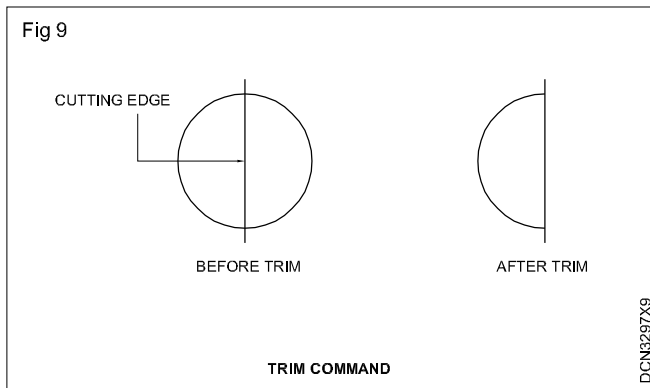
TRIM COMMAND

Select object to trim of shift - select to extend or

[Fence / Crossing / Project / Edge / eRase / Undo]: Select object to trim.

Select object to trim or shift - select to extend or

[Fence / Crossing / Project / Edge/ Erase/ Undo]:

10 Chamfer (Fig 10)

This command is used to join two non parallel lines with an intermediate line. It produces an inclined surface at the edge of two intersetting lines.

Tool bar   : Modify, Chamfer.

Pull down   : Modify, Chamfer.

Command   : Chamfer or CHA.

Example

Command   : Chamfer or CHA.

(TRIM mode) Current chamfer Dist1 <Default>, Dist2 <Default>.

Select first line or [Undo Polyline/Distance/Angle/.

Trim/mEthod/Multiple]   : D.

Specify first chamfer distance <0.5000>.

Specify second chamfer distance <3.0000>.

Select first line:

Select second line:

Fig 10

BEFORE CHAMFER

AFTER CHAMFER

CHAMFER COMMAND
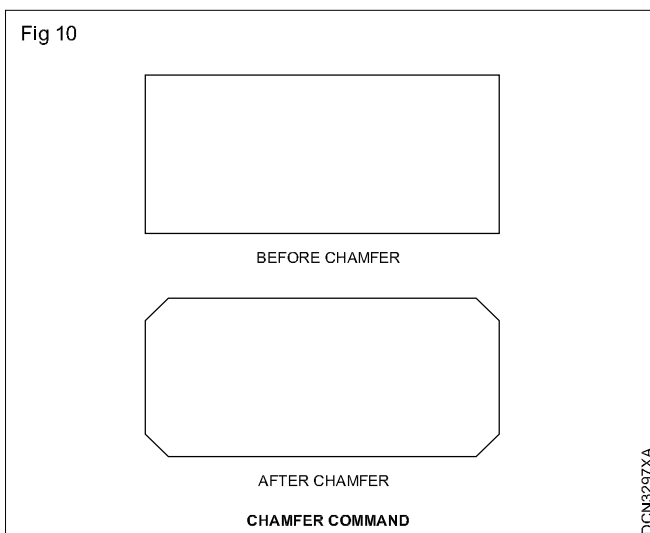
11 Extend (Fig 11)

This command is used to extend the shorter lines to meet another object.

Tool bar   : Modify, Extend.

Pull down   : Modify, Extend.

Command   : Extend or EX.

Example

Command   : Extend or EX.

Select boundary edges.

Select objects or <Select all>   : Select A, 1 found.

Select objects:

Select object to extend or shift - select to trim or [Fence/Crossing/Project/Edge/Undo]:Select B.

Select object to extend or shift - select to trim or [Fence/Crossing/Project/Edge/Undo]:

Fig 11

BOUNDARY EDGE

A   B   A   B

BEFORE EXTEND   AFTER EXTEND

EXTEND COMMAND
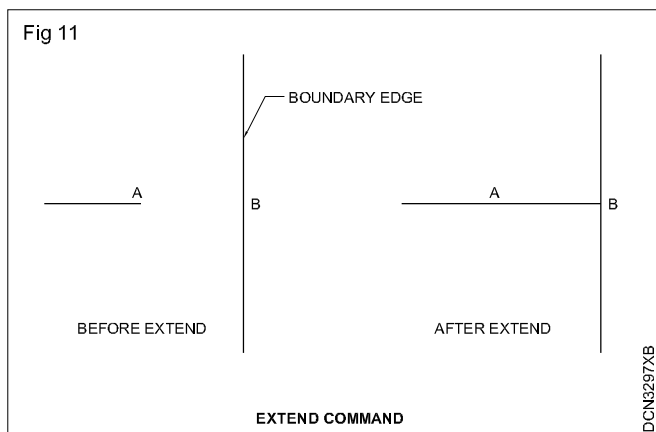
12 Break (Fig 12)

This command is used to erase a part of an object between two points.

Tool bar   : Modify, Break.

Pull Down   : Modify, Break.

Command   : Break or BR.

Example1   : To break a line

Command   : Break or BR.

Select objects   : Select A.

Specify second break point   : Select B.

Fig 12

A   B   A   B

BEFORE BREAK   AFTER BREAK

BREAK COMMAND
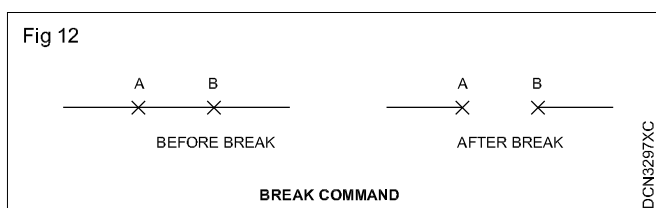
13 Join (Fig 13)

This command is used to join two lines.

Tool bar : Modify, Join.

Pull down : Modify, Join.

Command : Join or J.

Example

Command : Join or J. Select source object.

Select lines to
join to source : Select A and B.

Fig 13

BEFORE JOIN   AFTER JOIN

JOIN COMMAND
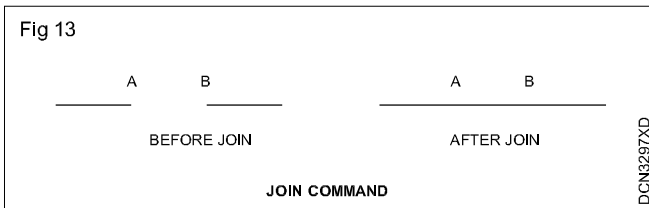
14 Mirror (Fig 14)

Tool bar : Modify, Mirror.

Pull down : Modify, Mirror.

Command : Mirror or MI.

This command is used to create a miror image of the select objects. After selecting the objects the beginning point and end point of a mirror line is entered.

Example

Command : Mirror.

Select object : Select the object.

Select object :

First point of
mirror line : Specify the first point.

Second point : Specify the second point.

Delete old object ?
retaining <N> : Enter Y for deletion, N for the previous object.

Fig 14

MIRROR LINE

END POINT 1

ORIGINAL OBJECT   MIRRORED OBJECT
END POINT 2

MIRROR COMMAND
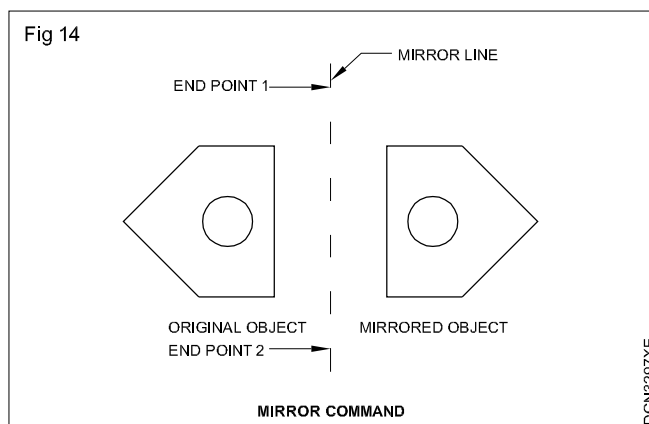
15 Array (Fig 15)

Tool bar : Modify, Array.

Pull down : Modify, Array.

Command : Array or AR.

This command is used to make multiple copies of an object in rectangular or polr (circulr) patterns.

Example : 1

Command : Array.

Select objects : Select circle of radius 5.

Rectangular or polar
array (R/P) : R.

Number or rows
(----) <1> : 4.

Number of columns
(III) <1> : 3.

Unit cell or distance
between Rows (----) : 3.

Distance between
columns (III) : 3.

Example : 2

Command : Array.

Select objects : Select circle C1.

Rectangular or
polar Aarray (R/P) : P.

Base /<Centre point
of Array> : Select circle C2.

Number or Items : 4.

Angle to fill <360> : Press to acept 360°.

Rotate objects as they
are copied ? <Y> : Enter Y or N.

Fig 15

BEFORE ARRAY   AFTER ARRAY

C1   C1

C2   C2

BEFORE ARRAY   AFTER ARRAY

ARRAY COMMAND
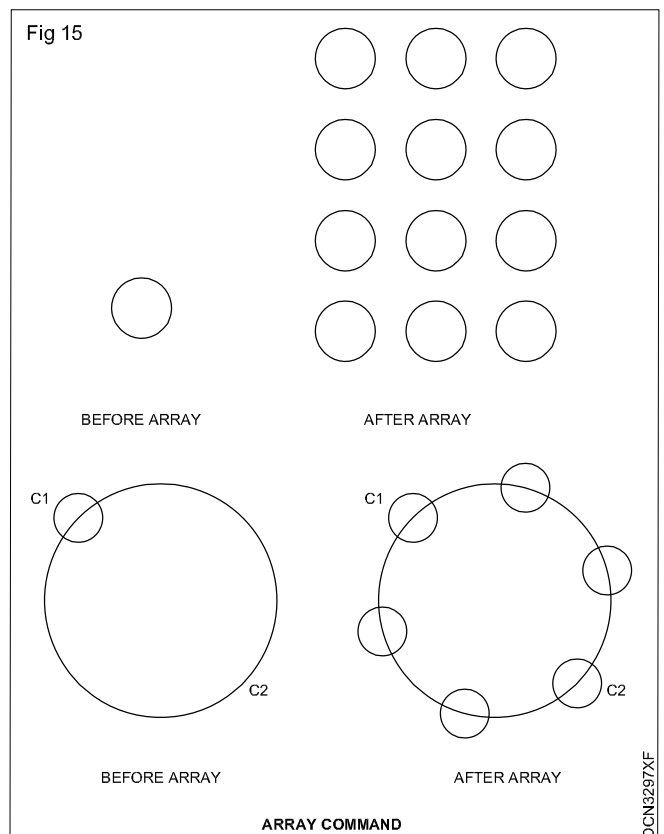
16 Strech (Fig 16)

Tool bar   : Modify, Strech.

Pull down   : Modify, Strech.

Command   : Strech or S.

This command is used to lenghten or shorten the line or objects.

Example   : 1

Command   : STRETCH.

Select objects to stretch by crossing - window

Select objects   : Select A and B by crossing - window.

Select objects   :

Specify base point or [Displacement] <Displacement>.

Specify second point: Mouse click at C.

Fig 16

BEFORE STRETCH   AFTER STRETCH

STRETCH COMMAND

DCN3297XG
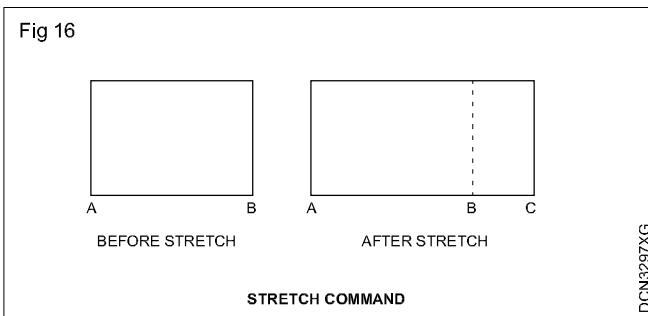
17 Lenthen (Fig 17)

Tool bar   : Modify, Lengthen.

Pull down   : Modify, Lengthen.

Command   : Lengthen or LEN.

This command is used to lengthen or shorten a line.

Example   : 1

Command   : LEN or LENGTHEN.

Select an object or [DElta/Percent/Total/Dynamic]: T

(Current length: 10).

Specify total length of [Angle] <1.0000)>:15.

Select an object to change or [Undo]: Select line AB

Select an object to change or [Undo]

Fig 17

BEFORE LENGTHEN   AFTER LENGTHEN

LENGTHEN COMMAND

DCN3297XH
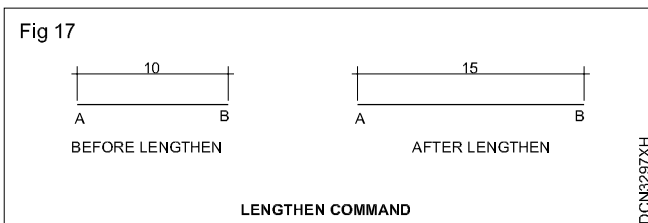
18 Explode (Fig 18)

Tool bar   : Modify, Explode.

Pull down   : Modify, Explode.

Command   : Explode or X.

This command will split the component objects such as blocks, polylines, regions etc. If you explode a ployline the result will be ordinary lines or arcs.

Example   : 1

Command : EXPLODE or X.

Select an object : Select the rectangle.

Fig 18

BEFORE EXPLODE   AFTER EXPLODE
SINGLE OBJECT   4 OBJECTS AB, BC, CD & AD

EXPLODE COMMAND

DCN3297XI
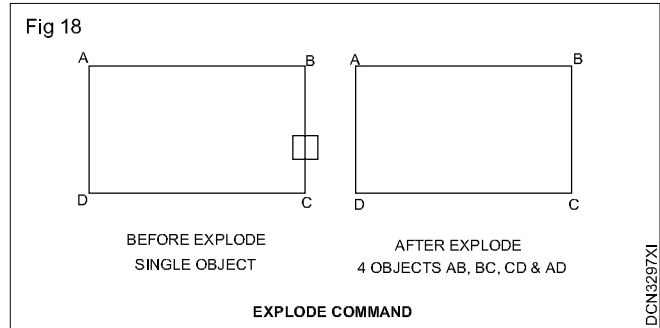
19 SCALE (Fig 19)

Choose   Modify, Scale.

Click   the Scale icon.

Type   SCALE at the command prompt.

             Command : SCALE.

             Select objects: (Select Objects).

Pick   A pivot point to scale about base point : (point).

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

             or

Pick   A scale factor< Scale Factor>/ Reference: (Point).

             Scale factor / Reference: (points).

Scale by specifying length

Fig 19

SCALE COMMAND

DCN3297XJ
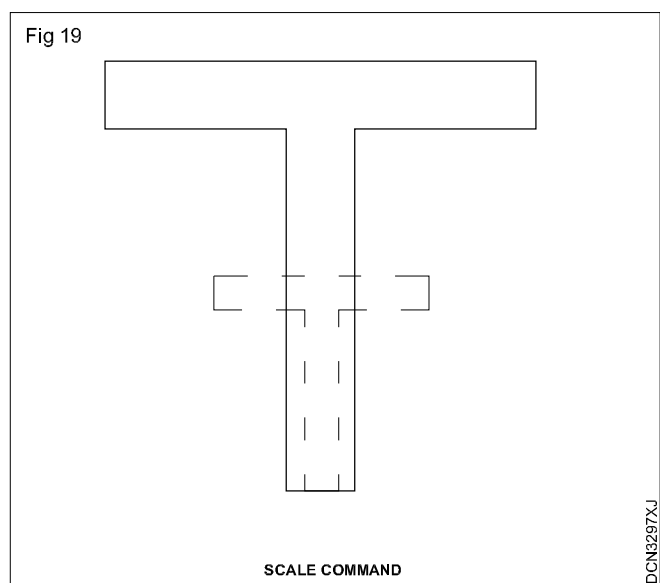
You can show AutoCAD the reference length (by pointing to the two endpoints of a line to be scaled), and then specify the new length. You can specify the new length by pointing, or by dragging the object.

1	Type	R to define a reference length
		Scale factor / Reference: (R)
2	Choose	A reference scale factor.
		Reference length; (number or points)
3	Choose	A new scale factor.
		New length: (number of points) .

can be closed to form enclosed to form enclosed shapes. A closed multiline automatically joins the beginning and end of the shape. When you are drawing a multiline shape, the command option 'c' closes the shape otherwise just press enter to finish the command.

Editing multiline (Fig 20)

Fig 20

EXERCISE

DCN3297XK
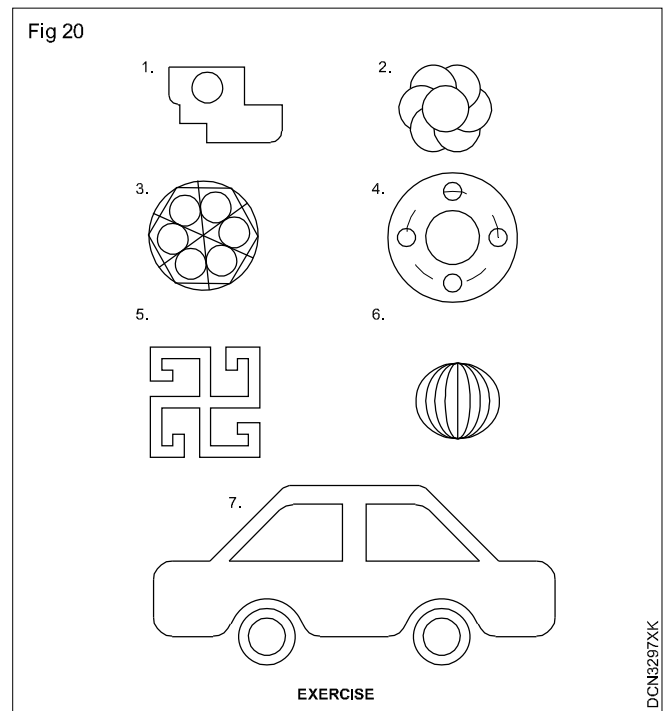
Basic commands - III

Objectives : At the end of this exercise you shall be able to
• **point rectangle**
• **revision cloud spline multilines**
• **construction line (xline) ray hatch.**

1 Point

This command is used to display a point on the screen (Drawing area).

Command   : Point.

Point   : 5,6.

Changing the point type.

Normally the point appears as a dot on the screen, the style in these dialog box by clicking the pointing device (mouse) then select the OK button.

Command   : PDMODE.

Pull down   : Format, point style.

While using the pull - down menu, the point style dialogue box will appear select a point style in this dialog box by clicking the pointing device (mouse) then select the OK button.

Command   : PDMODE.

New value for PDMODE<current>: Enter new value (2) .

Command   : Point.

Point   : (2.2).

2 Rectangle

This command is used to draw Rectangle.

Example

Command   : RECTANGLE / REG.

First comer or (Chamfer / Elevation / Fillet / Thickness / Width) : 2,1

Other corner (Area / Dimension / Rotation): 5,6.

Chamfer   : Used for chamfering the edges.

Fillet   : Used for filleting the edges.

Width   : to change the width.

Thickness: allows to draw rectangle that projects in Z-direction by the specified value of thickness.

Elevation: allows to draw a rectangle at a specified distance from the XY-plane along the Z-axis.

3 Poly line

This command is used to draw poly lines. The PLINE command functions like the LIKE command with additional option like arc, length, width, etc.

Example

Command   : P LINE.

Start point   : select a point.

Current the width is 0.0000.

Next point or (Arc / Half width / Length / Undo / Width):

Select P1.

Next point or (Arc / Close / Half width / Length / Undo / Width): Select P2.

1 **Width:** To change the width of the poly line, enter W atlast prompt. It asks you to enter the starting width and ending width of the poly line.

2 **Undo:** This erase the most recently drawn poly line segment. This can be invoked by entering U at the last prompt.

3 **Length:** This asks you to enter the length of a new poly line segment. This can be invoked by entering U at the last prompt.

4 **Half width:** This is used to specify the starting and ending hald width or a poly line. This can be invoked by entering H at last prompt.

5 **Arc:** This is used to draw poly arcs from the previous point. It provides the various option for drawing poly arcs. The Arc option can be invoked by entering a last prompt.

4 Revision cloud (Fig 1)

This command is used to high light your mark-ups.

Example

Command : REVCLOUD.

Minimum arc length: 2.0000 Maximum arc length: 3.0000 Style: Normal specify start point or (Arc length / object / Style) <Object>: Specify start point.

Guide crosshairs along cloud path:

Revision cloud finished.

Fig 1

REVISION CLOUD COMMAND
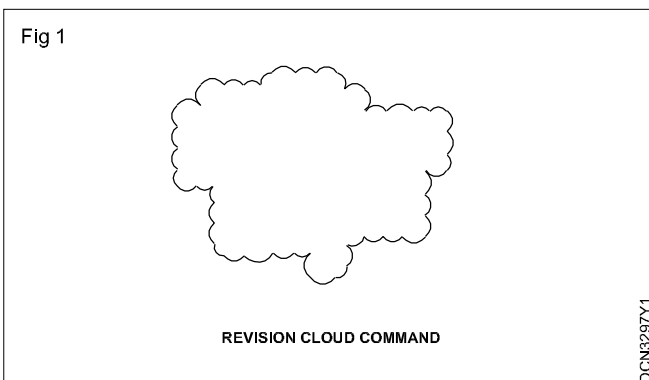
5 Spline (Fig 2)

Example

Command : SPLINE.

Specify first point or [Object]: Click on the first point.

Specify next point: <Ortho off>.

Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

Specify next point or [Close/Fit tolerance] <start tangent>: Enter.

Fig 2

SPLINE COMMAND
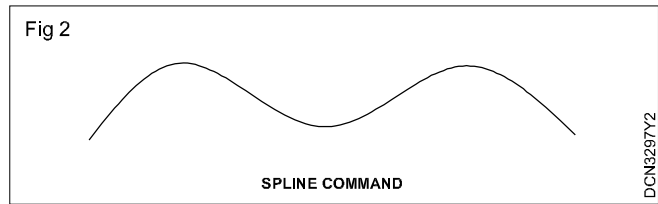
Practice 1: Instructions (Fig 3)

1 Start a New file and select 1 workbook helper. Dwt.

2 Draw the objects below using:

DRAW / LINE.

ORTHO ON for Horizontal lines.

OBJECT SNAP = ENDPOINT.

3 Save this drawing as. (Fig 3A)

Fig 3

LINE COMMAND

Fig 3A

LINE COMMAND
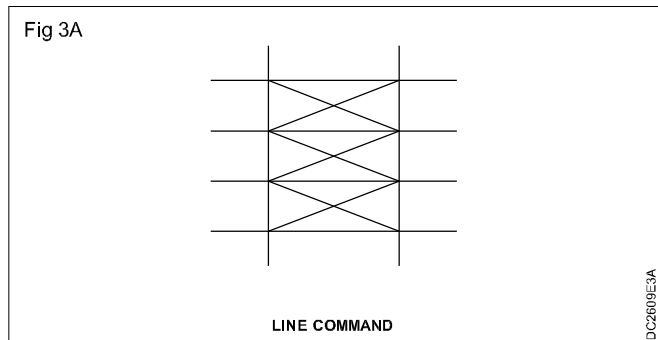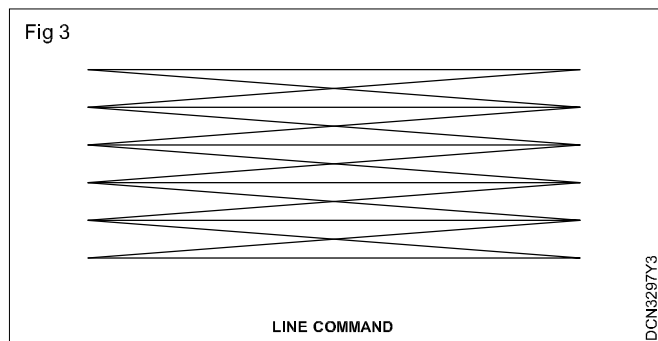
Practice 2: Instructions a (Fig 4)

1 Start a New file and select 1 workbook helper. Dwt

2 Draw the 2 vertical and 4 horizontal lines using.

DRAW / LINE.

ORTHO (F8) = ON.

SNAP (F9) = OFF.

3 Then draw the diagonal lines using.

DRAW / LINE.

ORTHO & SNAP = OOF.

OBJECT SNAP = INTERSECTION.

4 Save this drawing as. (Fig 4A)

Fig 4

START HERE

LINE COMMAND
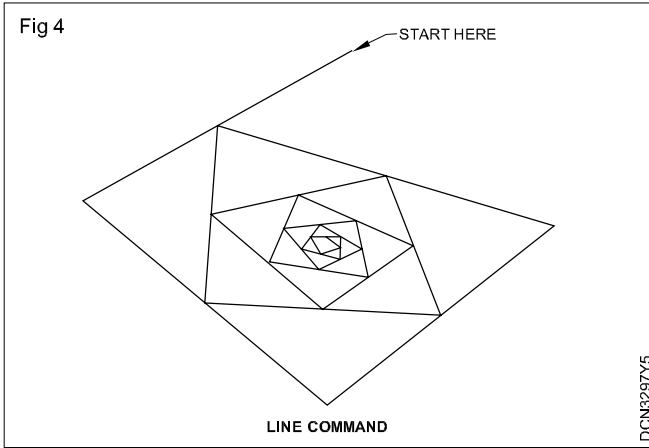
Practice 3: Instructions

1 Start a New file and select 1 workbook dwt.

2 Using FORMAT / UNITS:

Set the units to DECIMALS.

Set the precision to 0.00.

3 Using FORMAT / DRAWING LIMITS set the drawing limits to :

Lower left corner = 0,0.

Upper right corner = 12,9.

4 Use view/zoom/ all to make the screen adjust to the new limits.

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8)

(Your screen should be blank and your crosshair should move freely).

6 Draw the Lines below using.

DRAW / LINE.

OBJECT SNAP = MIDPOINT.

7 Save this drawing as.

Practice 4: Instructions (Fig 4A)

1 Using a new file and select 1 workbook helper. dwt.

2 Using FORMAT / UNITS

Set the units to ARCHITECTURAL

Fig 4A

LINE COMMAND
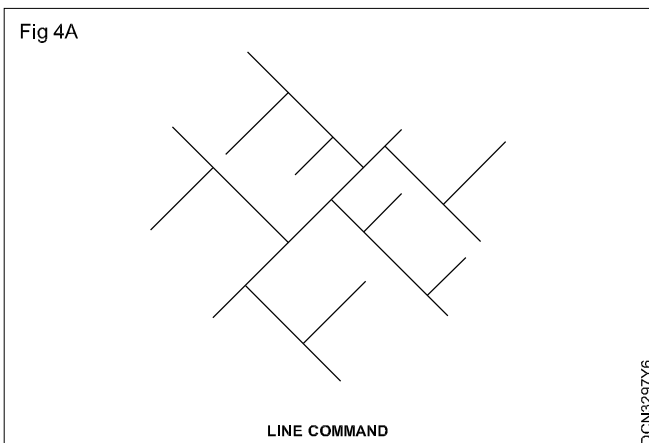
Set the precision to ½"

> **A warning may appear asking you if you "are sure you want to change the units"? Select the OK button.**

3 Using FORMAT / DRAWING LIMITS set the drawing limits to.

Lower left corner = 0.0

Upper right corner = 25, 20

4 Use VIEW / ZOOM / ALL to make the screen adjust to the new limits

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8)

(Your screen should be blank and your crosshair should move freely)

6 Draw the Lines below using.

DRAW / LINE

OBJECT SNAP = MIDPOINT.

7 Save this drawing as.

Practice 5: Instructions (Fig 5)

1 Start a New file and select 1 workbook helper. dwt.

2 Draw the house below using at least 4 commands.

3 You can change the GRID and INCREMENT SNAP setting to whatever you like.

4 You decide when to turn Ortho and Snap On or Off. Have some fun with this one.

5 Save this drawing as.

Fig 5

LINE COMMAND
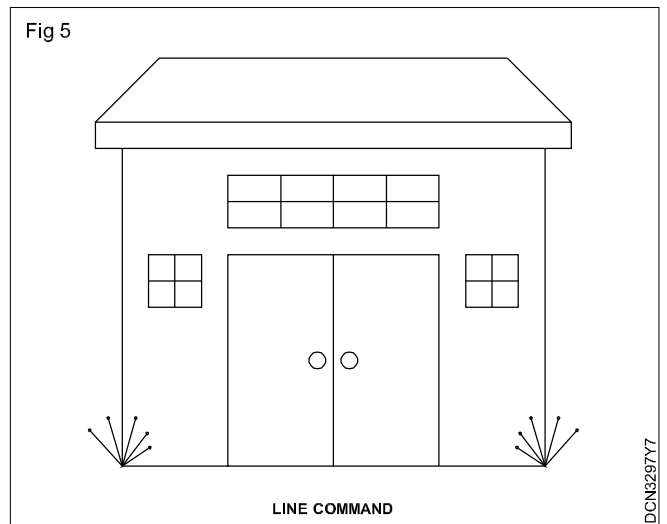
Practice 6: Instructions (Fig 5A)

1 Start a New file and select 1 workbook helper. dwt.

2 Draw the rectangles below using the options, dimension, chamfer, fillet and width.

3 Save this drawing as.

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Fig 5A

CHAMFER = .50

RADIUS = .75

NOTICE:
THE .200 WIDTH
STRADDLES THE
RECTANGLE LINE

WIDTH = .200

EXERCISE

DCN3297Y8
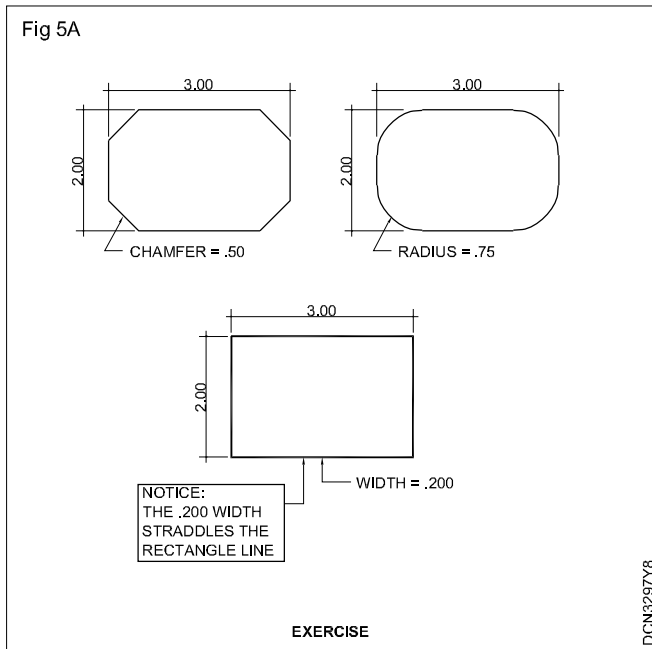
Practice 7: Instruction (Fig 6)

1 Start a New file and select 1 workbook dwt.

2 Using FORMAT / UNITS:

Set the units to FRACTIONAL

Set the precision to ¼".

Fig 6

USE LAYER "HATCH"
FOR THE CIRCLE

USE LAYER "HIDDEN"
FOR THE LINES

HIDDEN COMMAND

DCN3297Y9

3 Using FORMAT / DRAWING LIMITS set the drawing limits to:

Lower left corner = 0,0.

Upper right corner = 12,9.

4 Use VIEW / ZOOM / ALL to make the screen adjust to the new limits.

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8).

(Your screen should be blank and your crosshair should move freely).

6 Draw the objects below using:
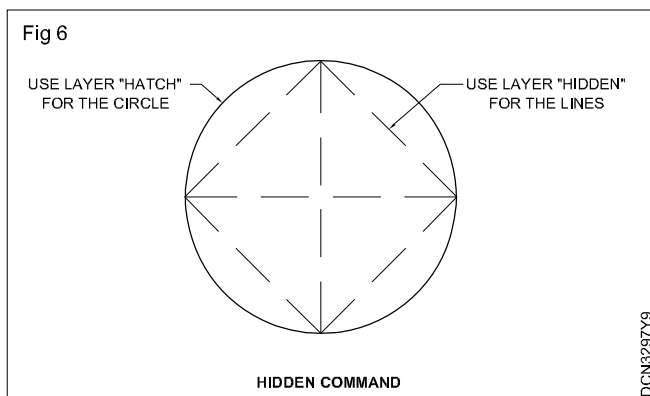
DRAW / CIRCLE (CENTER, RADIUS) and LINE.

OBJECT SNAP = QUADRANT.

7 Save this drawing as.

Practice 8: Instructions (Fig 6A)

1 Start a New file and select 1 workbook dwt.

2 Using FORMAT / UNITS.

Set the units to FRACTIONAL.

Set the precision to ½".

3 Using FORMAT / DRAWING LIMITS set the drawing limits to:

Lower left corner = 0,0.

Upper right corner = 20,15.

4 Use view/zoom/all to make the screen adjust to the new limits.

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8).

(Your screen should be blank and your crosshair should move freely).

6 Draw the objects below using

DRAW / CIRCLE (CENTER, RADIUS) and LINE.

OBJECT SNAP = CENTER and TANGENT.

Very important: Use the Tangent option at each end of the line. AutoCAD needs to be told that you want each end of the line to be tangent to a circle.

7 Save this drawing as.

Fig 6A

EXERCISE

DCN3297YA
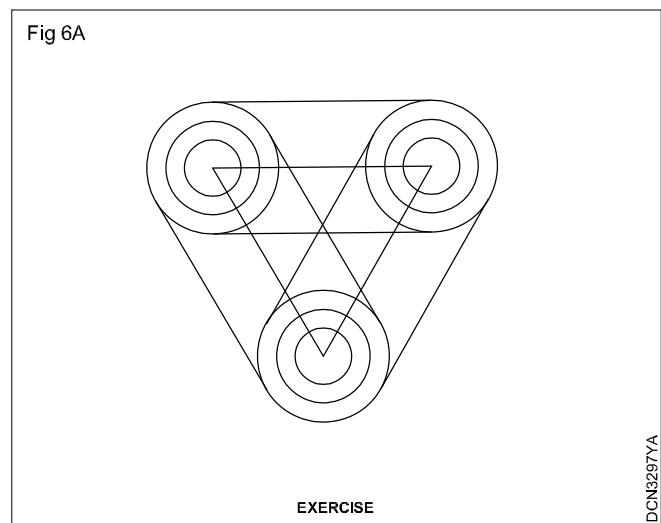
6 Multilines (Fig 7)

This command allows you to draw between 1 and 16 lines parallel to each other. You must tell AutoCAD the distance between the parallel lines.

Pull down menu : Draw, Multiline.

Command : Draw multiline, ml.

Once the command is issued, Autocad responds with

Current settings: Justification = Top, Scale = 1.00, Style= STANDARD.

Specify start point or [Justification/Scale/Style]:

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Fig 7

MULTILINE JOINED TO THE LINE WITH JUSTIFICATION SET TO TOP

MULTINE JOINED TO THE LINE WITH JUSTIFICATION SET TO ZERO

MULTINE JOINED TO THE LINE WITH JUSTIFICATION SET TO BOTTOM

MULTILINES COMMAND
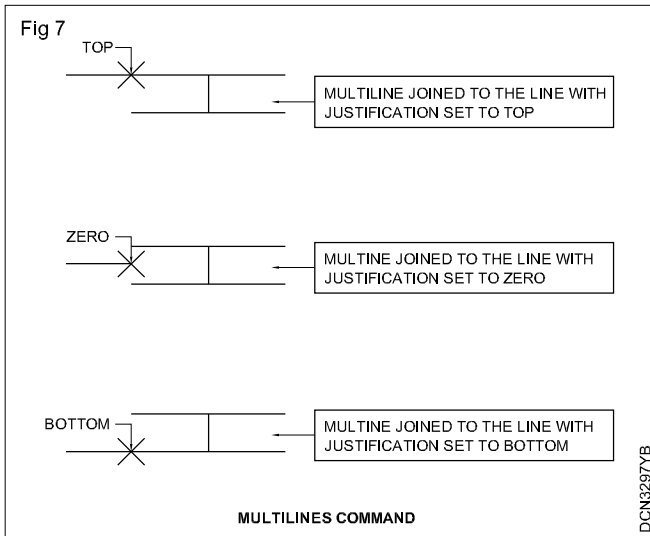
Scale is the distance in units between the parallel lines. Justification determines where the start point of a vertex is. Both these settings are illustrated in the diagram below. Top, Zero and Bottom refer the justification.

Multiline can be closed to form enclosed to form enclosed shapes. A closed multiline automatically joins the beginning and end of the shape. When you are drawing a multiline shape, the command option 'c' closes the shape otherwise just press enter to finish the command.

Editing multiline

Command line: mledit

Menu: Modify, object, multiline

When the command is issued, the mulitiline edit tools dialogue box is displayed. The box is divided in to four columns. Each column helps you to edit a different type of intersection.

7 Construction line (X line)

X line is a linear object, which starts at infinite and ends at infinite, or we can say that it is a line, which has no start or end point but passes through a specified point. These lines are used for projections.

Command   : X line.

Specify a point or [hor/ver/ang/bisect/offset]: use one of the point fixing methods or enter.

An option. Eg. H.

Specify through point: Use one of the point fixing methods

8 RAY

Ray creates semi infinite lines commonly used as construction lines. A ray has a finite starting point and extends to infinity.

Command   : Ray.

Menu   : Draw, Ray.

Specify start
point   : Fix a point on the screen.

Specify through point

AutoCAD draws a ray and continue to prompt for though points so you can create multiple rays. Press to end the command.
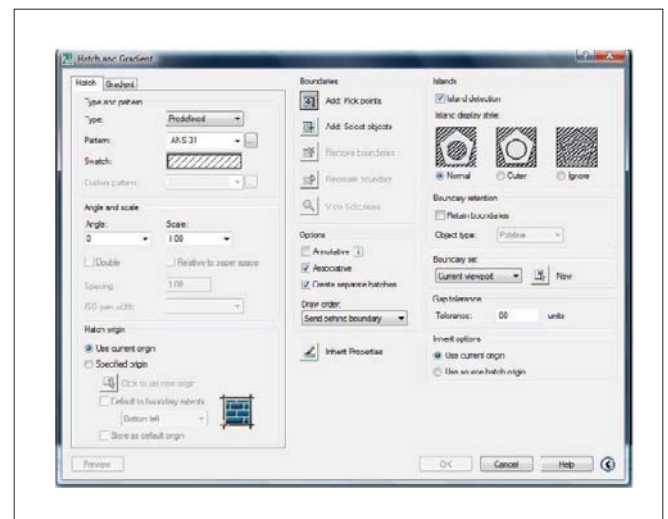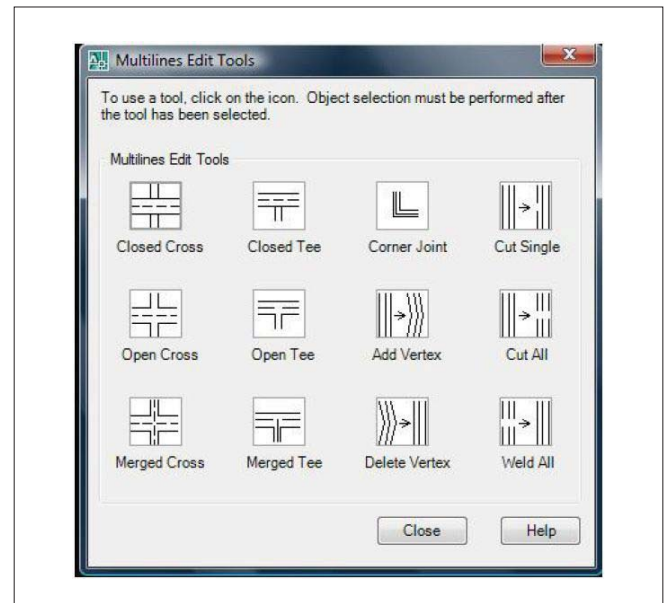
9 Hatch (Fig 8)

Hatch is used to fill an area defined by lines arcs, circles or poly line with either a predefined pattern, a user defined pattern or a simple hatch pattern. It is used to show the section of solids or objects.

Fig 8
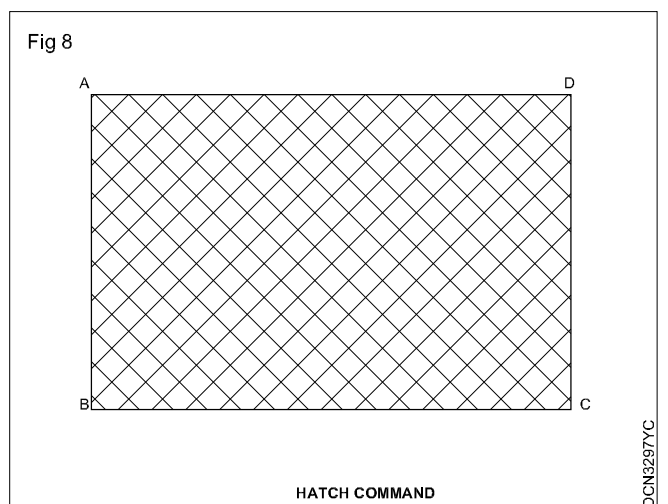
HATCH COMMAND

Tool bar: Draw, Hatch.

Pull down menu: Draw hatch B.

Command: Hatch or H.

This allows you to hatch a region enclosed within a boundary by selecting the objects to be hatched. When you invoke the HATCH command. The hatch and gradient dialogue box is displayed. This dialogue box has several options which give various aspects of hatching.

Command: Hatch or H

1   Select type and pattern from predefined, user defined and customer select colour from gradients.

2   Mouse click on add pick point.

3   Click inside ABCD.

4   Change angle and scale if you want click on preview. If it is ok then click on in the dialogue.

Example

Command: Hatch, H (Fig 9)

1   Select type and pattern from predefined user defined cand custom or select colour from gradient

2   Mouse click on add pick point.

3   Mouse inside ABCD.

4   Change angle and scale if you want.

5   Click on preview.

6   If it is ok then click on OK in the dialogue box.

Fig 9
MULTILINES
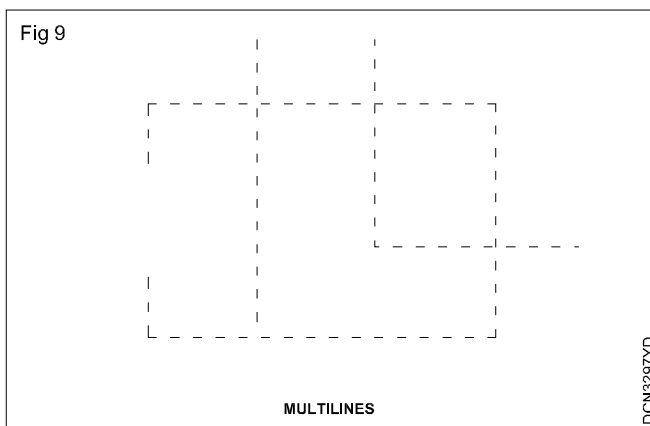
List

AutoCAD lists out the properties and the geometrical parameters of the selected objects.

Pull down menu :- Tools, inquiry, list.

Command: list.

Select objects: use any object selection method select rectangle ABCD.

Select objects: 1 found.

Select objects:

Properties of the rectangle ABCD = LWPOLYLINE layer: "0"

Space: Model space, Handle = d8a, Closed, Constant width 0.0000

Area 16486.7990, perimenter 551.6401.

Distance

Pull down menu: Tools, inquiry, distance.

To measure the distance between two points.

Command: Dist.

Specify first point: Select A.

Specify second point: Select B.

Distance = 118.6843, Angle in XY Plane = 0, Angle from XY Plane = 0.

Delta X = 118.6743, Delta Y = 0.0000, Delta Z = 0.0000.

Area (Fig 10)

Calculate the area and perimater of object or of defined areas.

Fig 10
AREA COMMAND
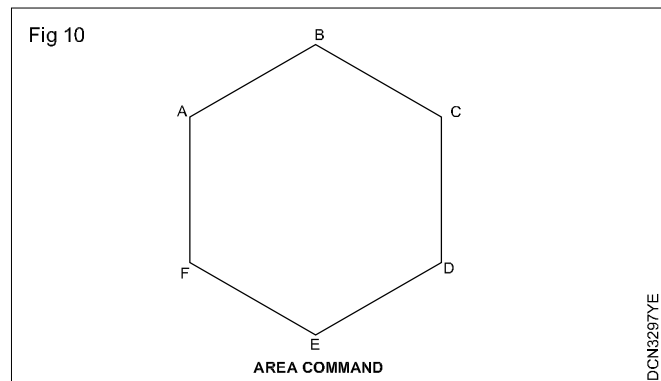
Pull down menu: Tools, inquiry, area.

Command Area.

Specify first corner point or [Object / Add / Subtract] first point A.

Specify next corner point or press ENTER for total: Select next point B.

Specify next corner point or press ENTER for total: Select next point C.

Specify next corner point or press ENTER for total: Select next point D.

Specify next corner point or press ENTER for total: Select next point E.

Specify next corner point or press ENTER for total: Select next point F.

Specify next corner point or press ENTER for total.

Area = 8316.3401, Perimeter = 339.4622.

REGEN.

Command : Regen.

This command makes Auto CAD to regenerate the entire drawing to update it. By using this commands, the circles and arcs can be smoothened.

Creation of object in different layers

Objective : At the end of this exercise you shall be able to
• **plotting drawings.**

Printing or plotting of a drawing can be done by using a printer or a plotter.

Print or plot command

Various input facilities are available for printing a drawing. Facilities like key board, menu bar or tool bar with mouse are explained below.

1 Printing a drawing by using key board

Type print or plot at the command prompt area using key board and press the enter key. Now the command prompt area appears as shown below:

Command : PRINT or PLOT

Now a dialogue box namely plot appears on the screen.

2 Printing a drawing by using menu bar with mouse

Pick file from menu bar and plot from pull-down menu. Now a dialogue box namely plot appears on the screen.

3 Printing a drawing by using tool bar with mouse

Pick the icon of plot, from standard toolbar. Now a dialogue box namely plot appears on the screen.

For printing a drawing, follow the procedure shown below:

1 Pick the plot device tab.

2 Select the printer name (Say, HP deskjet) from the combo box.

3 Pick plot setting tab.

4 Select a paper size (say, A4-210 x 297 mm) from the combo box provided against the paper size.

5 Pick the drawing orientation option (say portrait)

6 Then select the scale 1:1 from the combo box under plot scale.
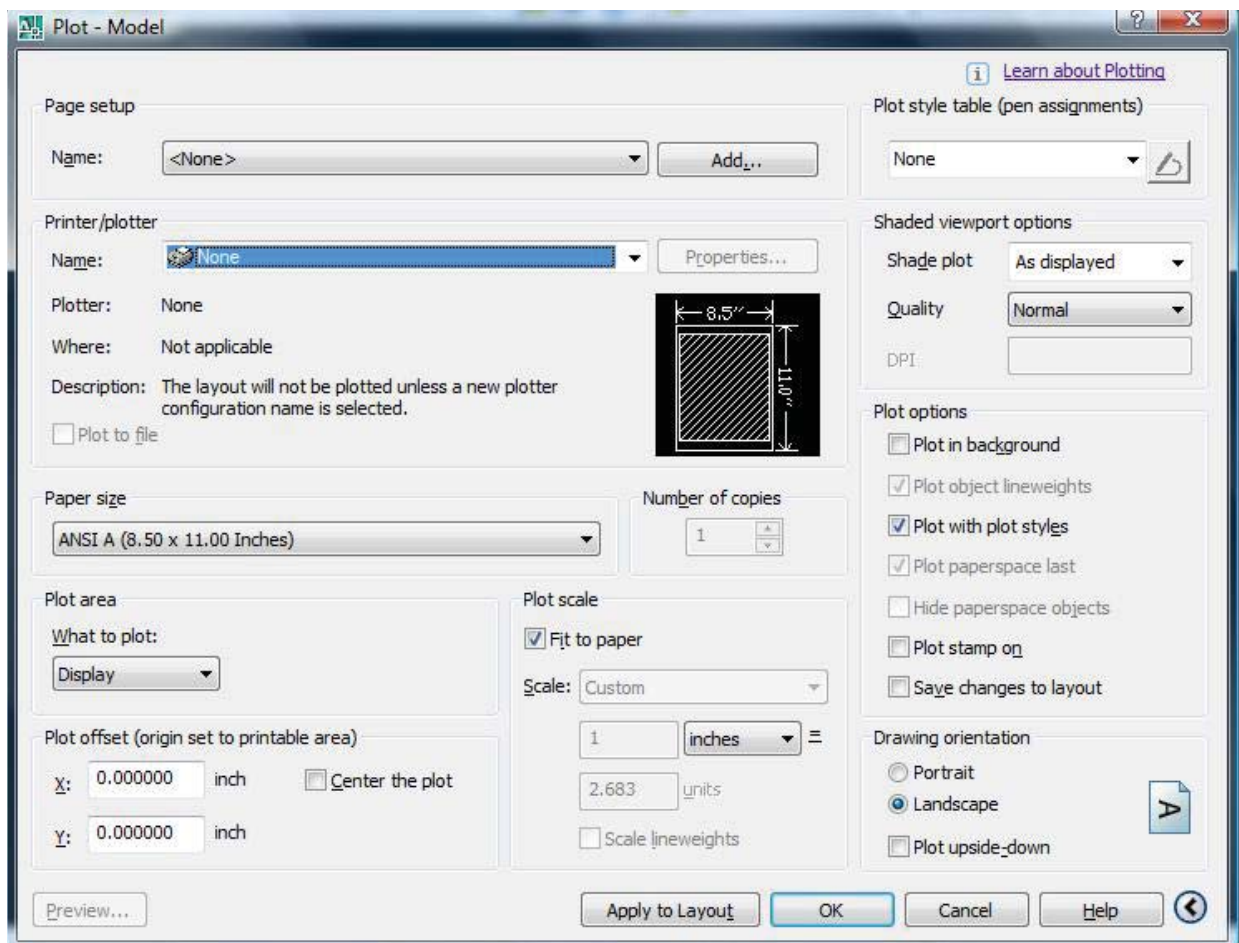
7 Pick the window button under the heading plot area. Now, the cursor and drawing appears on the screen and command prompt area show, specify first corner: (Here, specify the first corner for the window on the screen).

Specify opposite corner: (Here, Specify the opposite corner for the window).

8 Pick the full preview button provided on the bottom left of the dialogue box.

9 Now the paper lay out with selected drawing appears on the screen.

10 Then click the right button of the mouse and pick exit from the button menu.

11 The dialogue box again appears on the screen.

12 Click OK button.

Now, the plotted drawing is obtained from the plotting device.

Layers

Objective: At the end of this exercise you shall be able to
• **layers**.

Layers

An Auto CAD drawing can be constructed over several layers. A layer is like a transparent sheet of paper which holds drawing objects. For example, a drawing of the plans of a house could be constructed as follows: the walls would occupy a layer called 'walls', the doors and windows would be placed on a layer called 'fittings' etc. When the drawing is structured in this way you have control over numerous aspects of the work. Auto CAD supplies you with one default layer named 0. Any other layer must be created by the user, although you can assign as many layers as you like to a drawing.

Setting up a new layer

Here we will set up two layers called hatch and fittings. To create a new layer first issue the layer command.

Pull down menu: Format, Layer

Command line: Layer, LA

In the layer properties dialogue box, click on new

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.98

click on line weight

click on apply m click on ok on the layer properties manager dialogue box

Making a layer current

A layer must be current before you can draw on it. To make the layer (hatch) current, carryout the following easy steps

i   Click on the layer name in the layer properties manager dialogue box, then click on the current button.

ii Click ok to return to the drawing editor.

iii The object properties toolbar at the top of the screen (see below) will show the name of the current layer and its colour. Try drawing something it will appear in colour 53.

Click on the colour for the hatch colour in the select colour dialogue box

click ok

Click on line type
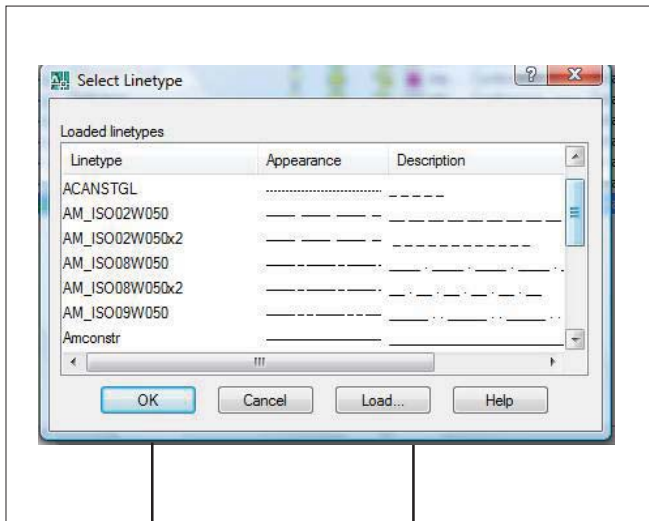
click ok
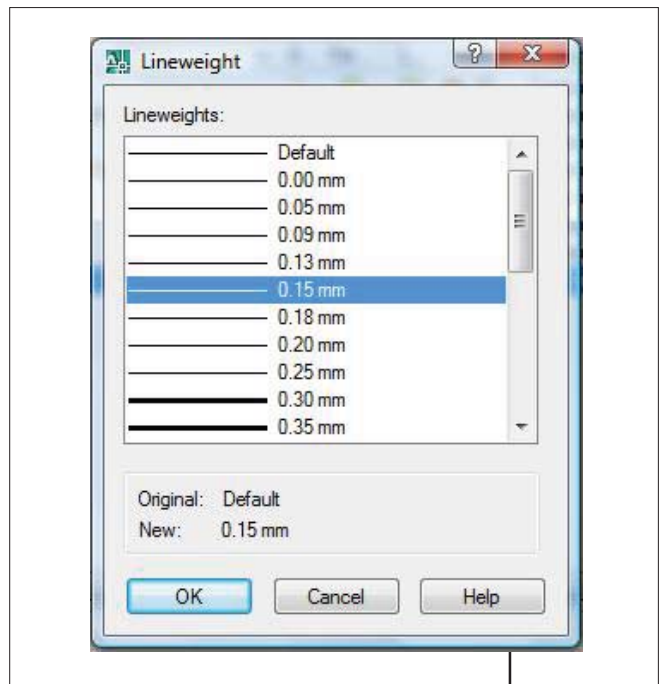
select line type

click ok

select line weight
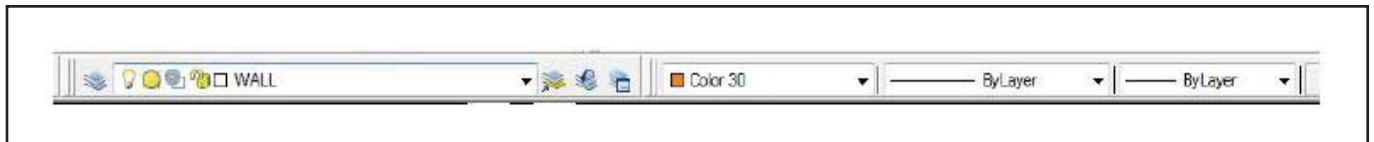
layers icon

current layer and color

Alternatively, to make a layer current from within the Drawing editor.
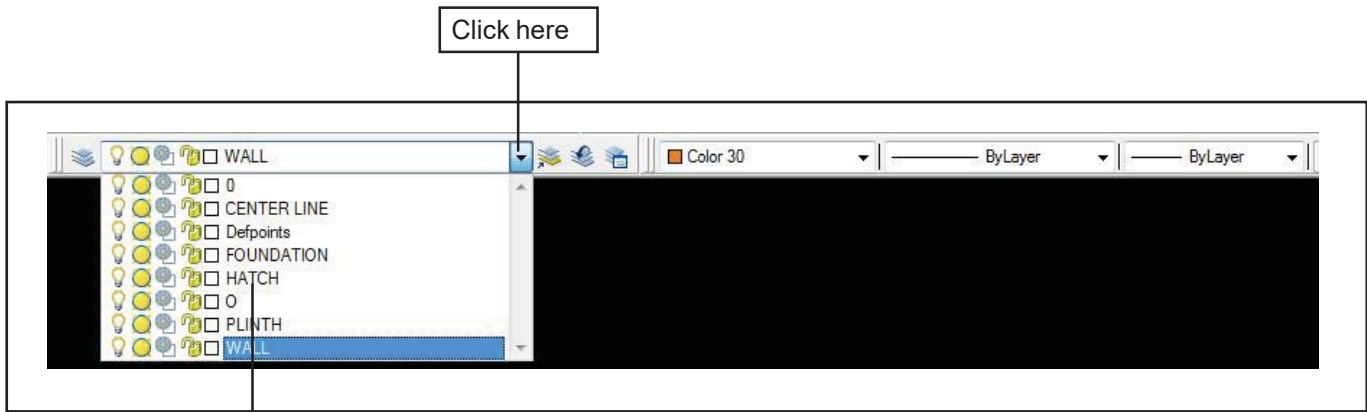
Click here

Click here near the layer name

Click here
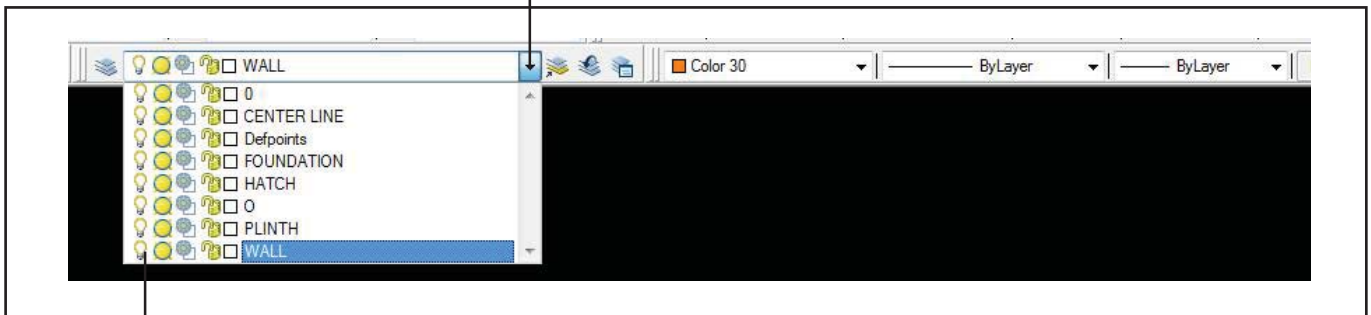
Click here on the light bulb

Click on the drawing editor any where.

Making layer visible or invisible

Complex drawings may become cluttered, when can make it difficult to select objects for editing or drawing. This clutter may be reduced by making a layer invisible if you are not working on it. When layer is made invisible, the objects drawn on it disappear from the screen, but they still exist and are part of the drawing. Layers which are invisible are not click out on the drawing editor anywhere. Clickout on the drawing editor anywhere.

Several layers can be made invisible if required. The icon for visible is a glowing light bulb. Invisibility is shown by a dull light bulb.

Practice 1 : Instructions (Fig 1)

1   Start a New file and select 1 workbook helper. dwt

2   Draw the LINES below using:

Draw / Line

Ortho (f 8) ON (to help you draw horizontal lines)

Increment snap (f 9) ON

Fig 1

LAYER HIDDEN

LAYER OBJECT

LAYER PHANTOM

LAYER SECTION

LAYER TXT-HVY

LAYER TXT-LIT

LAYER DIM

LAYER CENTER

LAYER HATCH

LINETYPES

DCN3298E1
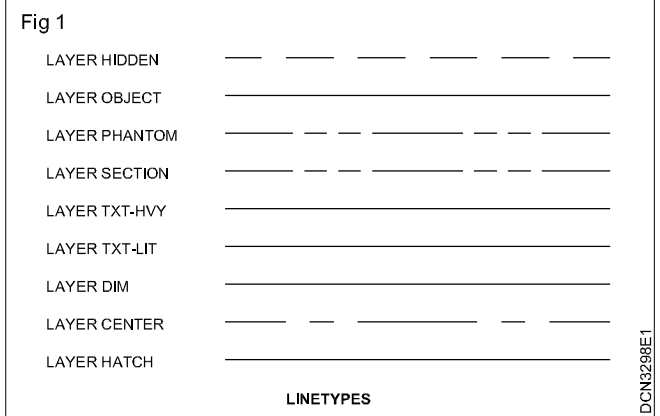
3   Change to the appropriate layer before drawing each line.

4   Save this drawing using:

File / Save as / (File name)

Practice 2 : Instructions (Fig 2)

Fig 2

LAYERS

DCN3298E2
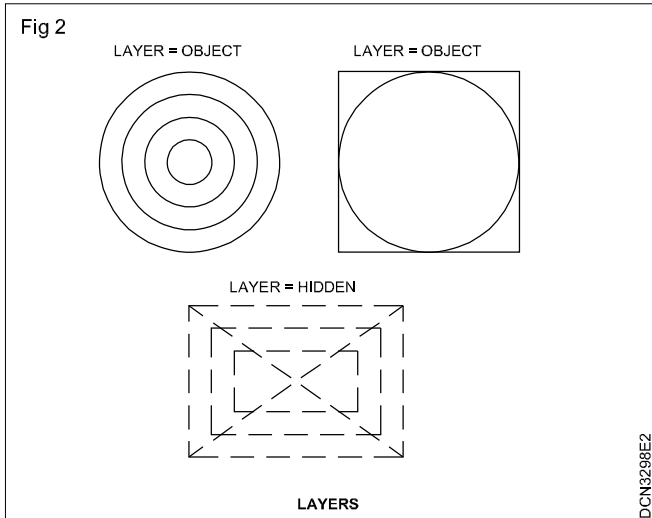
1 Start a New file and select 1 workbook dwt

2 Change the GRID SPACING to .40 and SNAP to .20

Using: TOOLS/DRAFTING SETTINGS

3 Draw the objects below, use the layers indicated.

4 Save this drawing using:

File/Save as/ (File Name)

Practice 3 : Instructions (Fig 3)

1 Start a New file and select 1 workbook dwt

Fig 3

EXERCISE

DCN3298E3
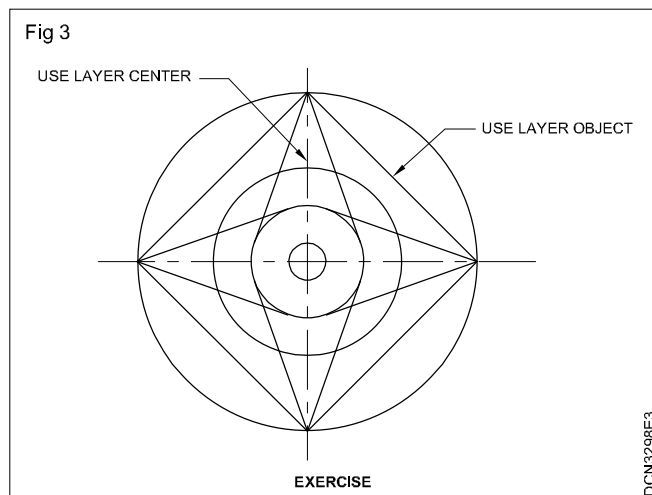
2 Draw the 4 circles with the following Radii: 1,2,3, & 5 (use Object snap "Center" so all Circles have the same center)

3 Draw the lines using

DRAW/LINE

ORTHO and SNAP = OFF

OBJECT SNAP = QUADRANT and TANGENT 4. Use Layers: Object and Center

5 Save this drawing as (File name)

ISO planes

Objectives : At the end of this exercise you shall be able to
• **identify ISO axes**
• **practice ISO drawings.**

ISO metric drawing (Fig 1)

Isometric drawing have three principal planes. They are isoplane right, isoplane top and the isoplane left.

Fig 1
LEFT PLANE
LEFT
ISOMETRIC DRAWING
DCN3299H1
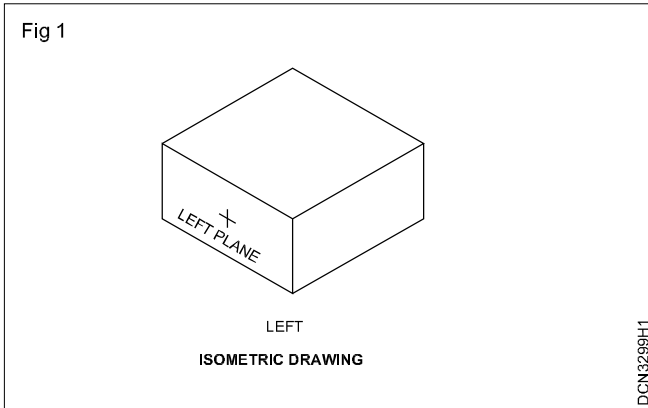
ISO planes

To turn on an isometric plane

1   Click Tools menu>> Drafting Settings.

2   In the Drafting settings dialog box, snap and grid tab, under snap type, select isometric sanp.

3   Click OK.

You can cycle through the three isometric planes by pressing F5.

Command: Isoplane (or Isoplane for transparent use)

Enter isometric plane setting [left/top/right] <top>: enter an option or press ENTER.

The isometric plane affects the cursor movement keys only when Snap mode is on and the snap style is isometric. If the snap style is Isometric, Ortho mode uses the appropriate axis pair even if Snap mode is off. The current isometric plane also determines the orientation of isometric circles drawn by ELLIPSE. You can cycle through the isometric planes by pressing CTRL+ E or F5.

Left

Selects the left - hand plane, defined by the 90 - degree and 150-degree axis pair.

Top (Fig 2)

Selects the top face of the cube, called the top plane, defined by the 30- degree and 150 - degree axis pair.

Right (Fig 3)

Selects the right - hand plan, defined by the 90-degree and 30- degree axis pair.

Fig 2
TOP PLANE
TOP
ISOMETRIC DRAWING
DCN3299H2

Fig 3
RIGHT PLANE
RIGHT PLANE
ISOMETRIC DRAWING
DCN3299H3
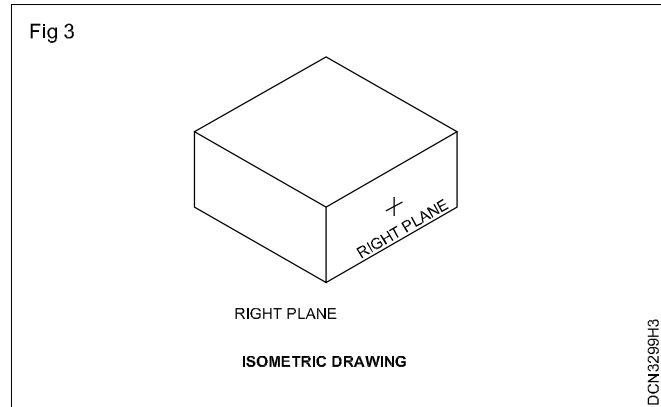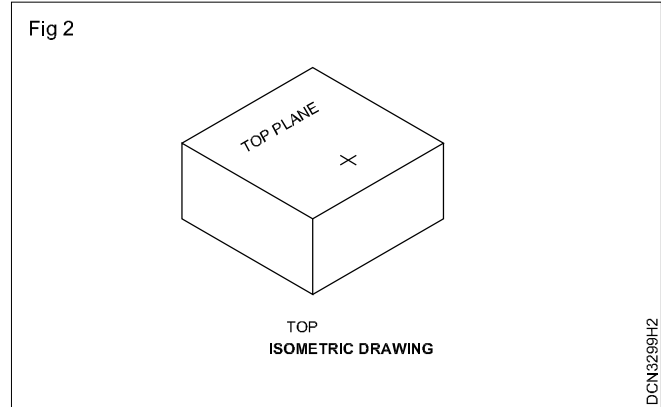
When the snap style has been set to isometric, you will find isocircle. Option under ellipse command. Use this to draw circle and arcs in isometric plane.

Example

1   Create the isometric drawing shown in the Fig 4

Fig 4
10   15
P7
P6
10
P4
P5
P1
P3
60
30
P2
ISOMETRIC DRAWING
DCN3299H4
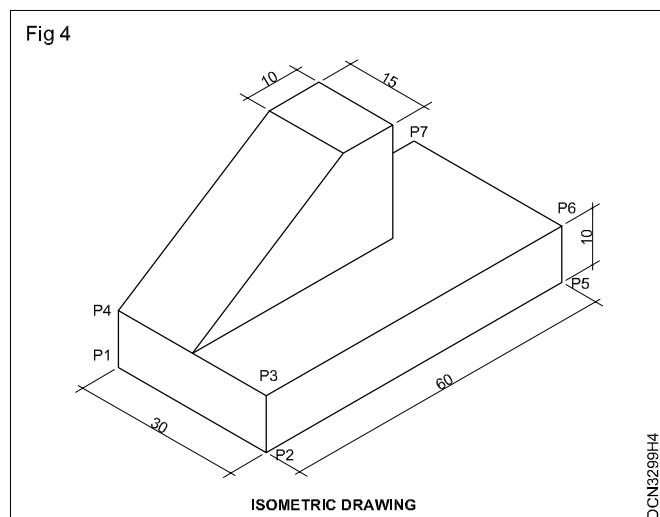
Step- 1

Change the isometric view by using sanpcommand.

Command: snap

Specify snap spacing or [ON/OFF/Aspect/Style / Type]<0.5000>:s Enter snap grid style [Standard/ Isometric] <S>:i

Specify vertical spacing <0.5000>.

Step- 2

Change the isoplane to isoplane left by pressing Ctrl+E or F5. Now draw lines between points P1, P2, P3 and P1.

Step- 3

Change the isoplane to isoplane right by pressing Ctrl + E or F5. Now draw lines between points P3, P2, P5, and P6.

Step- 4

Change the isoplane to isoplane top by pressing Ctrl +E or F5. Now draw lines between points P6, and P7.

Step- 5

Change the corresponding plane by pressing Ctrl +E or F5 and continue the procedure.

Create the isometric drawing shown Fig 5

ISOMETRIC DRAWING
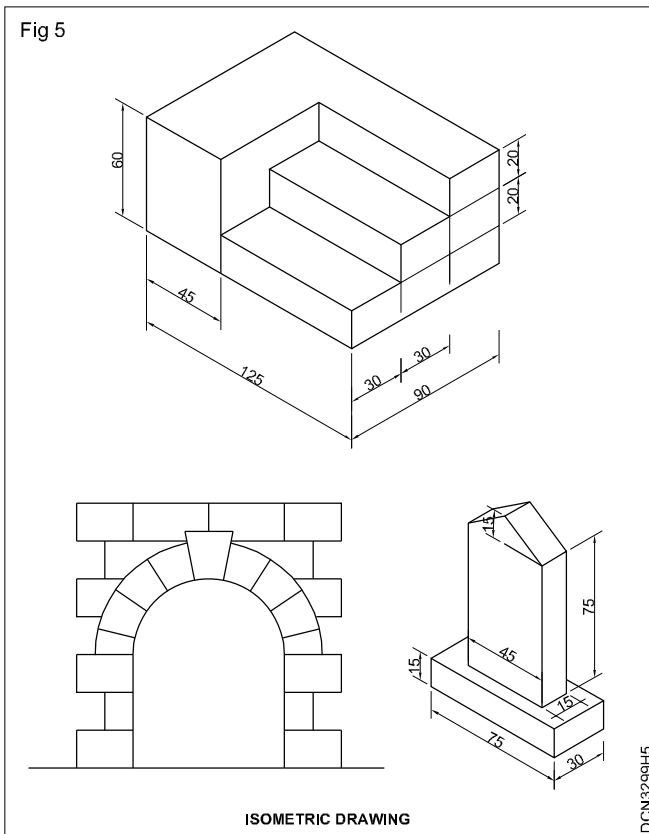
Create the orthographic projection drawing shown in Fig 6

PROJECTIONS
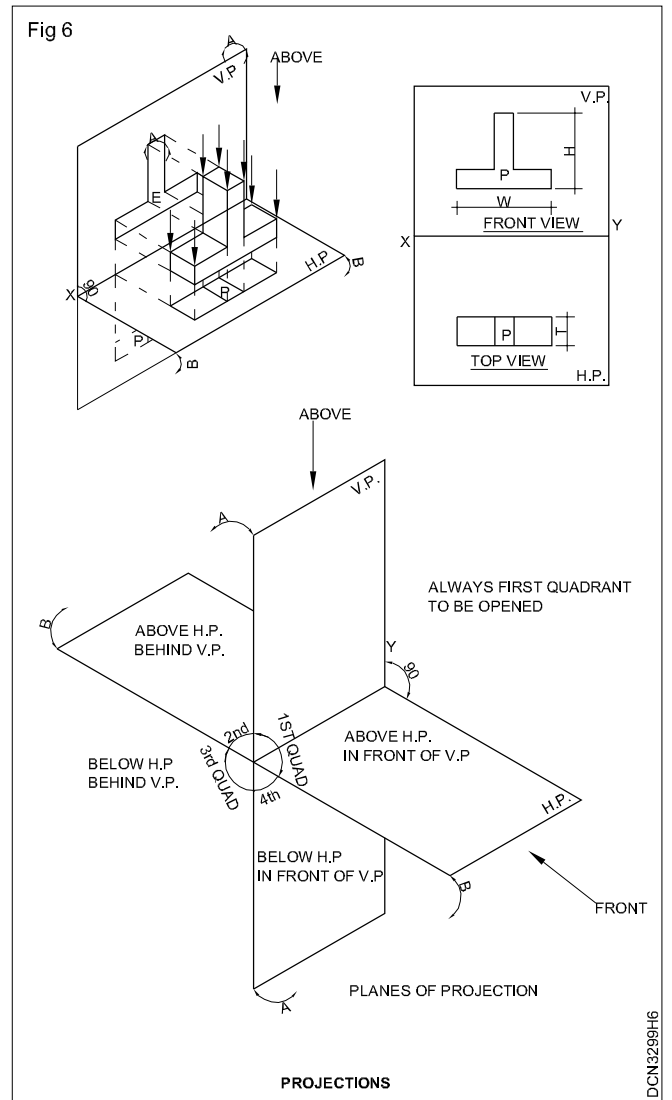
Dimensioning & text

Objectives : At the end of this exercise you shall be able to
• **dimensioning**
• **text & text style.**

Dimensioning commands

While manufacturing an object, the drawing must contain size description such as the length, width, height, angle, radius, diameter and location of the object. These are added to the drawing with the help of dimensioning.

1 Dimension - linear (Fig 1)

This command is used to measure horizontal and vertical dimensions between two points.

Tool bar   : Dimension, Linear

Pull Down   : Dimension, Linear

Command   : DIM LIN /DLI

Example

Command   : DIM LIN / DLI

Specify first extension line origin of : Selection point A

Specify second extension line original : Select point B

Specify dimension line location or

[Mtext/Text/Angle/Horizontal/Vertical/Rotated]: Mouse click on the position where the dimension is to be placed

Dimension text = 6.00
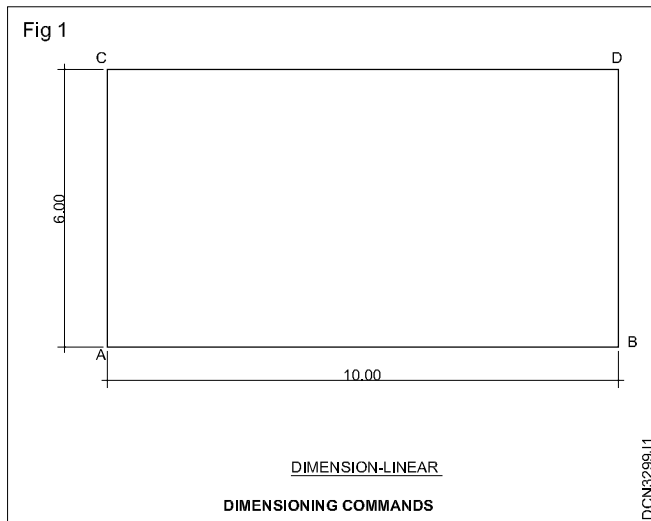
2 Dimension - aligned (Fig 2)

This command is used to measure inclined dimension between two points.

Tool bar   : Dimension, Aligned

Pull down   : Dimension, Aligned

Command   : DIM ALI /DAL

Example

Command   : DIM ALI/DAL

Specify first extension line origin or   : Select point A

Specify first extension line origin   : Select point B

Specify dimension line location or

[Mtext/Text/Angle/Horizontal/Vertical/Rotated]: Mouse click on the position where the dimension is to be placed

Dimension text = 9.00
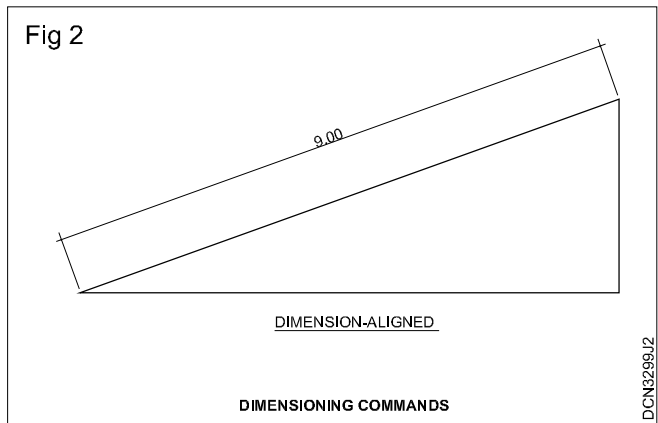
3 Dimension - ARC length (Fig 3)

This command is used to measure the length of an arc.

Tool bar : Dimension, Arc length

Pull Down   : Dimension, Arc length

Command   :DIMARC/DAR

Example

Command   : DIM ARC / DAR

Command   : DAR DIMARC

Select arc or polyline arc segment

Specify arc length dimension location,

Or [Mtext/Text/Angle/Partial/Leader]: Mouse click on the position where the dimension is to be placed

Dimension text = 12.00
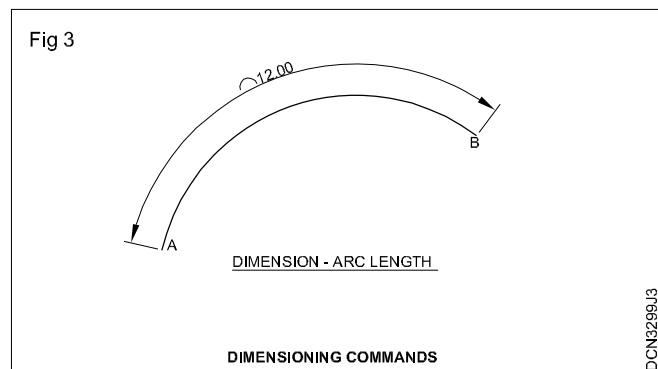
4 Dimension - radius(Fig 4)

This command is used to measure the radius of an arc or circle.

Tool bar : Dimension, Radius

Pull Down : Dimension, Radius

Command : DIM RA/DRA

Example:

Command : DIM RA / DRA

Select arc or
circle : Select the circle

Dimension text = 3.00

Specify dimension line location or [Mtext /Text/Angle]

Fig 4

DIMENSION - RADIUS

DIMENSIONING COMMANDS

DCN3299J4
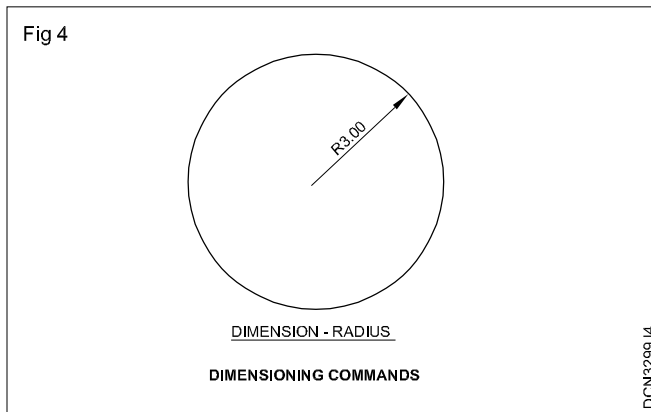
5 Dimension - jogged (Fig 5)

Tool bar : Dimension, Jogged

Pull Down : Dimension, Jogged

Command : DIM JO/DJO

Example

Command : DIM JO/DJO

Select arc
or circle : Select the circle

Specify center location override: Select center

Dimension text = 4.00

Specify dimension line location or [Mtext /Text/Angle]

Specify jog location: Mouse click on the position where the dimension is to be placed.

Fig 5

R4.00

A
B

DIMENSION - JOGGED

DIMENSIONING COMMANDS

DCN3299J5
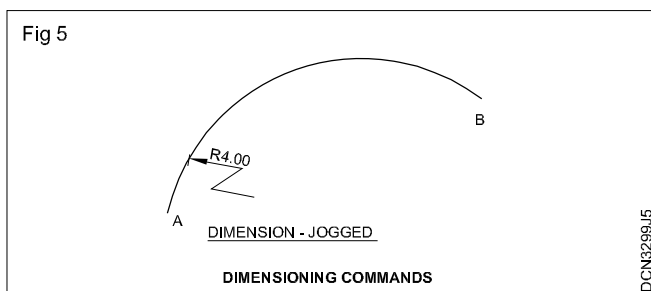
6 Dimension - diameter (Fig 6)

This command is used to measure the Diameter of a circle.

Tool bar : Dimension, Diameter

Pull Down : Dimension, Diameter

Command : DIM DIA/DDI

Example:

Command : DIM DIA/DDI

Select arc
or circle : Select the circle

Dimension text = 6.00

Specify dimension line location or [Mtext /Text/Angle] Mouse click on the position where the dimension is to be placed.

Fig 6

Ø6.00

DIMENSION -DIAMETER

DIMENSIONING COMMANDS

DCN3299J6
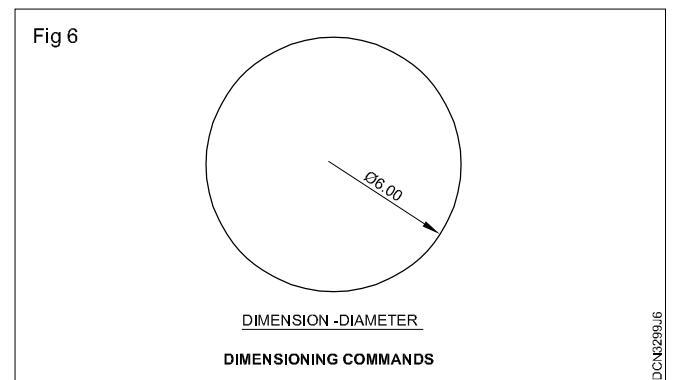
7 Dimension - Angular (Fig 7)

This command is used to measure the Angle between two non parallel straight lines.

Tool bar : Dimension, Angular

Pull Down : Dimension, Angular

Command : DIM ANG/DAN

Example

Command : DIM ANG/DAN

Select arc, circle, line, or <specify vertex>: Select AB

Specify dimension line location or [Mtext /Text/Angle]: Mouse click on the position where the dimension is to be placed.

Dimension text = 41

Fig 7

A

41°

B
C

DIMENSION - ANGULAR

DIMENSIONING COMMANDS

DCN3299J7

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.99   63
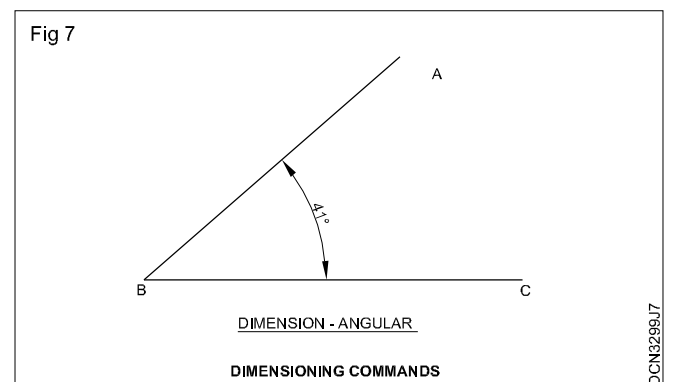
8 Dimension - continue (Fig 8)

This command is used to continue dimensioning after the first dimensioning has been executed.

Tool bar : Dimension, Continue

Pull Down   : Dimension, Continue

Command   : DIM CON/DCO

Example

Command   : DIM CON/DCO

Specify a second extension line origin or [Undo/Select] <Select>: Select C

Specify a second extension line origin or [Undo/Select] <Select>: Select D

Specify a second extension line origin or [Undo/Select] <Select>: Cancel

Fig 8

DIMENSION - CONTINUE

DIMENSIONING COMMANDS
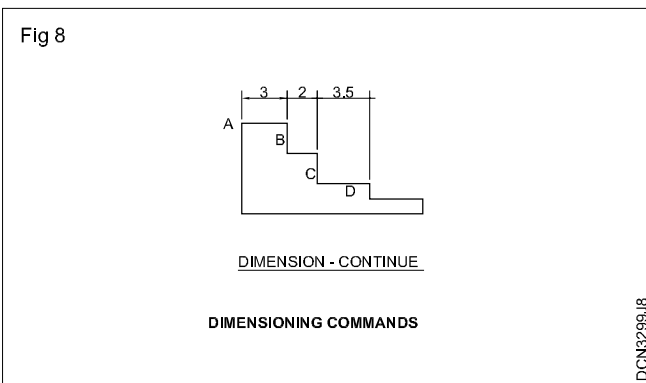
9 Dimension - base line (Fig 9)

This command is used to give dimension when number or dimensions of a part have a common datum.

Fig 9

DIMENSION -BASELINE

DIMENSIONING COMMANDS
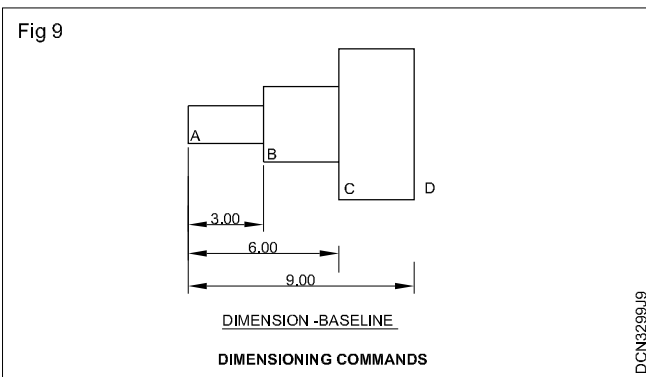
Tool bar   : Dimension, Base line

Pull Down   : Dimension, Base line

Command   : DIM LEA/LE

Example

Command   : DIM LEA/LE

Specify first leader point, Select point A

Specify next point: Select point B

Specify next point:

Specify text width <0.0000>:

Enter first line of annotation text <Mtext>: WOODEN BLOCK

10. Dimension - leader (Fig 10)

This command is used to give leader lines i.e. used to describe some features in the drawing.

Tool bar   : Dimension Leader

Pull Down   : Dimension Leader

Command   : DIM LEA/LE

Example

Command   : DIM LEA/LE

Specify first leader point, Select point A

Specify next point: Select point B

Specify next point

Specify text width <0.0000>

Enter first line of annotation text <Mitest> WOODEN BLOCK

Fig 10

DIMENSION - LEADER

DIMENSIONING COMMAND
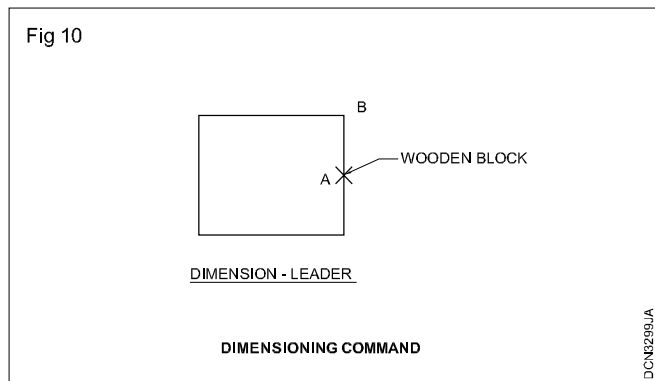
11 Dimension - style (Fig 11 to 14)

Tool bar   : Dimension, Dimension style

Pull Down   : Dimension, Dimension style

Command   : D

This command is used to select or change the properties of a dimension. When you enter this command the dimension style manager dialogue box will be displayed. This dialogue box provides various options for modifying the dimension. Click on modify and give the new values.

Dimension sytle

Pull down menu: Dimension, Dimension style

When you select this, a dimension style manager dialogue box will appear on the screen.

A dimension style is a saved set of dimension settings defining the appearance and behaviour of the dimensions. By creating dimension styles. You can set all relevant dimension system variables and control the layout and appearance of all dimesions within a drawing.

Fig 11

3.T-CLIP

T - CLIP

DCN3299JB

Fig 12

4.CHANNEL PLATE

CHANNEL PLATE

DCN3299JC

Fig 13

1. ANGLE SPACER

EXERCISES

DCN3299JD

Fig 14

2, BASE PLATE

EXERCISES

DCN3299JE
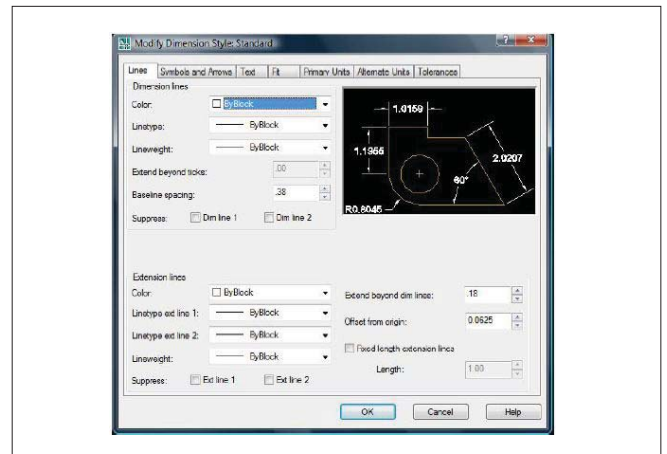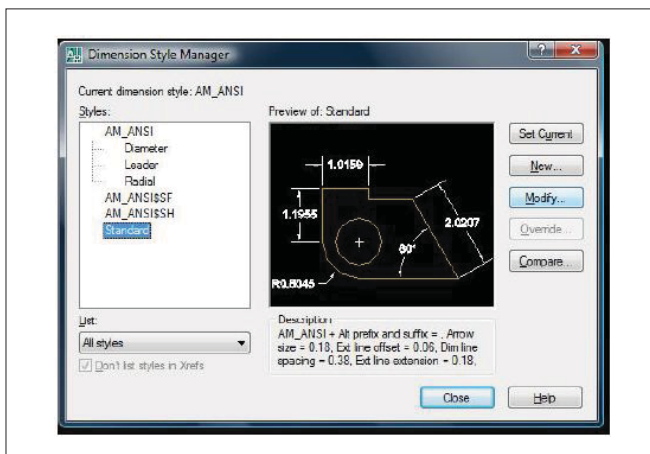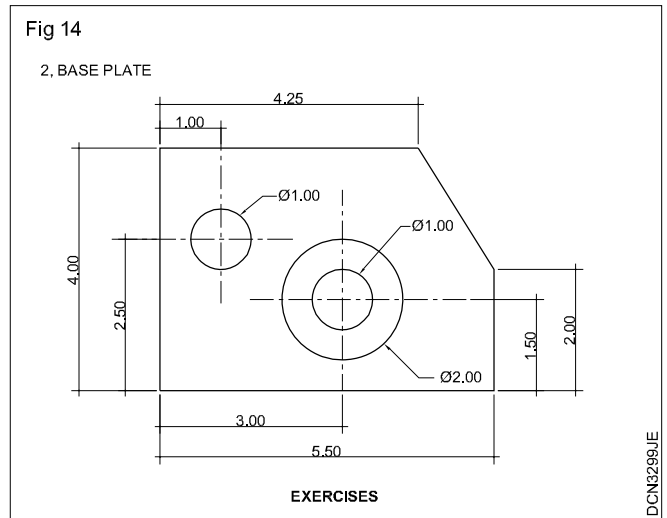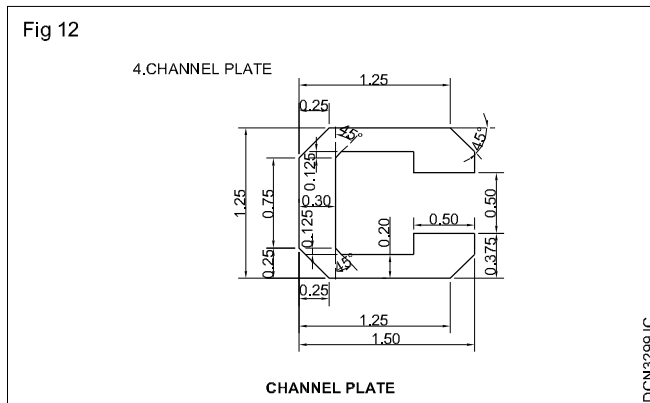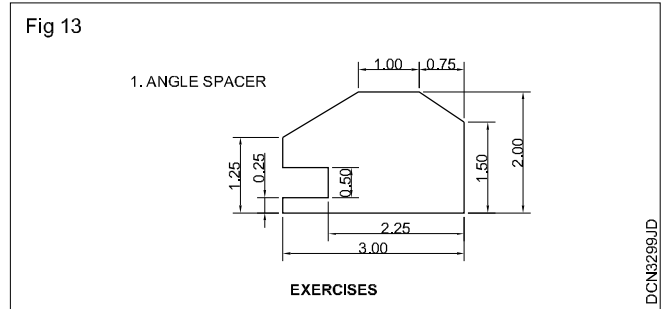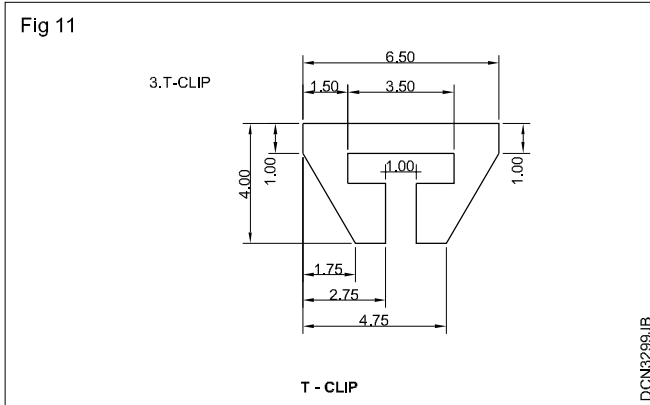
Description
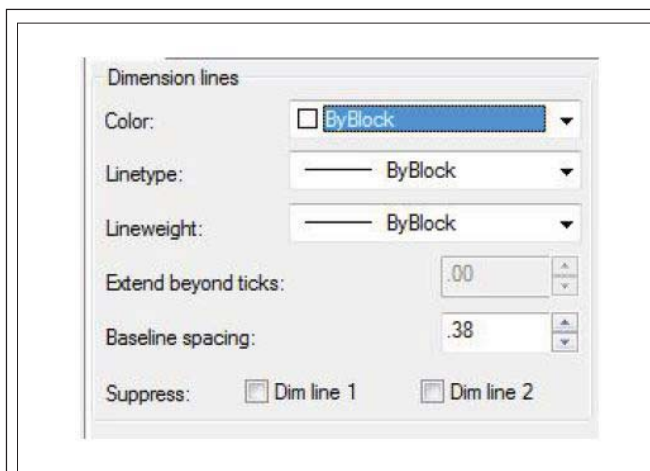
Sets the dimension line properties

1 Colour displayed and sets the colour for dimension line.

2 Line type sets the type of the dimension line.

3 Line weight sets the line weight of the dimension line.

4 Extend beyond ticks specifies a distance to extend the dimension line past the extension line when you use oblique, architectural, tick, integral, and no marks for arrow heads.

5 Base line spacing sets the spacing between the dimension lines of a base line dimension. Enter a distance.

6 Suppress suppresses display of dimension line when they are outside.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.99

Description
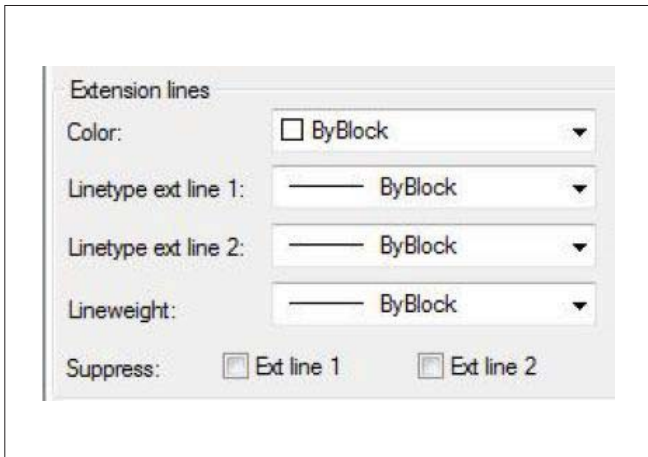
<table>
<tr>
<td>

</td>
<td>
Set the extension line properties

1 Colour displayed and sets the colour for extension line.

2 Line type sets the type of the extension lines.

3 Line weight sets the line weight of the extension lines.

4 Suppress suppresses display of extension lines.
</td>
</tr>
<tr>
<td>

</td>
<td>
1 External beyond dim lines specifies a distance to extension lines from the origin points that define the dimension.

2 Offset from origin specifies the distance to offset the extension lines from the origin points that define the dimension.

3 Fixed length extension lines, set the length of the extension line.
</td>
</tr>
</table>
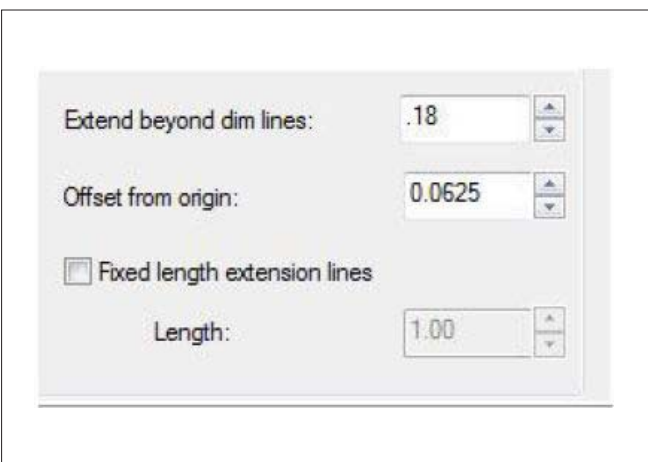
Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.99
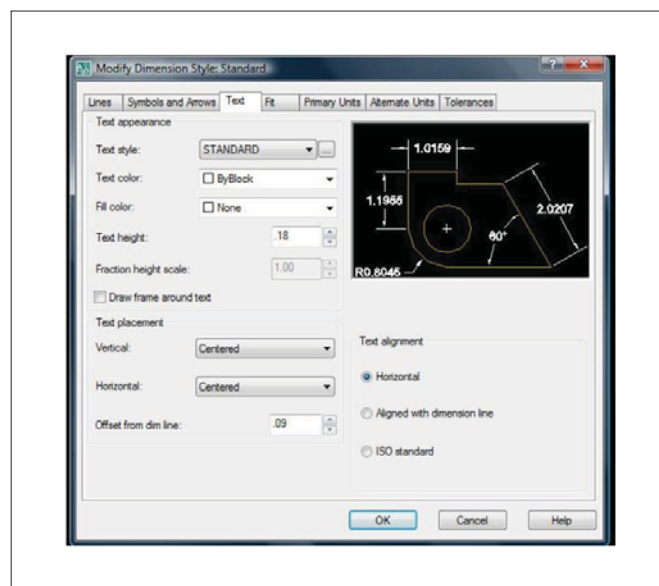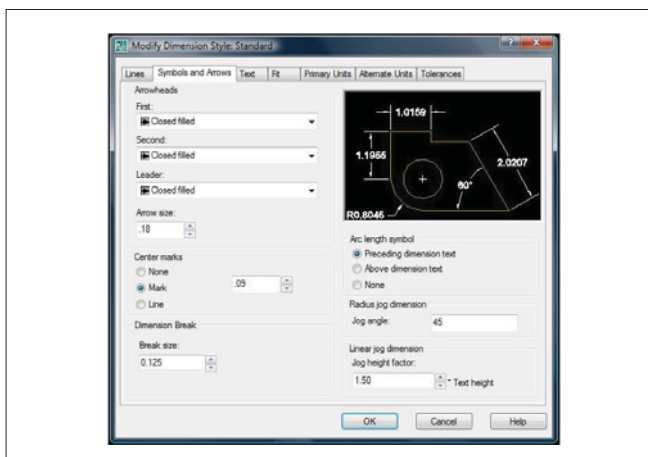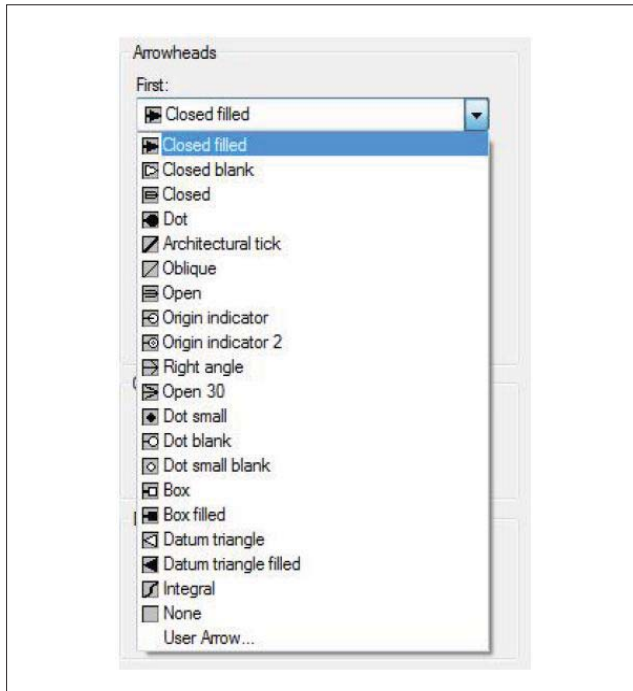
Description	
	1 Here you can set the types of arrow heads. 2 Arrow size sets the size of arrow.

Symbols and arrows tab
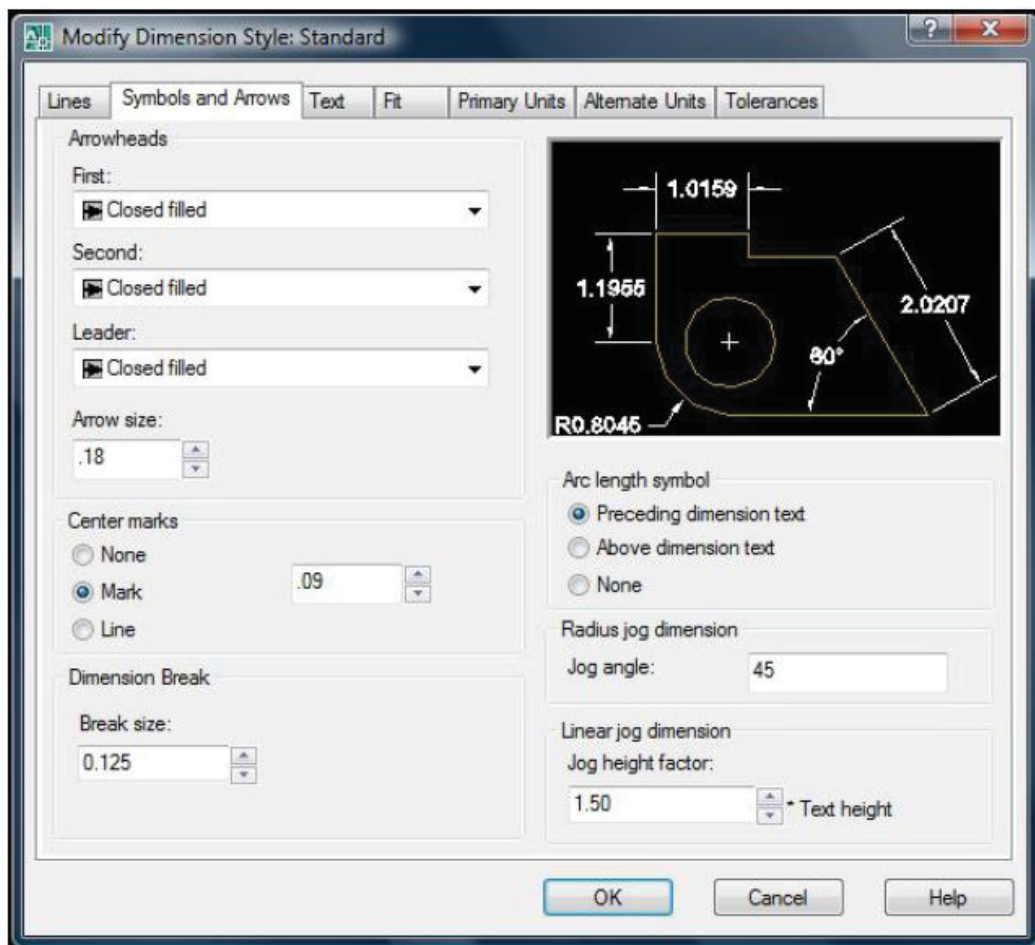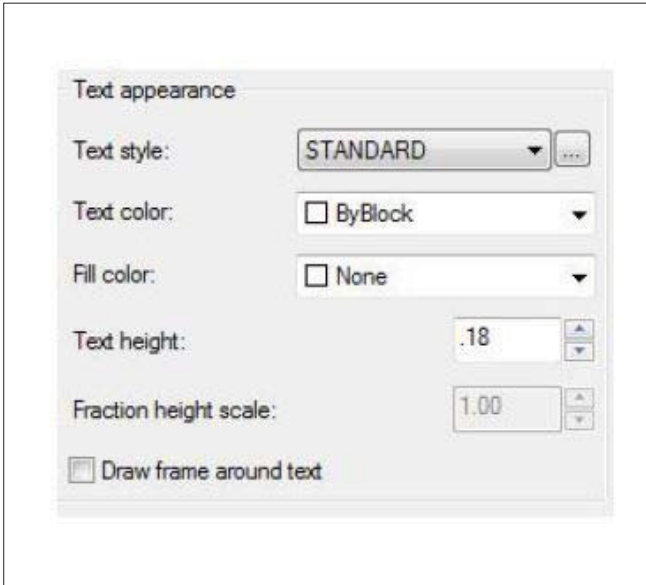
Description	
	1 Text style button displays the text style dialogue box, which you can use to define or modify text styles.
	2 Text colour displays and sets the colour for the dimension text.
	3 Text height displays and sets the current dimension text style.
	4 Draw frame around text draws a frame around dimension text.

Tex tab

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.99
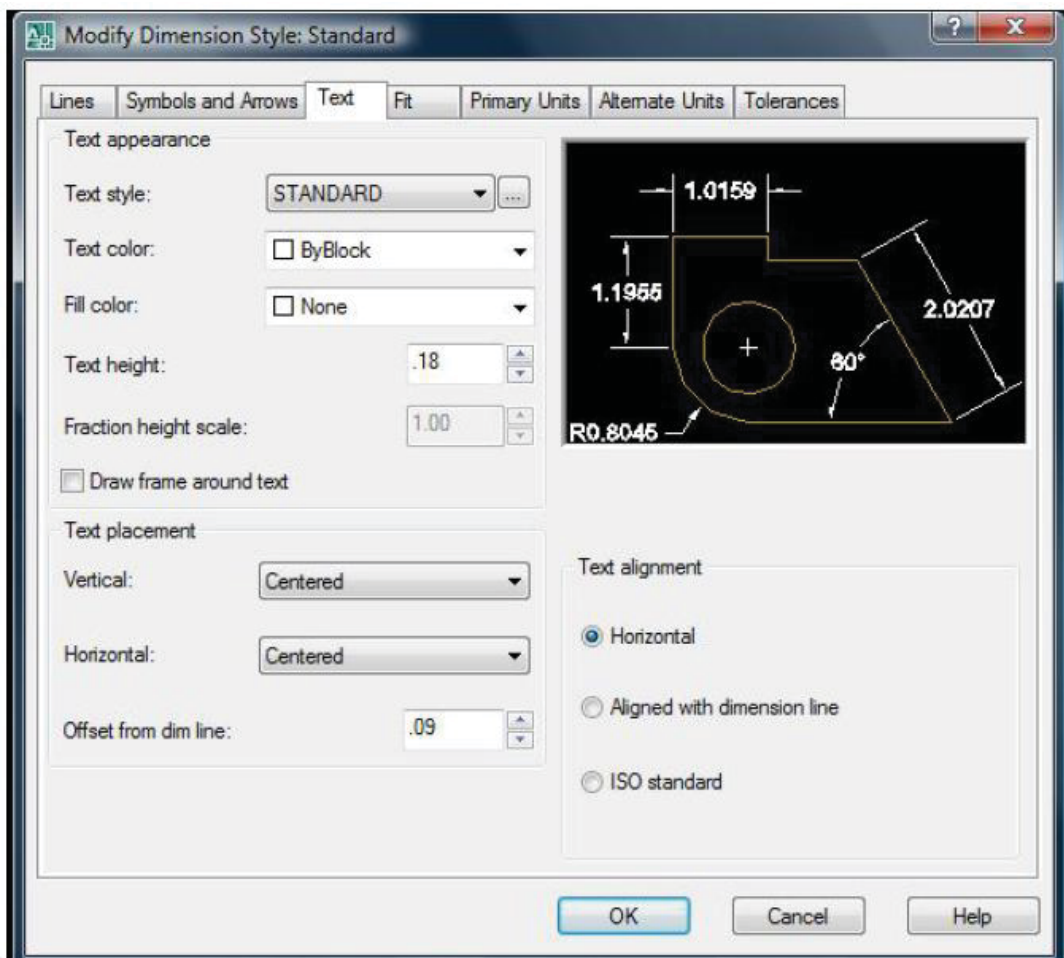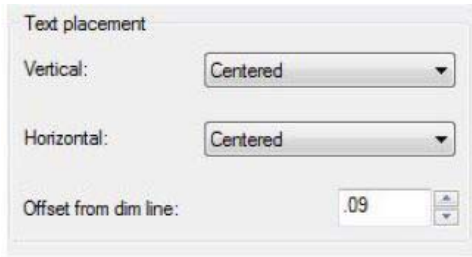
1 Vertical position controls the vertical justification of dimension text along the dimension line.

2 Horizontal position controls the horizontal justification of dimension text along the dimension line and extension line.

3 Offset from dimension line displays and sets the current text gap, which is the distance around the dimension text when the dimension line is broken to accommodate the dimension text.
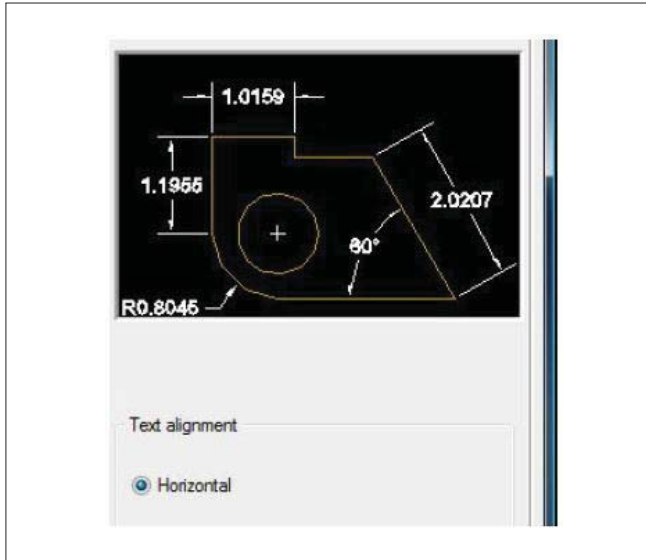
1 Horizontal places text in a horizontal position.
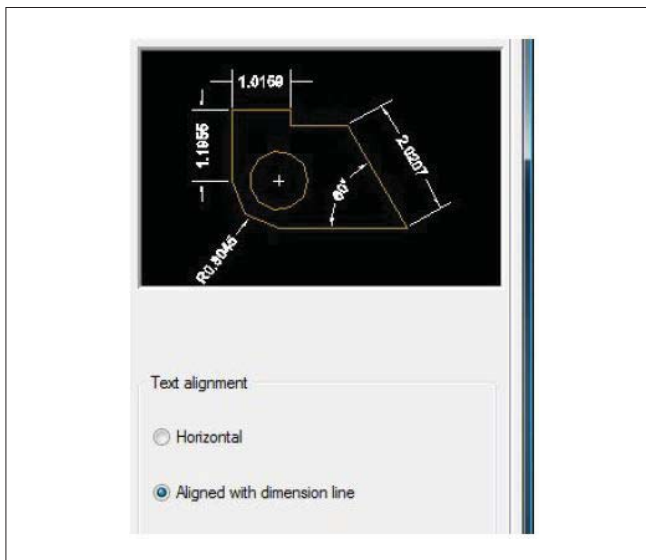
2 Aligned with dimension line aligns text with the dimension line.

3 ISO standards aligns text with the dimension line when the text is inside the extension lines, but aligns horizontally when text is outside the extension lines.

Primary units tab
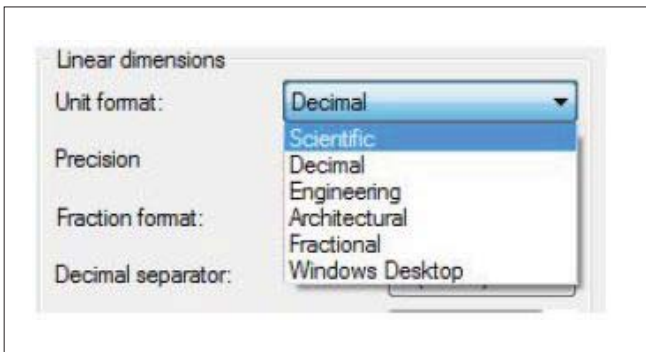
Description

1 Unit format sets the current for all dimension types accept angular. Options to select from include scientific, decimal, engineering, architectural, fractional etc.

2 Precision displays and sets the number of decimal places in the dimension text.

3 Fractional format sets the format for fractions. Options to select from include diagonal, horizontal, and not stacked.

4 Decimal separator sets the separator for decimal formats. Options to select from include period (.), comma (.), or space.
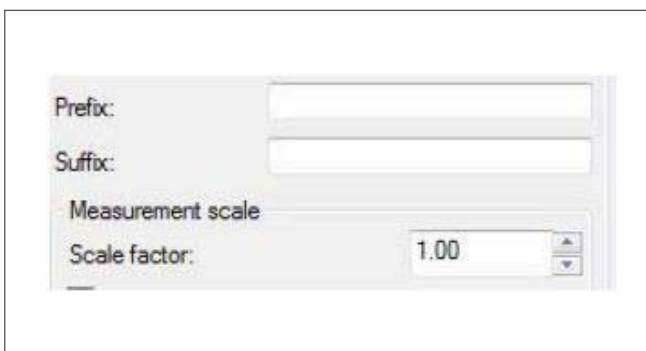
1 Prefix includes the prefix you enter in the dimension text. You can enter text or use control codes to display special symbols. For example, entering the control code % %c displays the diameter symbol.

2 Suffix includes the suffix you enter in the dimension text. You can enter text or use control codes to display special symbols.For example,entering the text mm results in the dimension text similar to that shown in the illustration.

3 Measurement scale defines measurements scale options as follows: Linear scale factor sets a scale factor for linear dimension measurements for all dimension types except angular.

Control code % displays the diameter symbol.

Primary units tab

Dimensioning: Create the following exercise using CAD commands.

Text

This command is used for entering the related details on a drawing. Text is used for entering details in the title blocks, for labelling the parts of drawing, For giving specifications and for making annotations etc. There are two types of text used in Auto CAD.

70 **Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.99**

1 Single line text or D text.

2 Multiline text or M text.

1 Single line text or D text

Pull down	: Draw, TEXT, single line text
Command	: TEXT or DT
Current text style	: "Standard"
Text height	: 0.2000

Specify start point of text or [Justify/Style]: Select start point

Specify height<0.2000>: 25

Specify rotation angle of text <0>

Type on the screen: TEXT

2 Multiline text or M text

Pull down	: Draw, Text, Multi line text
Command	: MText or MT
Current text style	: " Standard"
Text height	: 0.20000
Specify first corner	: Click on the first corner

Specify opposite comer or [Height/Justify/

Line spacing /Rotation/Style/Width]: click on the second corner Give text height, type, style, etc.

Enter the text, And press button OK.
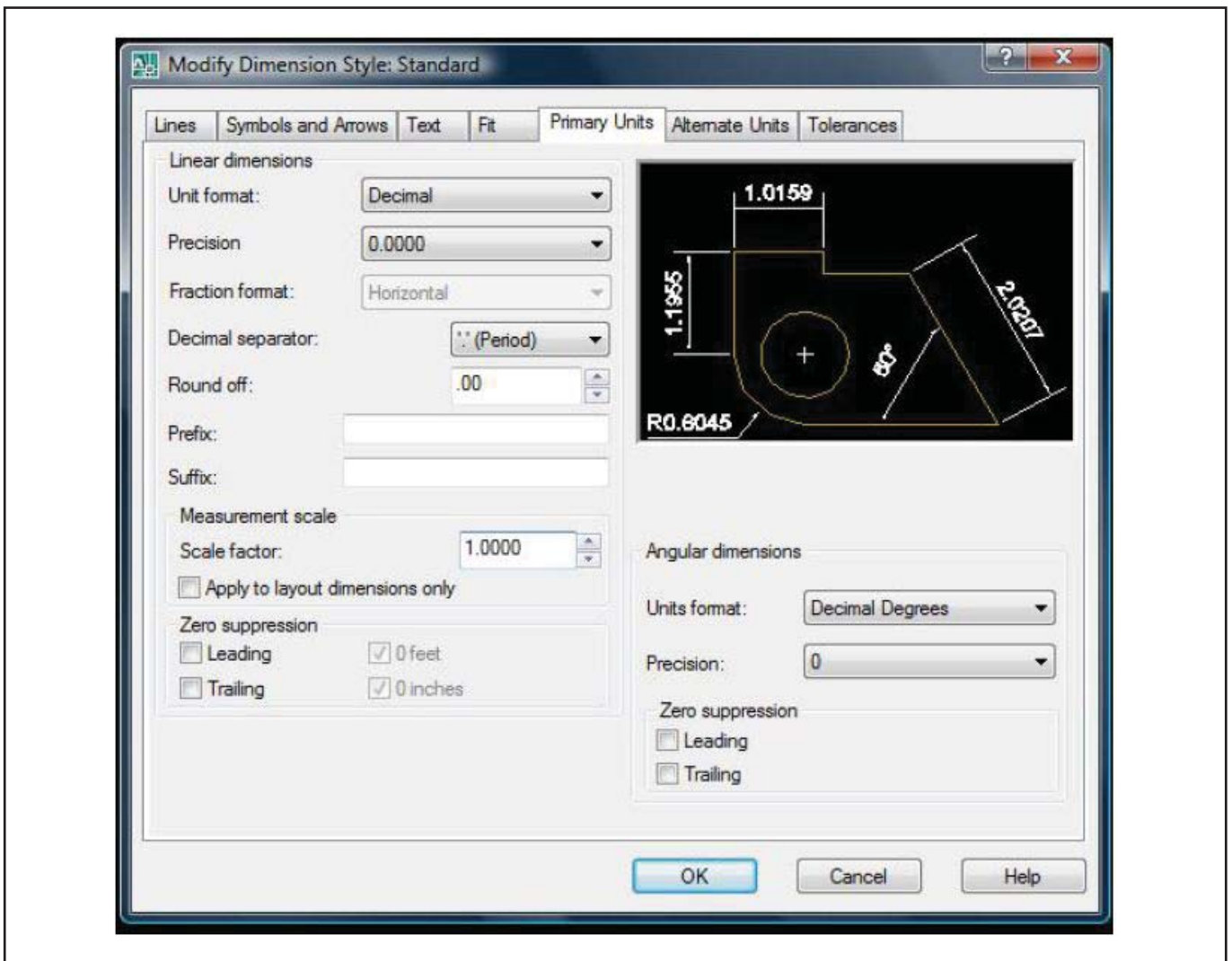
Text style

This command is used to change the text style.

After giving changes click on apply.

Computer aided drafting exercise 15-16

Plotting

Objectives: At the end of thess lessons, you shall be able to practice

Plotting drawings.

Plotting drawings

Printing or plotting of a drawing can be done by using a printer or a plotter.

Print or plot command

Various input facilities are available for printing a drawing. Facilities like key board, menu bar or tool bar with mouse are explained below.

Fig 15

EXERCISES

DCN3299JF

Fig 16

EXERCISES

DCN3299JG

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.99
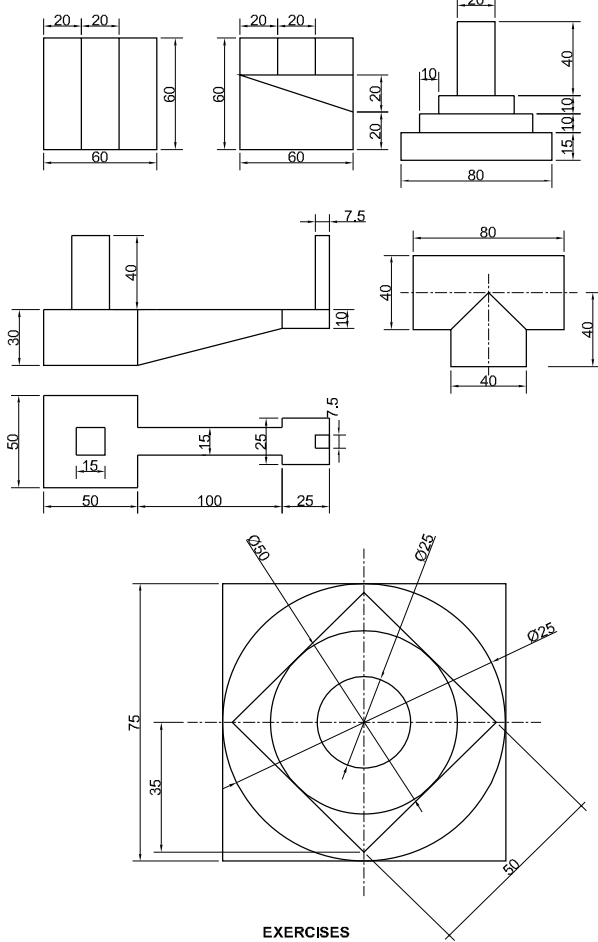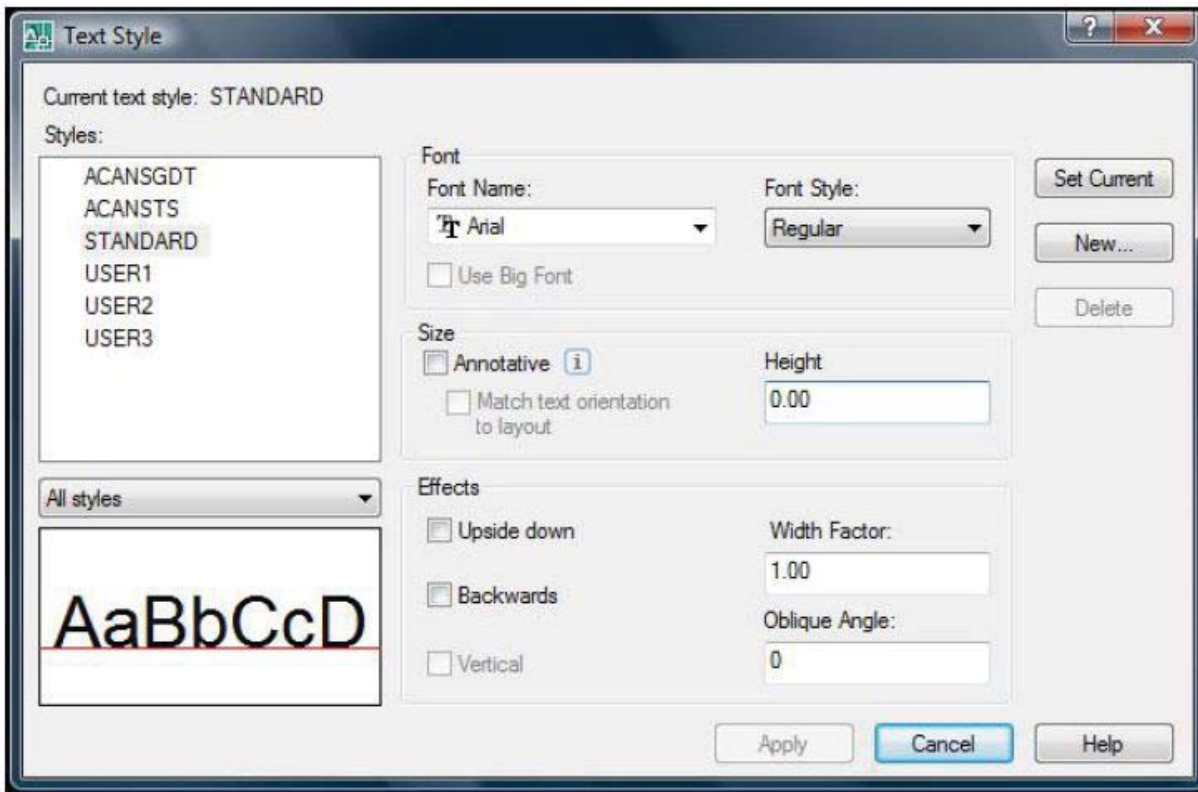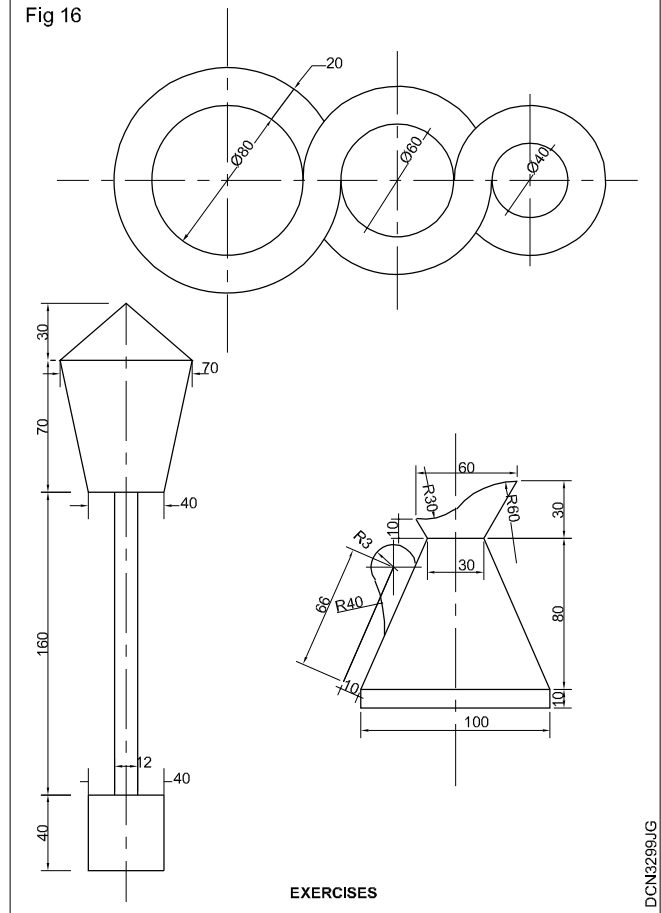
Properties & blocks

Objectives : At the end of this exercise you shall be able to
• **match properties**
• **identify line weight**
• **practice block.**

Match properties

This command is used to copies the properties from one object to one or more objects.

Pull down menu: Modify, match properties

Command: Match properties, MA

Select the source object: Pick the object whose property to be matched.

Select destination object(s) or [settings]: Select the object to which properties are to be copied or press

Select destination object(s) or [settings]

Change the properties

Command: CHPROP

When you select an object in the drawing area, the object properties window displays all the properties they have in common.

The properties that are in grey cannot be modified.
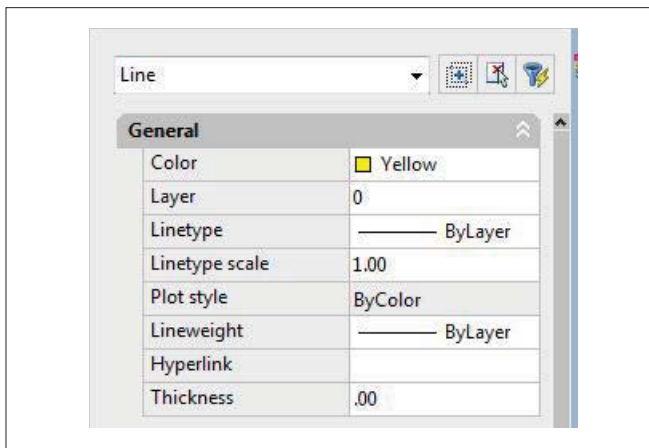
Line type

Pull down menu   : format, line type

Command   : L type

After invoke this command a 'Line type manager' dialogue box will appear on the screen.

click here
Clik ok

Select line type from here

Click Ok in the 'line type manager' dialogue box.

Object snaps (Fig 1)

Suppose you want to draw a line from the center of the circle to the middle of the vertical line you extended earlier. AutoCAD has a feature that makes this very easy. These are the object snaps (or Osnaps "Oh-Snaps"). Type os <ENTER>. You will see this dialog box appear.

Fig 1

ICON	SETTING	ICON	SETTING
/	Endpoint	⊓	Insertion Point
/	Midpoint	⊥	Perpendicular
.	Center	○	Tangent
.	Node	⋌	Nearest
○	Quadrant	×	Apparent Intersection
×	Intersection	//	Parallel
--	Extension	M2P	Midpoint between 2 points

OBJECT SNAP COMMAND
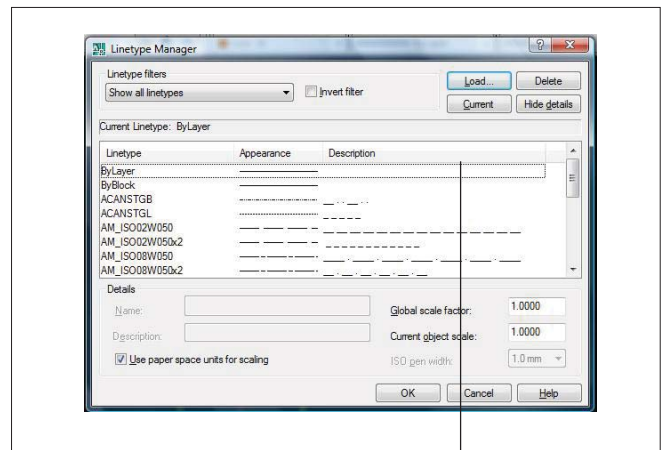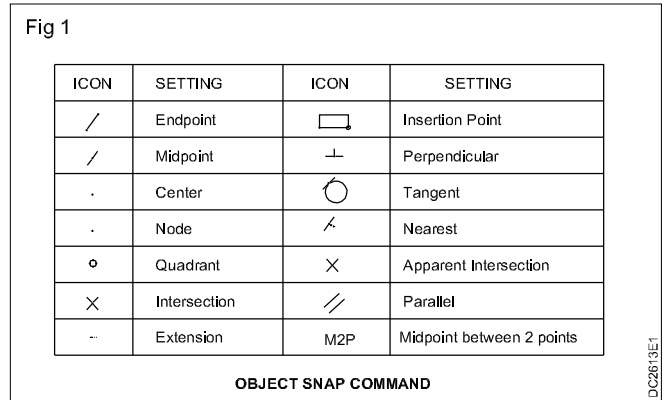
click here

Click ok

Select line type from here

Fig 2

BLOCK COMMAND

DCN3299X1
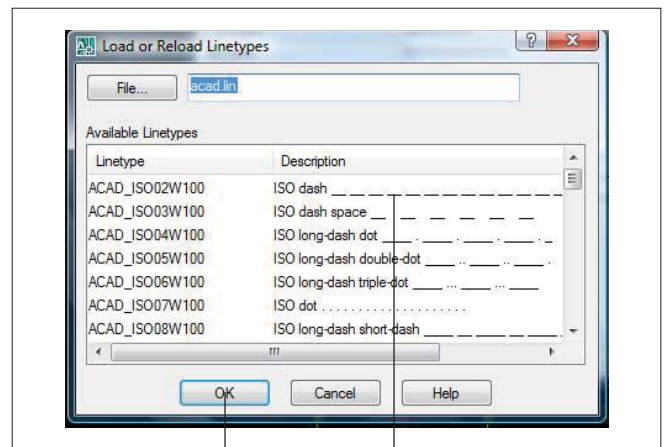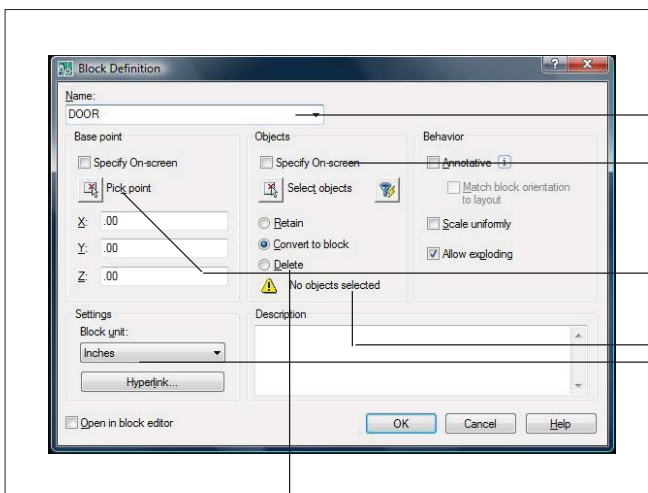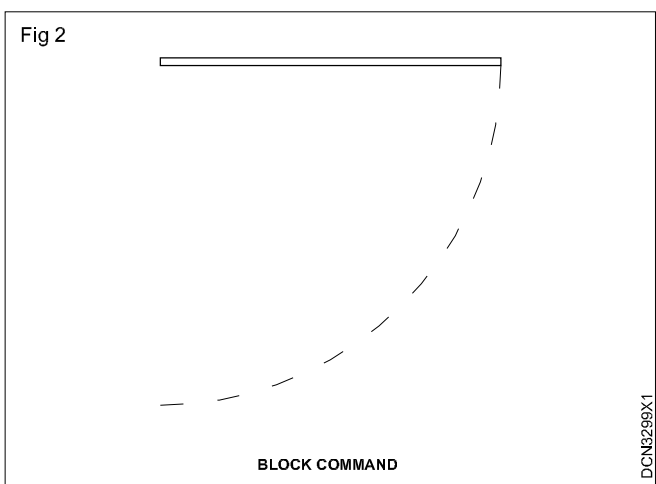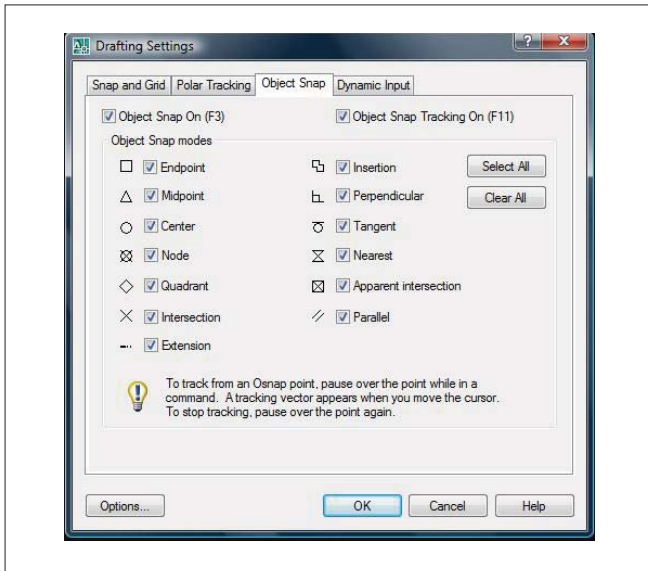
3 Type the name in this area, door.

4 Click on select objects. AutoCAD hides the dialogue box. Pull a selection window around the door and press enter. The dialogue box will return.

5 Click here and pick an insertion point, use object snap.

6 Select.

7 Unit offered here are the drawing units.

8 Click on ok

Block

This is used for storing a part of drawing or entire drawing or symbols that are needed in the same drawing or for other drawing. This is stored with a desired scale factor. All the objects inside a block considered as a single object.

Tool bar   : Draw block, make

Pull down menu   : Draw, block, make

Command   : Block or B

When you invoke the command BLOCK a block definition dialogue box is displayed.

1 Draw a door. (Fig 2)

2 Click on draw pull down menu, click on block, click on make

Insert block

Once the block has been created you may insert it in the drawing.

• Click on the insert menu

• Click on block

• The insert dialogue box will appear

• Click on the down arrow all the blocks created in the current drawing will be listed. Select the block name.

• At this point you are returned to the drawing with the block attached to the cross hairs at the insertion point you defined.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.99
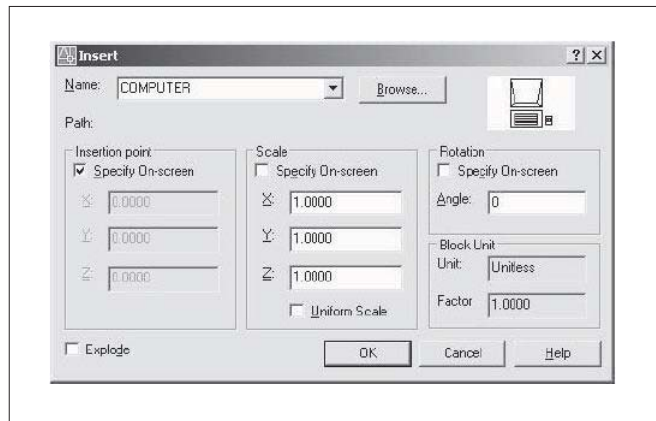
- Move the block in to position on the sreen. The command line asks for the insertion point and lists several options.[Scale, X/Y/Z/Rotate/Pscale/PX/PY/PZ/PRotate]

These options refer to the scaling and rotation of the block. If you simply pick a point on the screen the block will be inserted without being scaled(at the size it was drawn)

- The block is now locked in to position in the drawing.

Write block

If a block is converted in to a drawing file then you can use it in any other drawing.

- Type WBLOCK at the command line and press enter.
- The write block dialogue box appears.
- Select block
- Click on the down arrow and select the block name.

At this stage AutoCAD takes the block and converts it to a drawing. This drawing can be treated like Aito CAD drawing You can open it as a separare drawing, explode it, edit & draw in the usual way
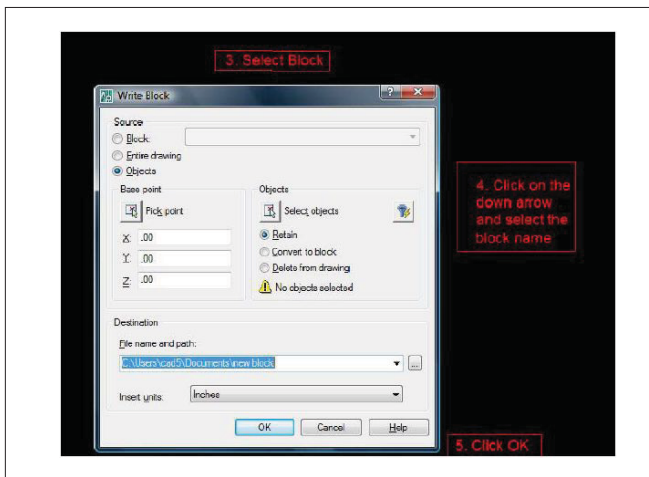
Divide

This command   is used to divide a line or arc or circle in to number of parts.

Command : Divied, div

Select object to divide: Select the line AB

A _____B

Before divide

A B

Before divide

If you cannot see the division on the screen, change the point stlyle.

Point style

Pull down menu: Format, point style

Select new pointstyle from this box

Click OK

Then the points are visible clearly.
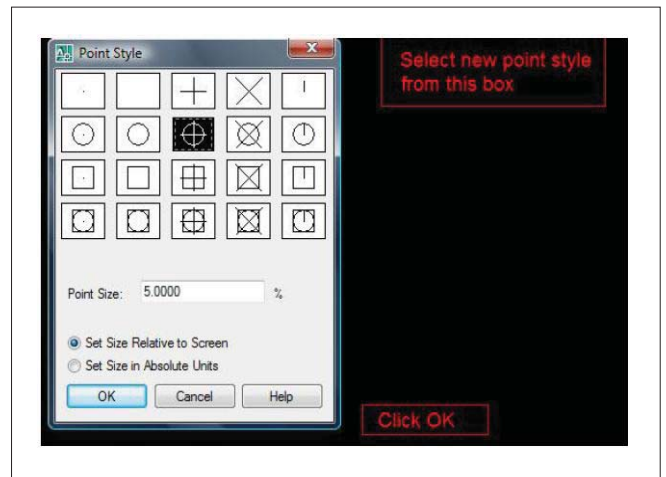
2D drafting doors windows and sanitory fittings using CAD

Objectives : At the end of this exercise you should able to
• **draw the flush door and panel door**
• **draw the window and hand rail**
• **draw the sanitory fittings.**

PROCEDURE

TASK 1 : **Draw a flush door to the standerd size as per I.S specification, and unite the commands of procedure**

— — — — — — — —

TASK 2 : **Draw a panel door to the standerd size as per I.S specification and illustrate the commands for the development of the object**

— — — — — — — —

TASK 3 : **Draw a window to the standard size as I.S specification and give the commands for the drawing of the window**

— — — — — — — —

TASK 4 : **Draw a door handle to the standerd size as per I.S specification ment**

— — — — — — — —

TASK 5 : **Draw sanitary fittings-wash basin-C.I pipe joints-as parts. Standards using CAD commands illustrate the commands used for the development**

— — — — — — — —

Preparing library folder by creation blocks of prepared   drawings

Objective : At the end of this exercise you should able to
• **Prepare a library folder for the drawing created by you.**

PROCEDURE

TASK 1 : **A sample library folder is given study the folder - with refering to the given folder**
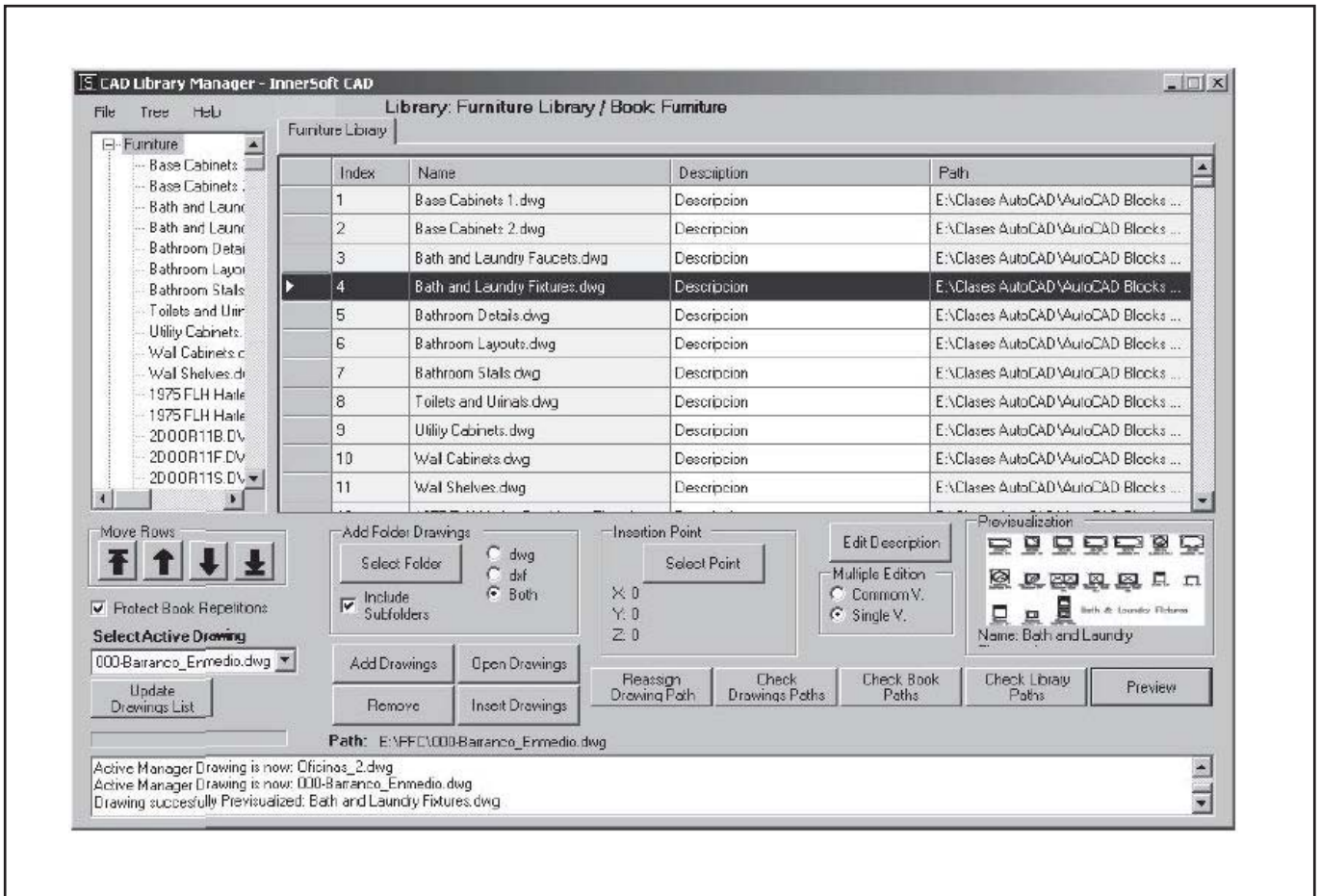
Building drawing line diagram of a residence

Objectives : At the end of this exetcise you shall be able to
• **identity the size of rooms**
• **identify the number and positions of wall opening**
• **draw the line diagram of the residential building.**

PROCEDURE

TASK 1 : **Prepare the given line sketch in a scale of 1:50**

1 Select a scale, of 1:50 (Fig 1)

2 Draw a riight angled corner indicates the corner of bed room.

3 Draw parallel lines and perpendicular lines as per the room. arrangements, according to the size and shape of various rooms.

4 By using outlines finish the positions of rooms.

5 Erase the unwanted construction line, if any position

6 Furnish the details of rooms, position of doors, windows etc.

7 Dimension the figure as per the datas given.

8 Specify the scale, and related notes.

9 Complete the required line sketch.

Fig 1

PLAN OF A RESIDENCE

ALL DIMENSIONS ARE IN CMS

BUILDING DRAWING

DCN32102E1

Reading room with R.C.C flat roof

Objectives : At the end of this exercise you shall be able to
- **draw the plan section & elevation of the reading room as per the given line sketch manually (traditional drawing)**
- **develop the plan section & elevation of the readig room as per the given line sketch through AutoCAD.**

PROCEDURE

TASK 1 : **Prepare the working drawing of the reading room from the given line sketch (Fig 1)**

Traditional and AutoCAD drafting

- Line sketch showing the arrangements of room.
- Foundation for wall.
- Foundation concrete - P. C. C. 1:4:8, 20 cm thick.
- RR masonry in cm 1:6 (60 x 60)
- Basement R.R masonry in cm 1:6 (45 x 45) cm.
- Wall - Brick work in cement mortar 1:6, 20 cm thick 360 cm height.
- Roof slab R.C.C 1:2:4, 12 cm thick
- Column R.C.C 1:2:4, (30 x 30) cm.
- Beam R.C.C. 1:2:4, (20 x 20) cm.
- Provide lintel and sunshades wherever necessary.
- Assume all missing data (For manual drawing).
- Draw the plan and finish datails as per the line sketch.

- Sketch the section plan which gives maximum details.
- Draw the sectional elevation as per the sectional plan.
- Draw elevation which gives pleasing apperance
- Complete the drawing through Auto CAD for this
- Set unit,
- Set layers for line work, hatching / dimensioning
- Name the layers
- Select layer for line work and complete the plan, section and elevation.
- Select hatch layer and hatch the necessary section areas.
- Select the dimension layer and dimension the figure and also print the specifications, schedule of joinery and others details.
- Print the drawing in A3 size paper.

Fig 1

A READING ROOM WITH R.C.C. FLAT ROOF

BOOK SHELF

R C C BEAM (CENTRAL PORTION ROOF IS AT A HIGHER LEVEL OF 100 CM FROM THE SIDE ROOF SLAB)

READING ROOM

STAFF IN CHARGE

PORTICO
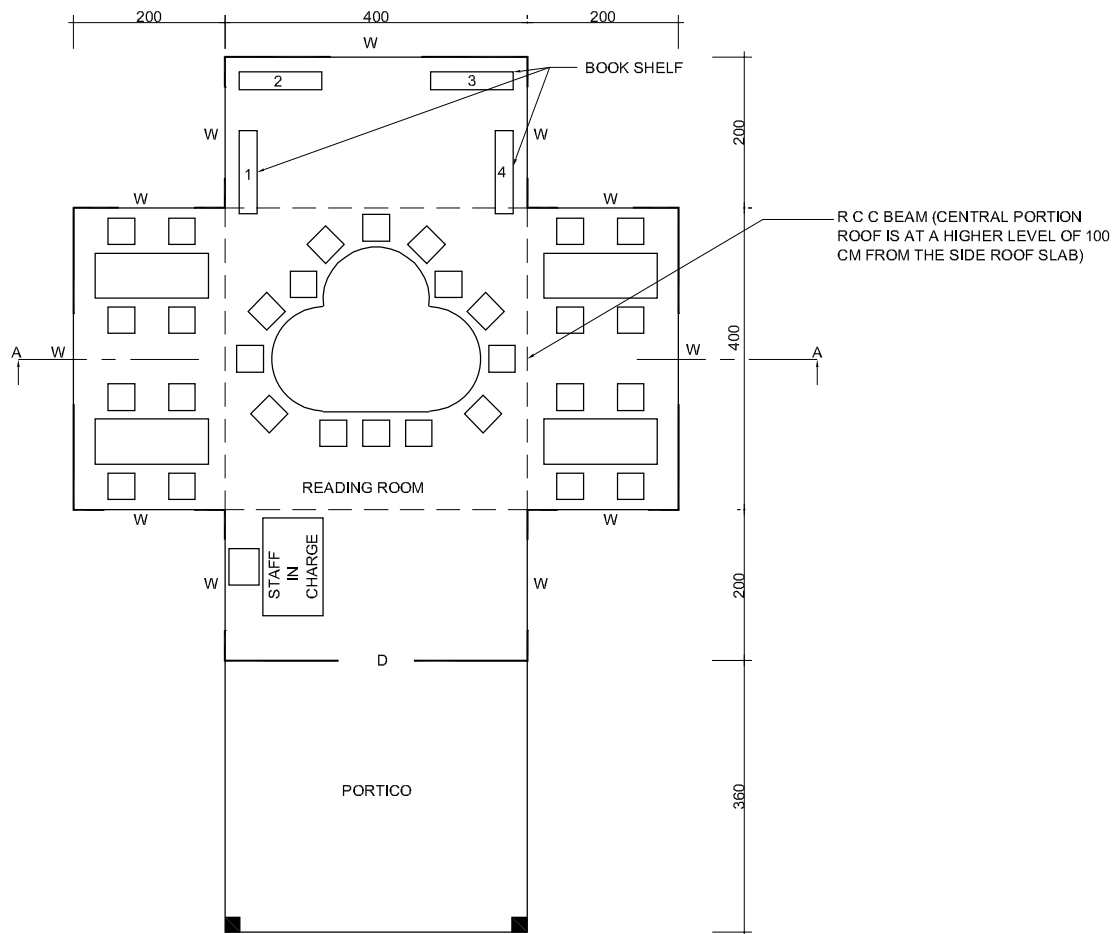
Note:- 1. DIMENSIONS ARE IN CM
2. DIMENSIONS ARE CENTRE TO CENTRE
3. MISSING DATAS MAY BE SUITABLY ASSUMED.

DCN32103E1

READING ROOM

Construction - Draughtsman Civil (NSQF LEVEL - 5) - Exercise - 3.2.103

Single storied residential building with single bed room (R.C.C. flat roof)

Objectives : At the end of this exercise you shall be able to
• **identify the thickness of wall**
• **draw the plan of building**
• **draw the section of the building**
• **draw the elevation of residence.**

PROCEDURE

TASK 1: **Draw the plan, elevation and sectional elevation of the building as for the line diagram (Fig 1)**

• Select a scale of 1:50.

• Layout the drawing sheet for plan, section and elevation.

• Prepare the plan starting from the corner of Living room.

• Draw wall thickness as per the scale.

• Create the rooms as per the figure.

• Erase the unnecessary construction lines.

• Mark the position of door, windows etc.

• Furnish the dimensions and notes where ever needed.

• Complete the plan.

Fig 1

LINE DIAGRAN FOR RESIDENCE

DCN32104E1
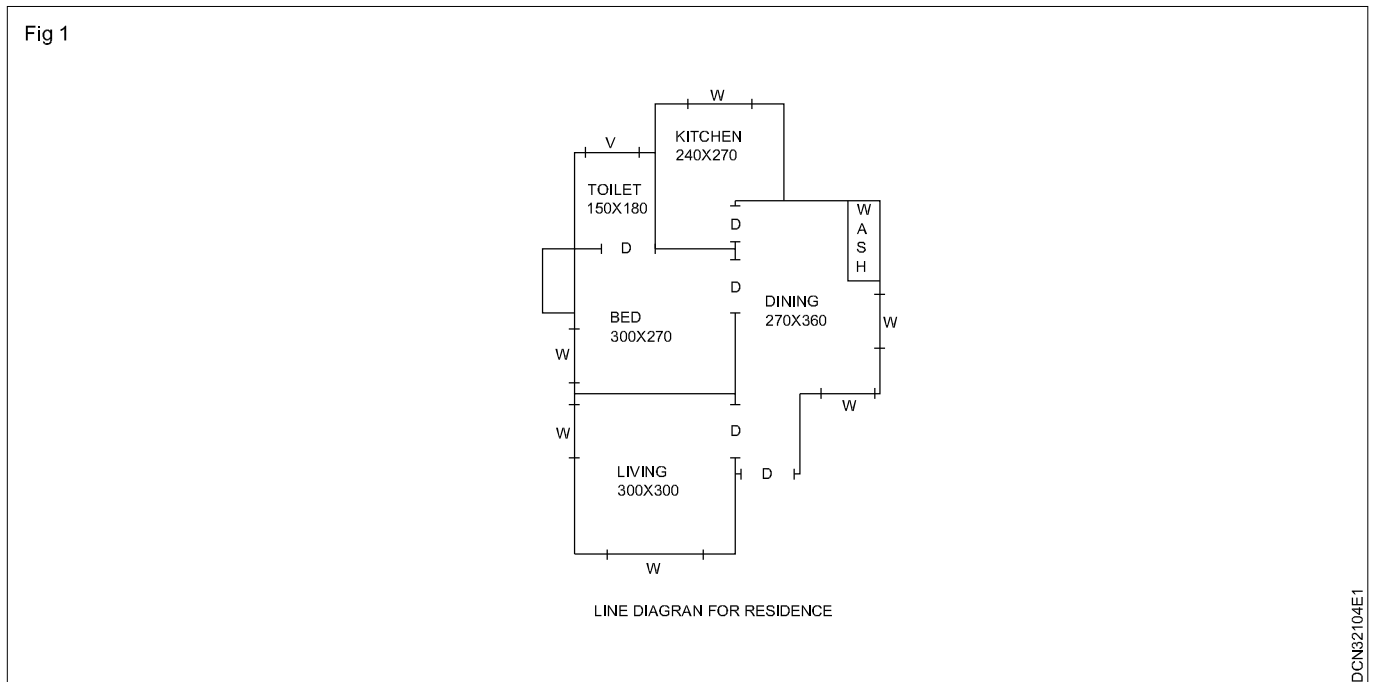
TASK 2 : **Draw the section (Fig 2)**

• Draw a horizontal line shows the ground level.

• Identify the position of cutting plane.

• Create projection lines for walls, as per the room size.

• Draw the basement line, roof line, parapet line etc.

• Furnish the foundation details as shown.

• Hatch the section as per the materials used.

• Furnish the dimensions,

• Complete the section.

TASK 3 : Draw the Elevation (Fig 2)

- Draw projection lines from plan and section.

- Remove the unwanted projection lines and develop. The elevation.

- Furnish the door, window, sunshade details etc.

- Finish the required elevation by outlines.

- Complete the working drawing with specification schedule of joinery and other details.

Fig 2

ELEVATION

SECTION ON AA

PLAN

SCHEDULE OF JOINERY

MARK	ITEM	SIZE	TYPE	NOS.
D	DOOR	110X210	PANELLED	1
D1	DOOR	100X200	PANELLED	2
D2	DOOR	90X200	PANELLED	1
W1	WINDOW	300X150	GLAZED	1
W2	WINDOW	120X150	GLAZED	1
W3	WINDOW	150X120	GLAZED	1
V	VENTILATOR	150X60	GLAZED	1

SPECIFICATIONS

1) FOUNDATION:-
2) WALLS:-
3) LINTELS:-
4) ROOF SLAB:-
5) PLASTERING:-
6) FLOORING:-
7) PAINTING:-

Note:- Provide Foundation according to the condition of soil

PLAN AND SECTION OF A BUILDING

DCN32104E2
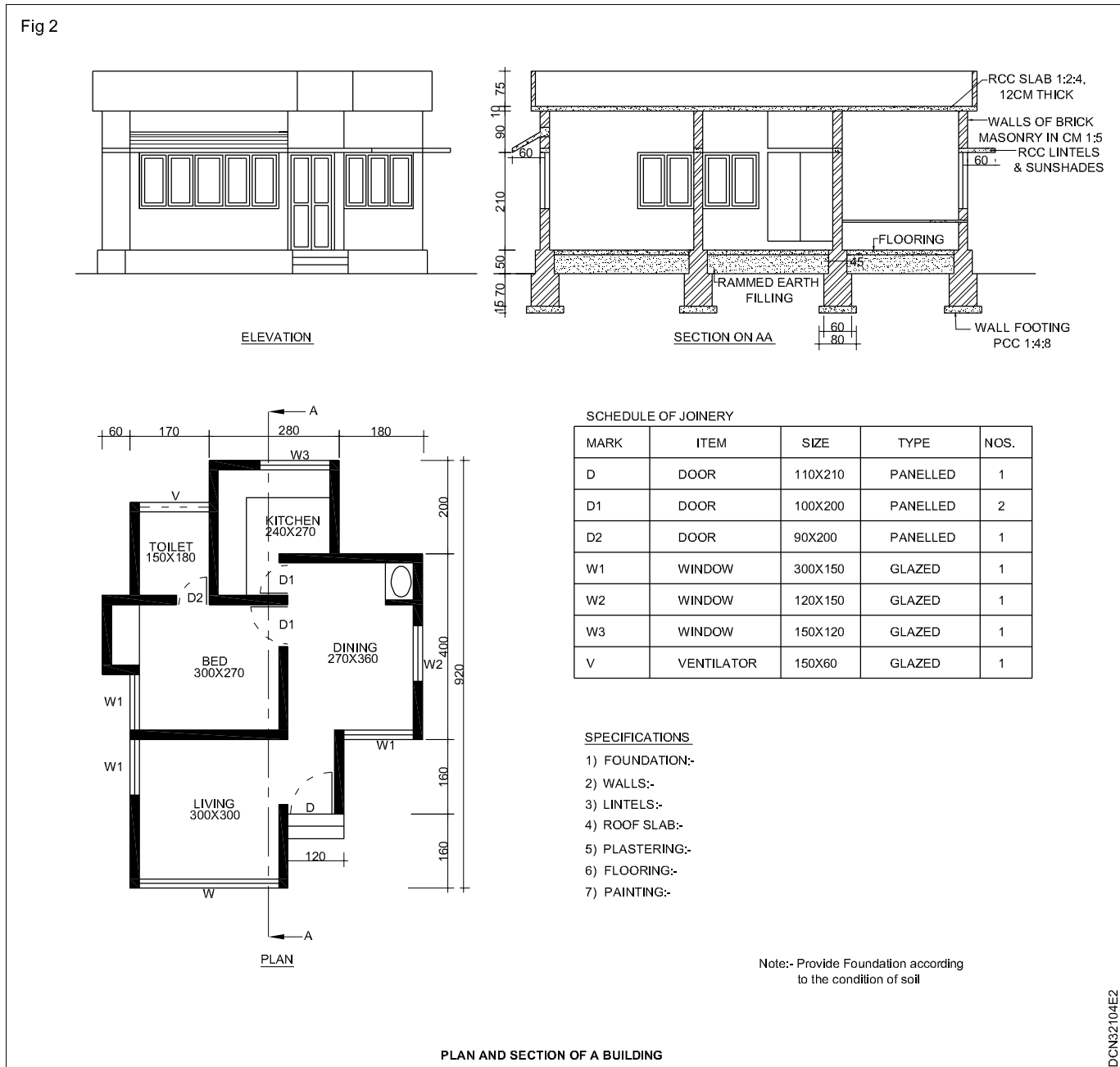
TASK 4 : Draw the plan, section and elevation of the residential of the building using the AutoCAD

Draw the plan of the residence

- Open the AutoCAD software.

- Draw the building outline of the house by using the "Line" command. Click the "Line" icon to activate the command. Left-click to start and end the line.

- Offset the building outline the desired thickness of the exterior wall. Use the "Offset" command.

- Draw all interior walls by using the same "Line" and "Offset" commands.

- Use the "Trim" command to trim any messy intersections on the exterior or interior conditions. Left click the "Trim" icon to activate the tool. Select the "cutting edge" line followed by the line that you would like to trim off.

- Cut openings for doors and windows by drawing lines and then trimming away the opening. If you want 100cm door draw a line perpendicular to the wall, offset it 100cm and trim away the excess lines.

- Draw the doors and windows where the new openings exist.

- Activate the text command to enter the names of rooms and their sizes.

- Activate the dimension icon and click the edges of each wall that you would like to dimension to. This will give the drawing a more professional look and also gives people a sense of the space.

- Insert the table and prepare the details of joinery.

- Using area command find the area of the building.

Draw the section of the residence

- Draw the base line to draw the section of the residence

- According to the section line shown in the plan, the width of walls, rooms has to be drawn according to the design using line, offset, trim commands.

- Use the hatch commands to show the R.C.C. rubble masonry in the section.

- Activate the text commands for mentioning the name and size of the rooms.

- Using dimension command complete the dimensioning of the section drawing.

- Plot the drawing to a printer or to a PDF format. Hit the plot icon to open the plot settings. Choose the layout type, pen settings and windows view that you would like to use.

Draw the elevation of the residence

- Draw the base line to draw the elevation of the residence.

- Draw the projected lines from the plan to create front view of the residence using line command.

- Draw the elevation of the residence using modify commands like offset, trim, fillet, extend to complete the outline

- Using block, insert block commands prepare the doors and windows in elevation.

- Assign proper line weights to create the effective apperance of the building.

- Plot the drawing to a printer or to a PDF format. Hit the plot icon to open the plot settings. Choose the layout type, pen settings and windows view that you would like to use.

— — — — — — — —

A residential building with double beded room (R.C.C flat roof)

Objective : At the end of this exercise you shall be able to
• **develop the working drawings of two bed room residence.**

PROCEDURE

TASK 1 : **Prepare the working drawing of a two bedroom residence through AutoCAD (Fig 1 & Fig 2)**

1   Line sketch showing arrangements of rooms.

2   Give standard dimensions for the building elements.

3   Develop the working drawings through Auto CAD

4   Table a print out in A3 sheet.

Create your own elevation

Fig 1
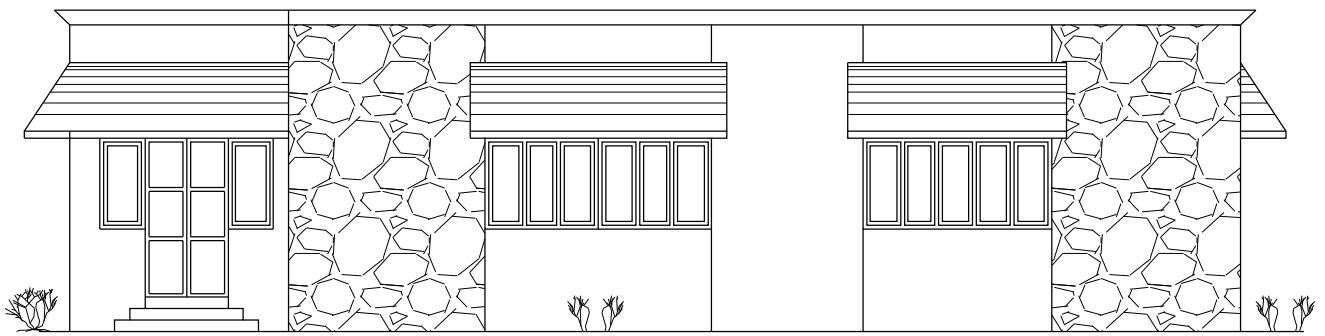
ELEVATION
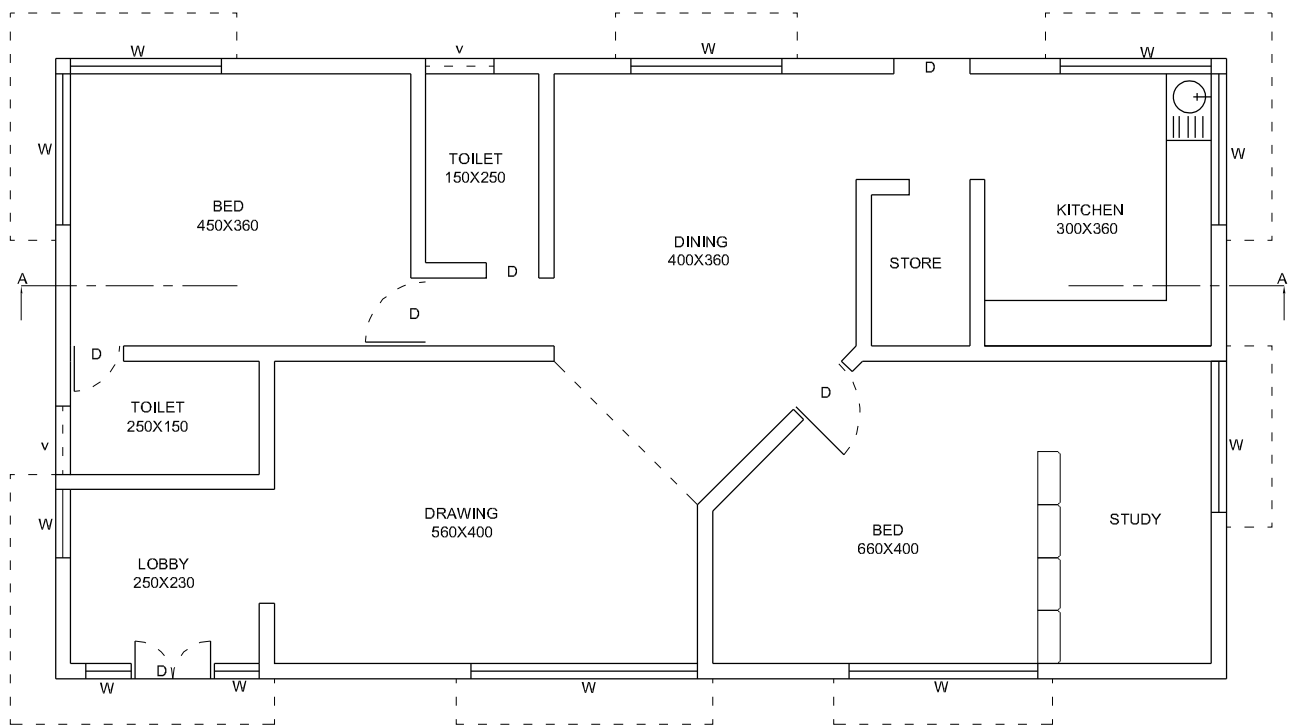
BED
450X360

TOILET
150X250

DINING
400X360

KITCHEN
300X360

STORE

TOILET
250X150

DRAWING
560X400

BED
660X400

STUDY

LOBBY
250X230

W

D

V

W

A

A

PLAN

REFERENCE

FOUNDATION :- R R MASONRY IN CM 1:6, 60CM WIDE AND
80CM DEEP OVER A LEVELLING COURSE OF PCC 1:4:8, 20CM
THICK.

BASEMENT:- R R MASONRY IN CM 1:6, 45CM WIDE AND 45CM
HIGH.

SUPERSTRUCTURE:- BRICK MASONRY IN CM 1:6, 20CM THICK
BOTH SIDES PLASTERED WITH CM 1:4. RCC LINTELS 15CM
THICK ARE PROVIDED OVER ALL OPENINGS.

ROOF:- RCC 1:2:4, SLAB 12CM THICK.

INDEX

D- DOOR (100 X 210 CM)
W- WINDOW (150 X 150 CM)
W1-WINDOW (50X150CM)
V- VENTILATOR (100 X 60 CM)

ASSUME SUITABLE DATA, IF NECESSARY

TWO BED ROOM RESIDENCE

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.105　　85

DC2711E1

Fig 2
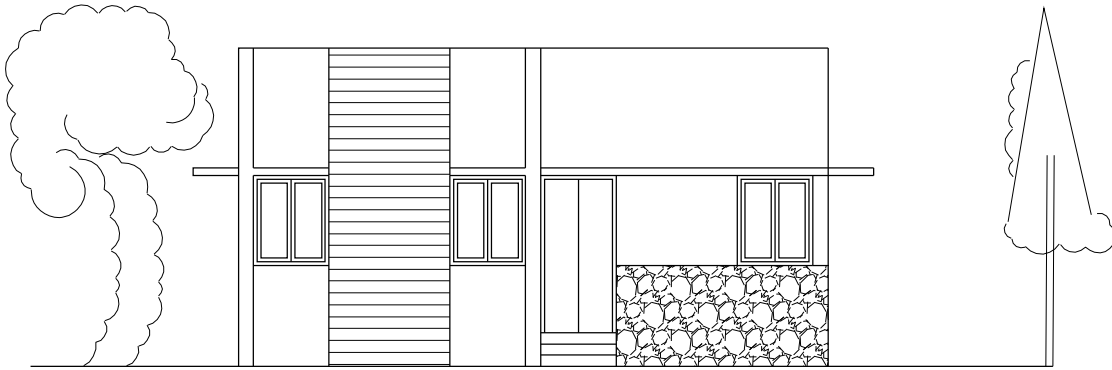
ELEVATION
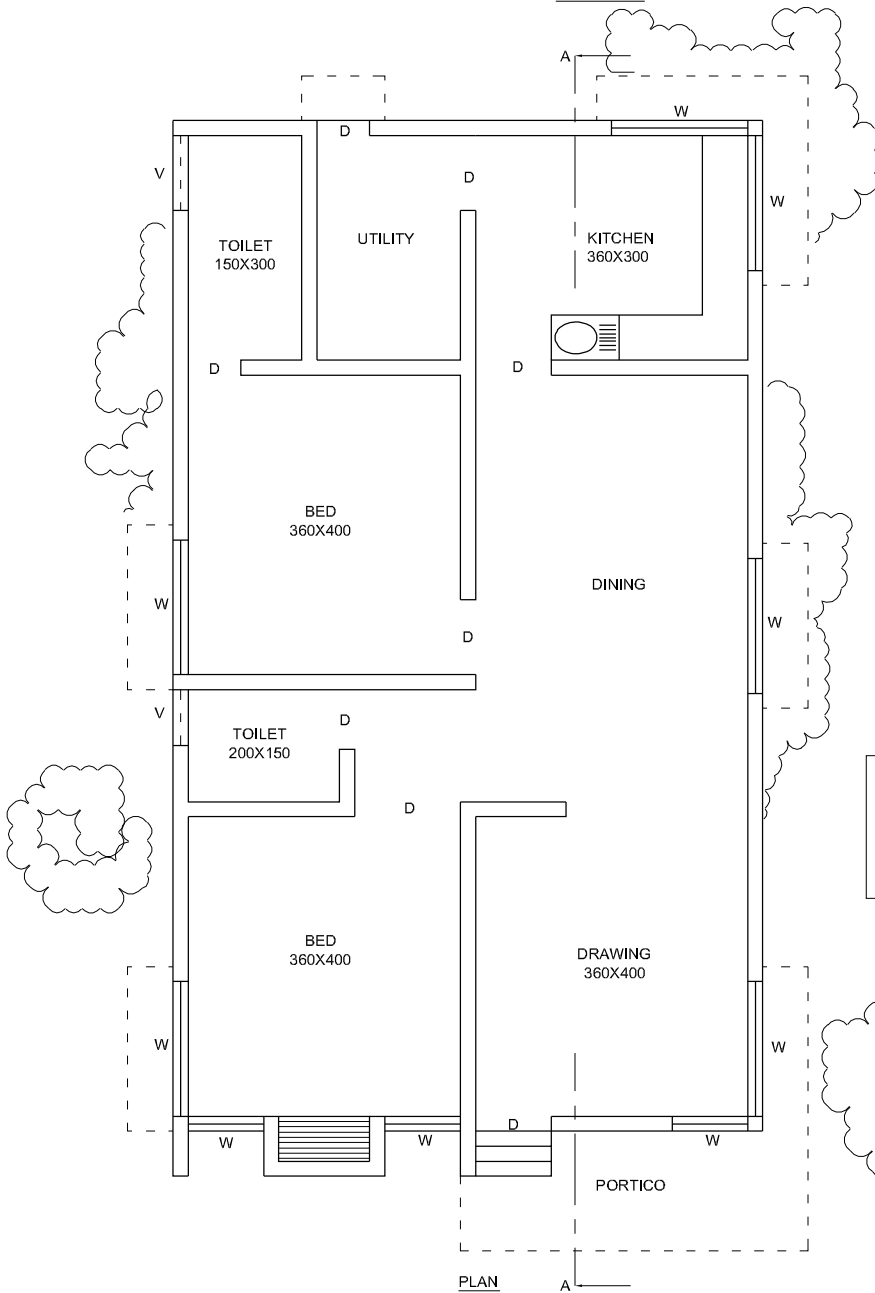
REFERENCE

FOUNDATION: RR MASONRY IN CM 1:6,60CM
WIDE AND 80CM DEEP OVER LEVELLING
COURSE OF PCC 1:4:8, 20CM THICK.

BASEMENT: RR MASONRY IN CM 1:6,45 CM WIDE
AND 45CM HIGH.

SUPERSTRUCTURE: BRICK MASONRY
IN CM 1:6, 20CM THICK BOTH SIDES
PLASTERED WITH CM 1:4.
RCC LINTELS 15CM THICK ARE
PROVIDED OVER ALL OPENINGS.

ROOF: RCC 1:2:4, SLAB 12CM THICK

INDEX

D- DOOR (100 X 210 CM)
W- WINDOW (150 X 150 CM)
W1 - WINDOW (100 X 100 CM)
V1- VENTILATOR (100 X 60 CM)

ASSUME SUITABLE DATA, IF NECESSARY

TOILET 150X300
UTILITY
KITCHEN 360X300
BED 360X400
DINING
TOILET 200X150
BED 360X400
DRAWING 360X400
PORTICO

PLAN

TWO BED ROOM RESIDENCE

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.105

House with single bed and a hall partly tiled and partly R.C.C. flat roof

Objectives : At the end of this exercise you shall be able to
• **draw the plan sectional elevation and front elevation showing partly tiled and partly RCC flat roof**
• **prepare the working drawing of the building.**

PROCEDURE

TASK 1 : **Prepare the working drawing of a single bedroom residence partly tiled and partly R.C.C flat roof**

DATA

• Line sketch showing arrangement of rooms.

• Height of R.C.C roof from the floor level - 300cm.

• Height of wall far pitched roof - 400cm Rise of pitched roof is 1/3 span.

• Assume suitable dimensions for other elements of the building.

• Develop the plan to a scale to 1:100 and show the roof line.

• Draw the section plane by cutting the R.C.C flat roof and crossing the ridge line of the pitched roof.

• Draw the sectional elevation.

• Develop the front elevation.

• Complete the working drawing.

Fig 1

| BATH 210X200 | UTILITY 630X200 | WC 150X200 | TOILET 230X200 |

KITCHEN 300X400

DINING 560X400

BED 400X600

PORTICO 300X400

LIVING 560X400

SITOUT 340X140

A HOUSE WITH PARTLY TILED AND PARTLY R C C FLAT ROOF

DCN32106E1

87
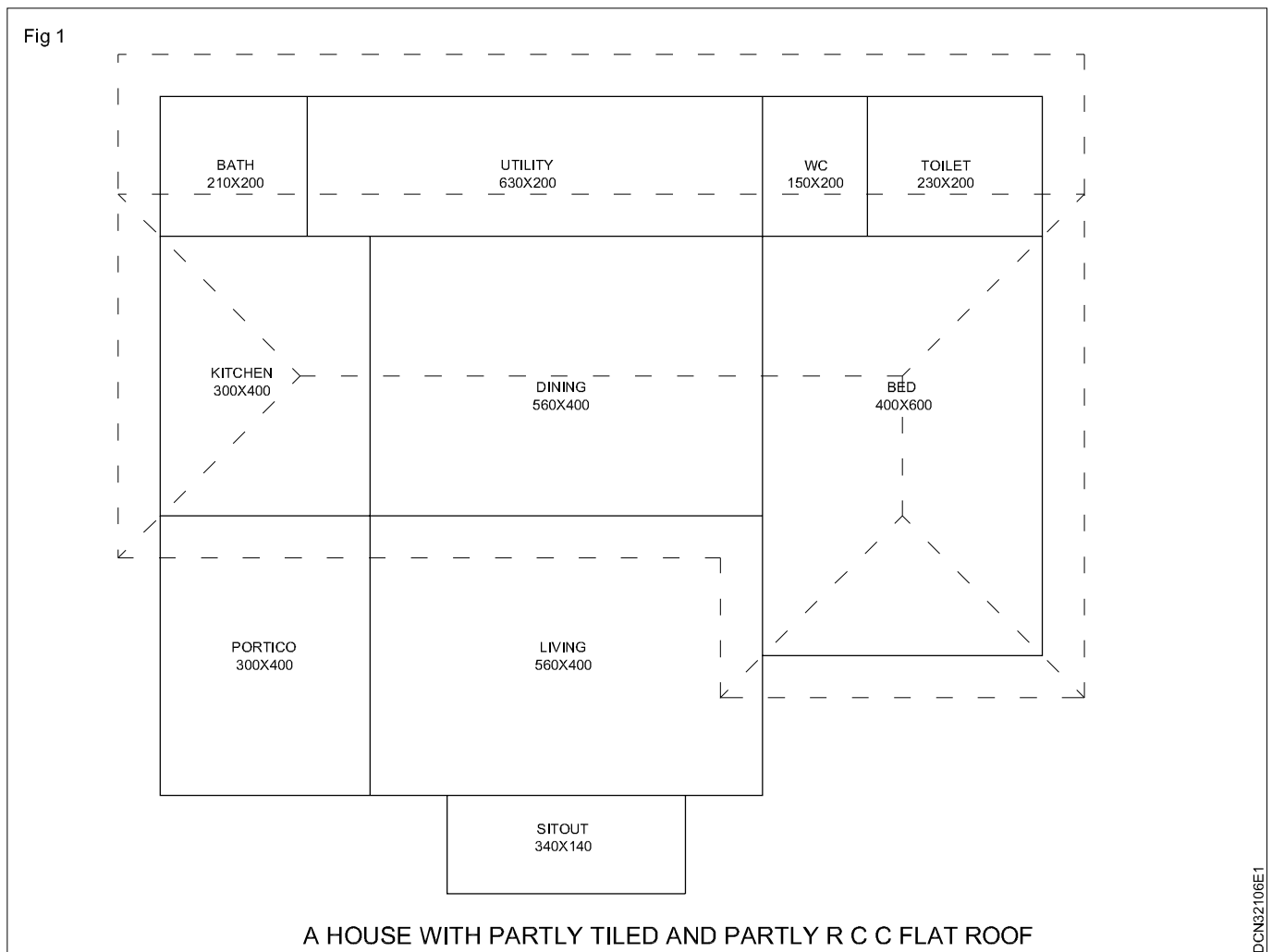
Two roomed double storied residential building (R.C.C sloped roof with gable end)

Objectives : At the end of this exercise you shall be able to
• **draw the ground and first floor plan**
• **draw the sectional view of the building**
• **draw the elevation of the residence.**

PROCEDURE

Task 1 : **Prepare plan, section and elevation of a double storied residential building as per given sketch**

1 Draw the plan.

2 Draw the ground floor plan and first floor plan of the building using various commands in AutoCAD.

3 Draw the sectional view.

4 Create the section of the building and provide foundation as shown in Fig 1.

5 Draw the elevation.

6 Draw the elevation of the residence by projection lines from both plan and elevation.

7 Complete the drawing by printing dimension and other related notes.

Fig 1

FRONT ELEVATION

SECTION ON AA

R.C.C. 1:2:4
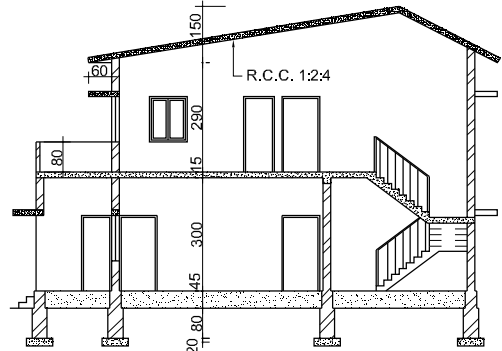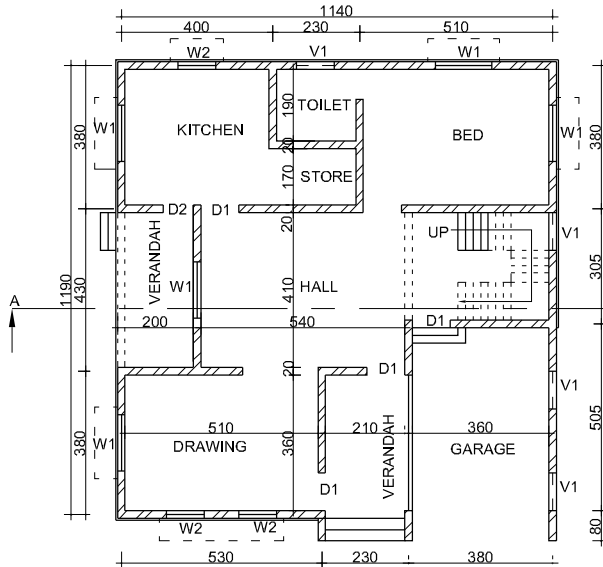
GROUND FLOOR PLAN
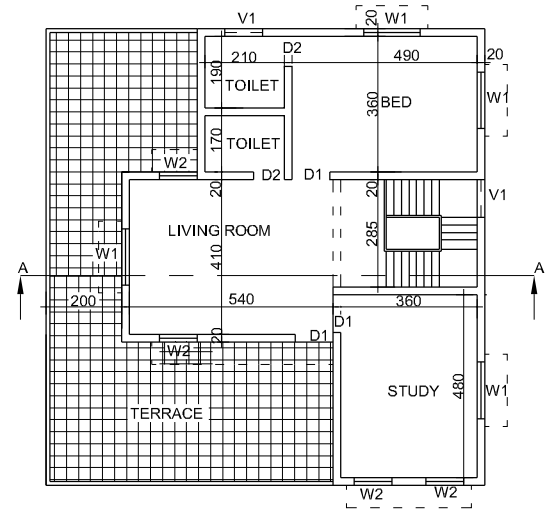
FIRST FLOOR PLAN

INDEX

MARK	ITEM	SIZE	NOS.
D1	DOOR	100X200	8
D2	DOOR	80X200	4
W1	WINDOW	150X120	8
W2	WINDOW	100X120	7
V1	VENTILATOR	100X60	7
W3	WINDOW GABLE	120X120	1

NB:- FOUNDATION MAY BE CANGED ACCORDING TO SOIL CONDITION

R.C.C. SLOPED ROOF RESIDENCE

DCN32107E1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.107   89

A house with fully tiled roof with hip and valleys

Objectives : At the end of this exercise you shall be able to
• **draw the plan of the building**
• **develop the front elevation and sectional elevation.**

TASK 1 : **Draw the plan, elevation and sectional view for the given line diagram, using CAD (Fig 1)**

Fig 1

450mm PROJECTED
EAVES BOARD

W   D   D   W

HALL
15000 mm X 5000mm

W   W

W   W   W   W

DOOR SCHEDULE
D   DOOR   1200mm X 2000mm
W   WINDOW 1000mm X 1200mm

ASSUME PROPORTIONATE
DIMENSION WHERE NOT PROVIDED

W   ROOM   W
5000mm X 6000mm

D
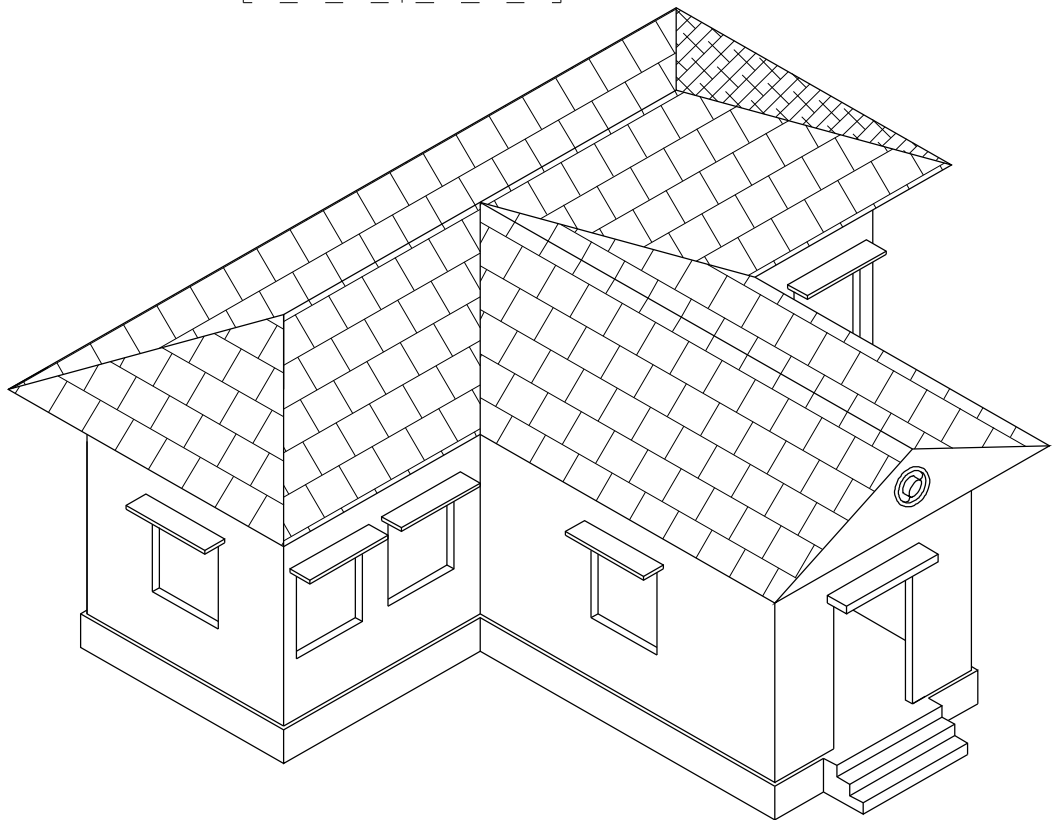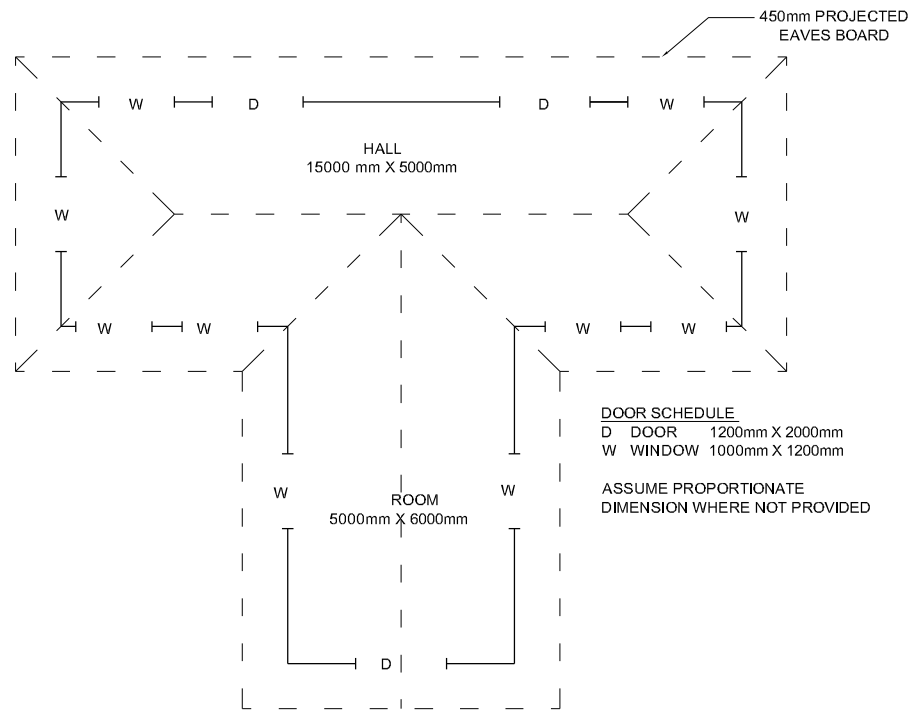
ISOMETRIC & ORTHOGRAPHIC PROJECTION

DCN32108H1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.108   91

Design a double storied residential building (3BHK) layout of furniture electrical appliances and plumbing sanitory fittings

Objectives : At the end of this exercise you shall be able to
• **design the interior layout for the residence plan**
• **render the plan and all furnitures with pleasing colours**
• **dimension and name the plan completely.**

PROCEDURE

TASK 1 : **Organization of interior space (manual)**

1   Print the previously drawn ground floor plan & first floor plan.

2   Economic utilisation of space is very important in designing interior.

3   Where should be minimum circulation area and best use of available space for the activity to be performed.

4   Minimum number of doors and partitions should be considered for free flow of space and spacious look.

5   To get a spacious look select limited variaty of textures, patterns and colours.

6   The 'Interior activity diagram' should be drawn showing the division of interior space with proper circulation.

7   Where should be acoustical and visual barries between entry and private area.

8   While designing seating for living room L-shaped or U-shaped seating makes the most economical use of space because it can accomodate a large group of people, leaving ample circulation space.

9   Do not clutter a small space with more items than needed.

10   Low seating helps in making the room look larger.

11   The dining table could be circular or rectangular.

12   Work triangles consists of the three essential elements in the kitchen, the clean up or sink area, the cooking centre, the mixing centre and the refrigeration plat from should be 600mm.

14   The position of the bed depends on a number of factors. The window should be parallel to the bed position.

15   The window should not be over the hand.

16   The toilet can be divided into two types of areas the dry area including the sink and the toilet and a wet area. which includes the bathing area. In well-planned toilets, you must separate these two areas.

17   Some cabinets or open shelves must be placed in the bathroom for storage.

18   With all consideration of furnitures and fixtures complete the sketch of organisation of space planning as Fig 1

Fig 1

9000

1200

UTILITY
1200 MM WIDE

D3

DECK
1200X3105

FD

KITCHEN
2635X3105

W3

DINING
2965X3205

LIVING
4165X3970

STAIRCASE

15000

W2

900

UP

W4

D/W/V SCHEDULE

G1	2860X1500
D1	1200X2100
D2	900X2100
D3	750X2100
W1	1800X1800
W2	1200X1800
W3	1500X1000
W4	900X2100
FD	2600X2100
V	750X750

D2

FOYER
1775X1585

TOILET
2635X1500

V

VERANDAH
1275X1685

D1

+0.45M

D3

UP

+0.15M

CAR PORCH
3250X4540

BED ROOM
3635X3960

900

±0.0

W1

1500

R O A D

GROUND FLOOR PLAN

DCN32109E1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.2.109

93

TASK 2 : Rendering ground floor and first floor plan with furniture layout

1 With reference to the organisation plan, the detailed furniture layout should be designed.

2 Choosing colour scheme should be considered carefully while rendering the plans and furnitures.

3 For the living room a single solid colour on the floor, or unpatterned floors tend to sketch the space. These include stone, tiles, wood etc.

4 Lighter the shade and the more reflective the surface, the more effective it will be in lightening up the room,

5 For dining avoid using carpet below the table.

6 Use the same flooring material as in the living.

7 For kitchen you can choose from a variety of tiles and stones.

8 Any type of flooring can be used in the bedroom from carpet to wood flooring to tiles or terazzo.

9 You must combine the shape, colour, texture for furniture to provide a pleasing environment.

10 Concrete, brick paving, slate, unpolished kota, sand stone are effective floor materials for the porch, out door sit out, inner courtyard, terraces and balconies.

11 Plan the garden simultaneously with the house so that the levels of drive way, terraces are co-ordinated.

12 The amount of soft surfacing (Lawn or ground cover) should be considered in designing the landscape.

13 Complete the drawing in colour

> **Note: Provide electrical fittings as per I.S. standerd.**

Fig 2
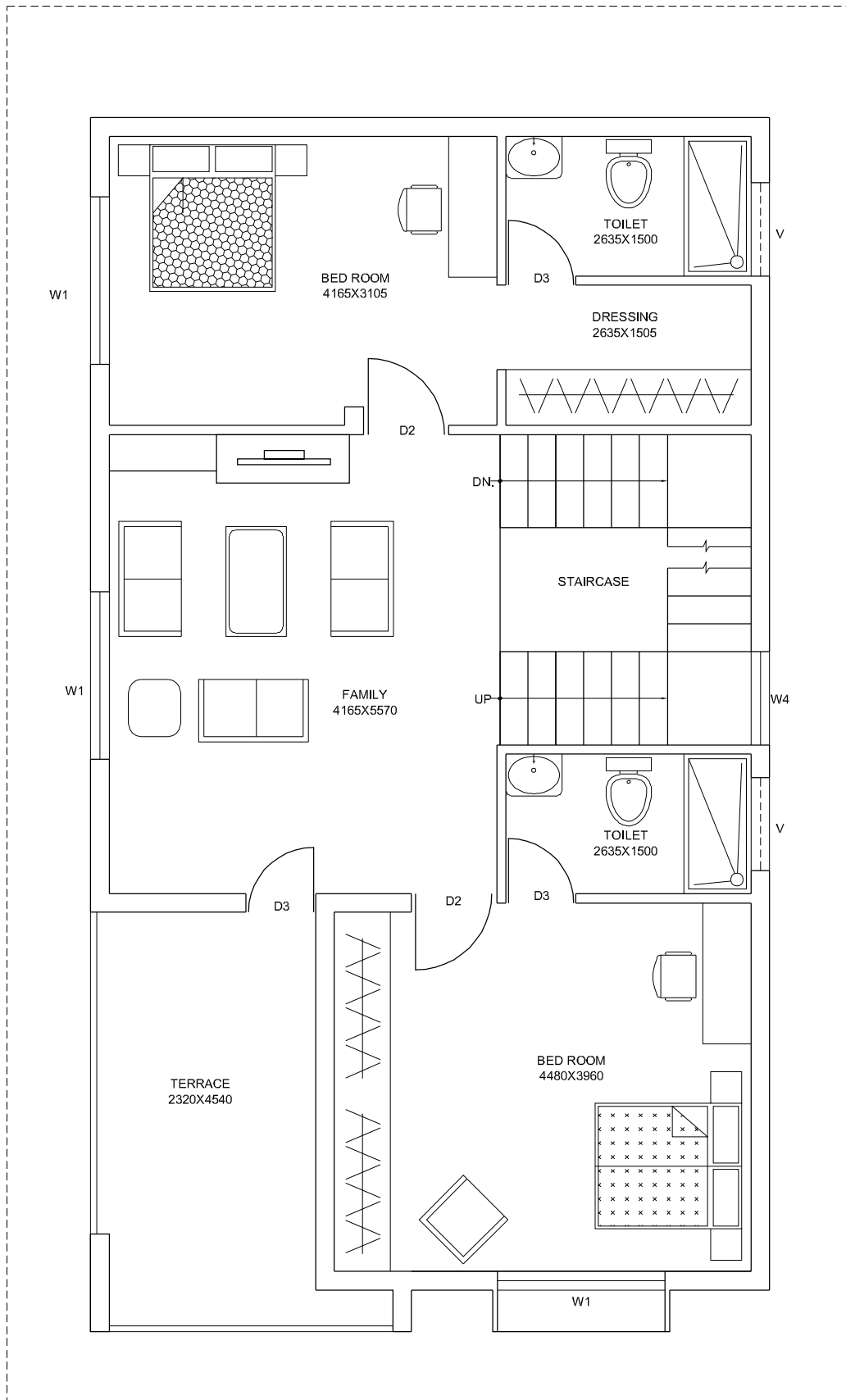
D/W/V SCHEDULE	
D2	900X2100
D3	750X2100
W1	1800X1800
W4	900X2100
V	750X750

BED ROOM
4165X3105

W1

TOILET
2635X1500

V

D3

DRESSING
2635X1505

D2

DN.

STAIRCASE

FAMILY
4165X5570

W1

UP

W4

TOILET
2635X1500

V

D3

D2

D3

TERRACE
2320X4540

BED ROOM
4480X3960

W1

FIRST FLOOR PLAN

DCN32109E2

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Create and use model space view ports

Objective : At the end of the exercise you shall able to
• **creating view ports for a model.**

PROCEDURE

TASK 1 : **Create and use model space port**

• Create the elevations and plan as per the given commands.

• Follow the given commands as per creating view ports.

• Create and model space viewport.

– – – – – – –
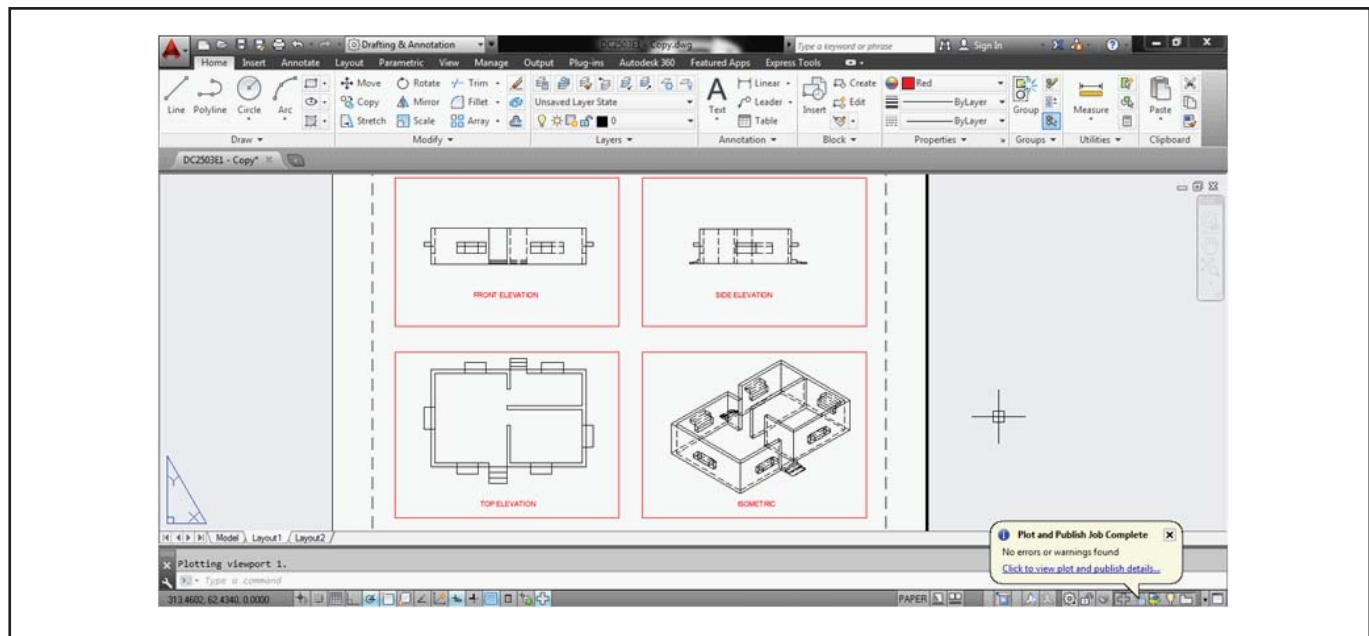
Create a standard engneering layout

Objective : At the end of this exercise you shall be able to
- **creating a engineering layout.**

PROCEDURE

TASK 1 : **Creating a engineering layout**

- Follow the CAD commands and complete the lay out as give in figure.

- Create a standard engineering layout.

— — — — — — — —
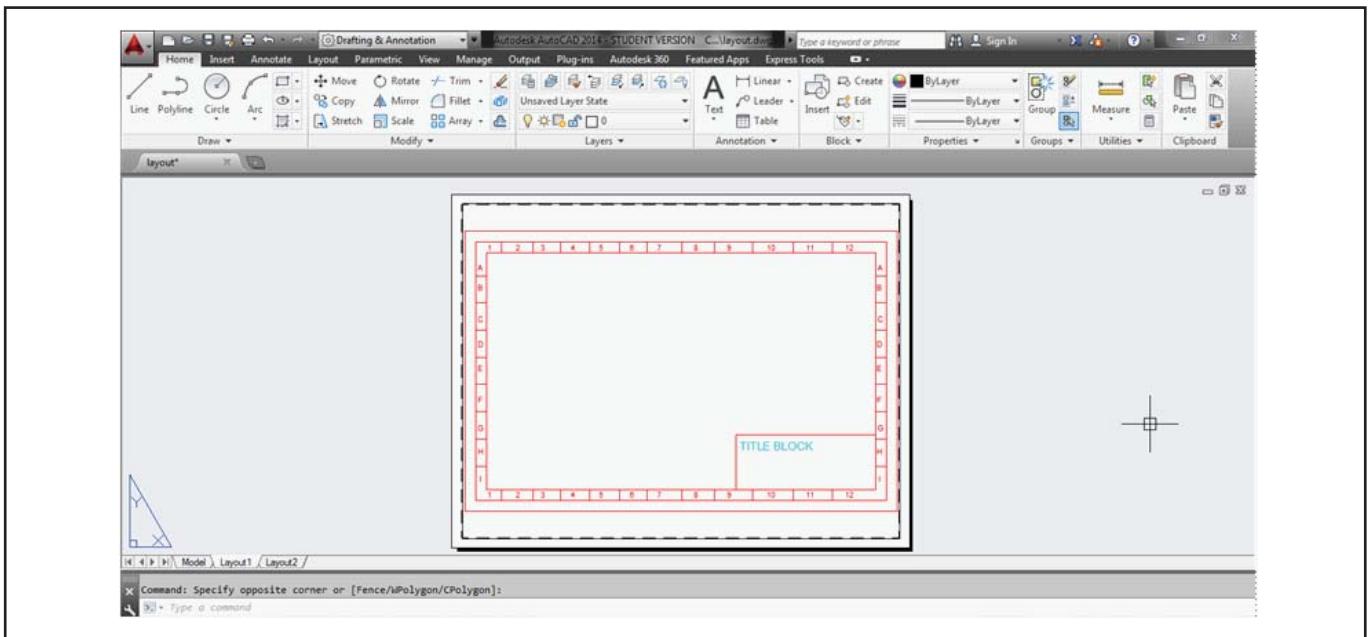
Create and edit wire frame model

Objectives : At the end of this exercise you shall be able to
• **creating and editting a wire frame.**

PROCEDURE

TASK 1 : **Create a wire frame model and edit it**

• Follow the CAD commands to create the wire frame model given.

• Create and edit wireframe model.

— — — — — — — —
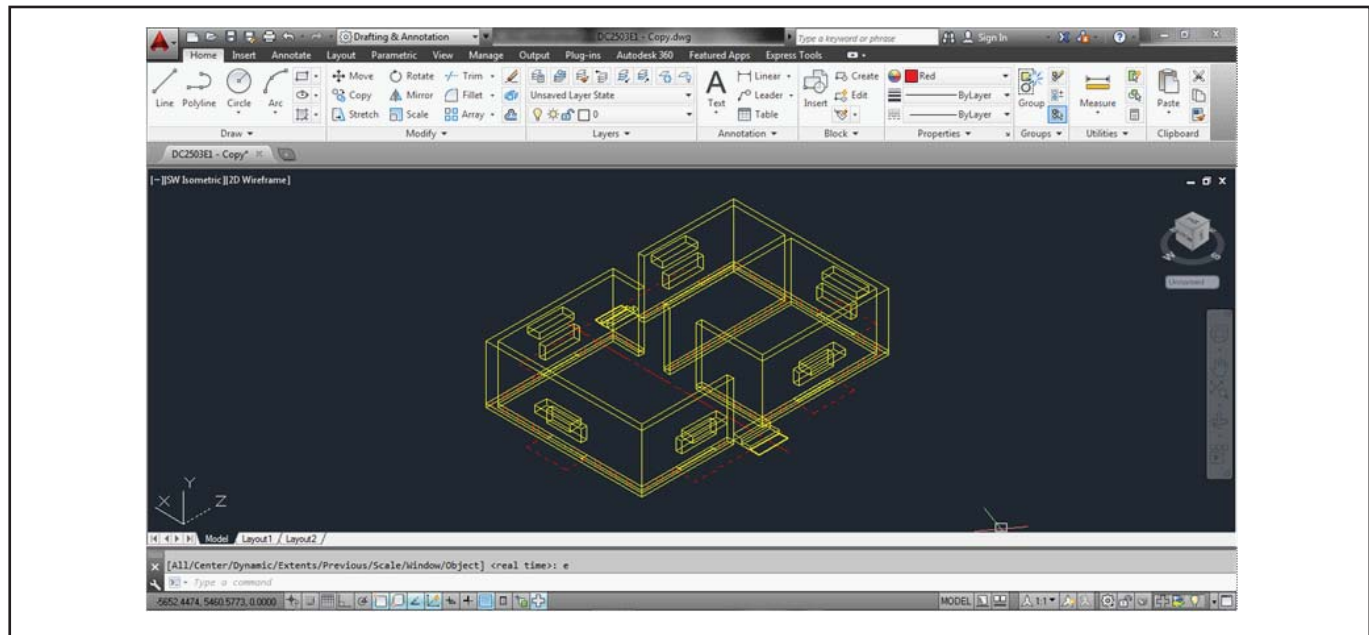
Create and edit solid mesh and surface modeling

Objective : At the end of this exercise you shall be able to

• **create and editting a solid mesh and surface.**

PROCEDURE

TASK 1 : **Creating a solid mesh and editting and surface modeling**

• Use CAD commands it create the models and for editting.

• Create and edit solid mesh and surface modeling.

– – – – – – – –
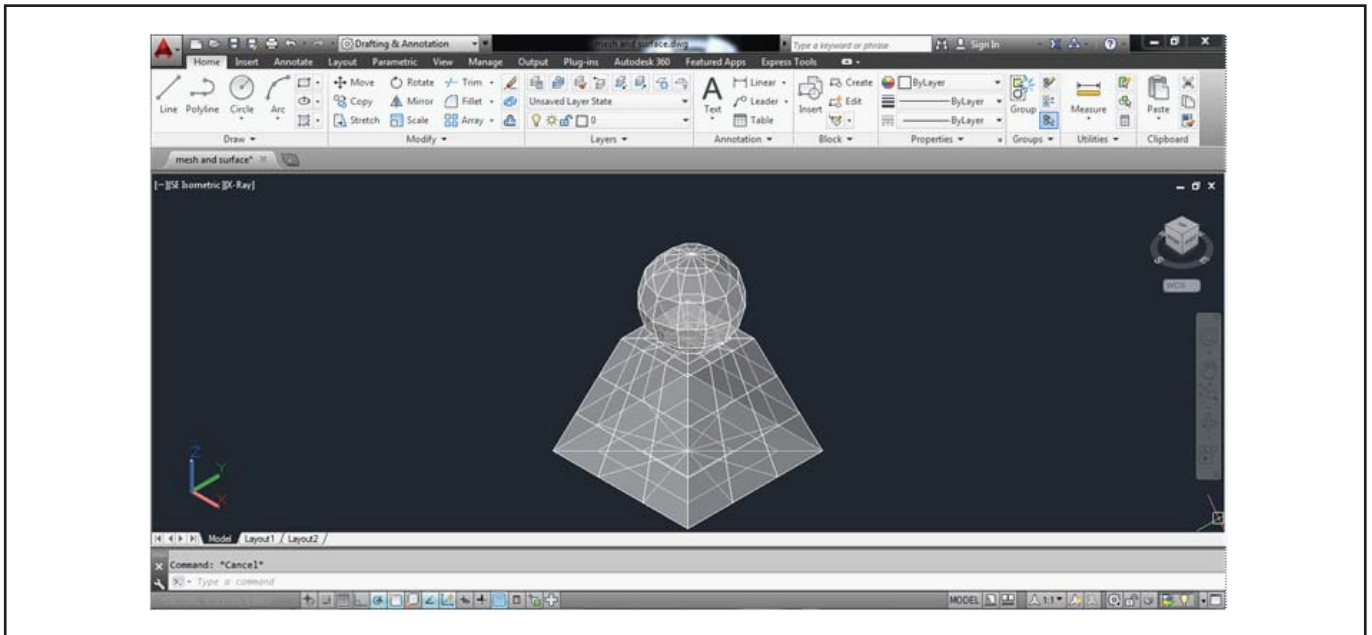
Create and edit simple 2D region and 3D solid model

Objective : At the end of this exercise you shall be able to
• **creating and editting a 2D region and 3D solid model.**

PROCEDURE

TASK 1 : **Creating a 2D drawing and draw the same in 3D**

• Create and edit simple 2D regions and 3D solid models.

— — — — — — —
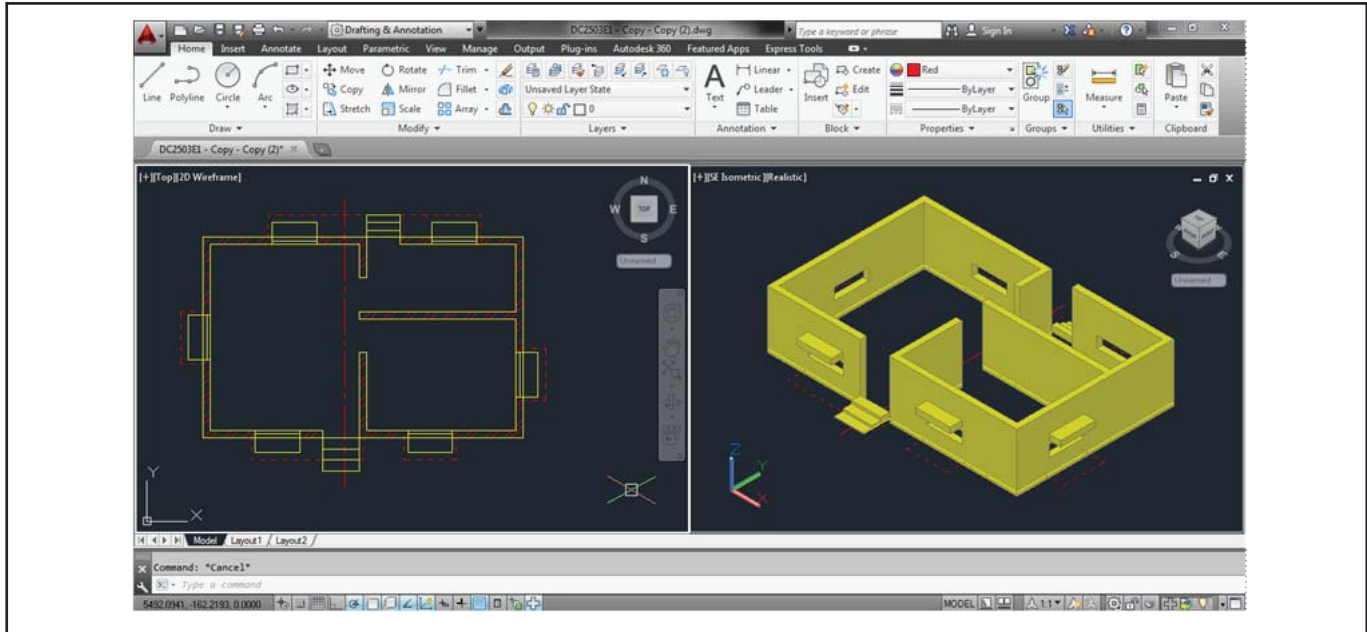
Generate   3D text and dimensions

Objective : At the end of this exercise you shall be able to
• **generate 3D text and 3D dimension display.**

PROCEDURE

TASK 1 : **Generate a 3D Text and dimensions using 3D display techniques**

• Generate 3D text and dimension using a variety of 3D
display techniques.

— — — — — — — —
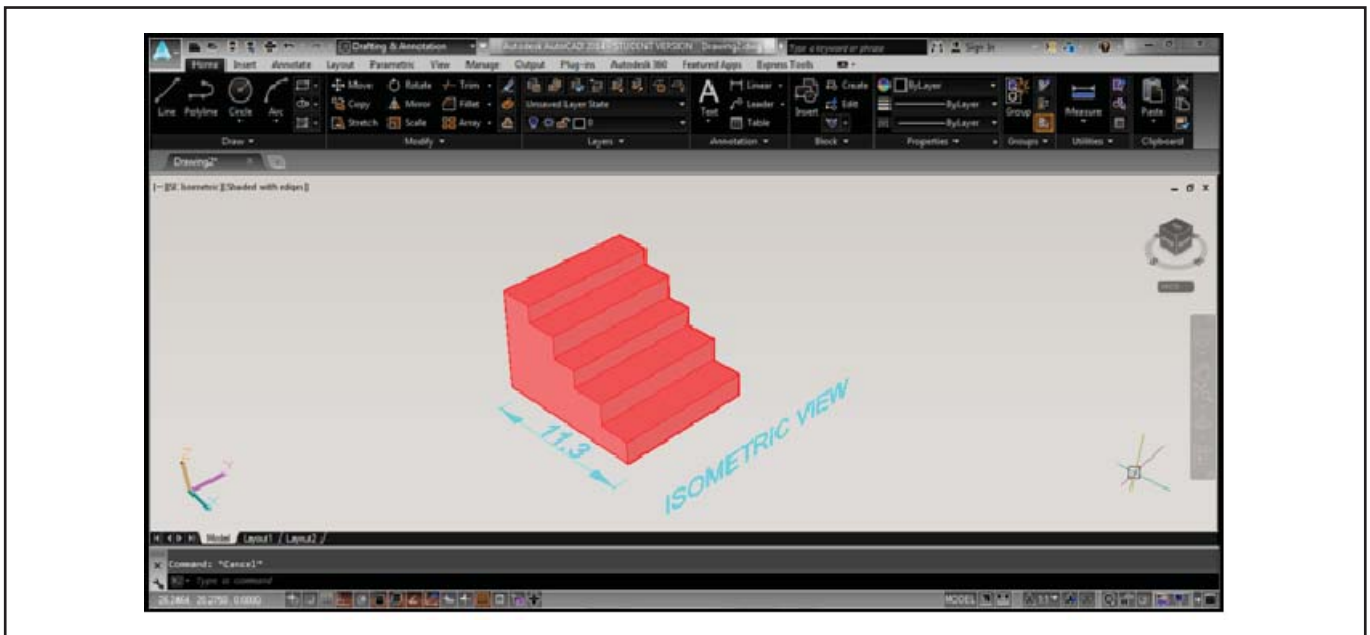
3D model with lights and materials

Objective : At the end of this exercise you shall be able to
• **rendering a 3D model with lights.**

PROCEDURE

TASK 1 : **Prepare a 3D model with lights**

• Render a 3D model with a variety of lights and materials.

— — — — — — — —
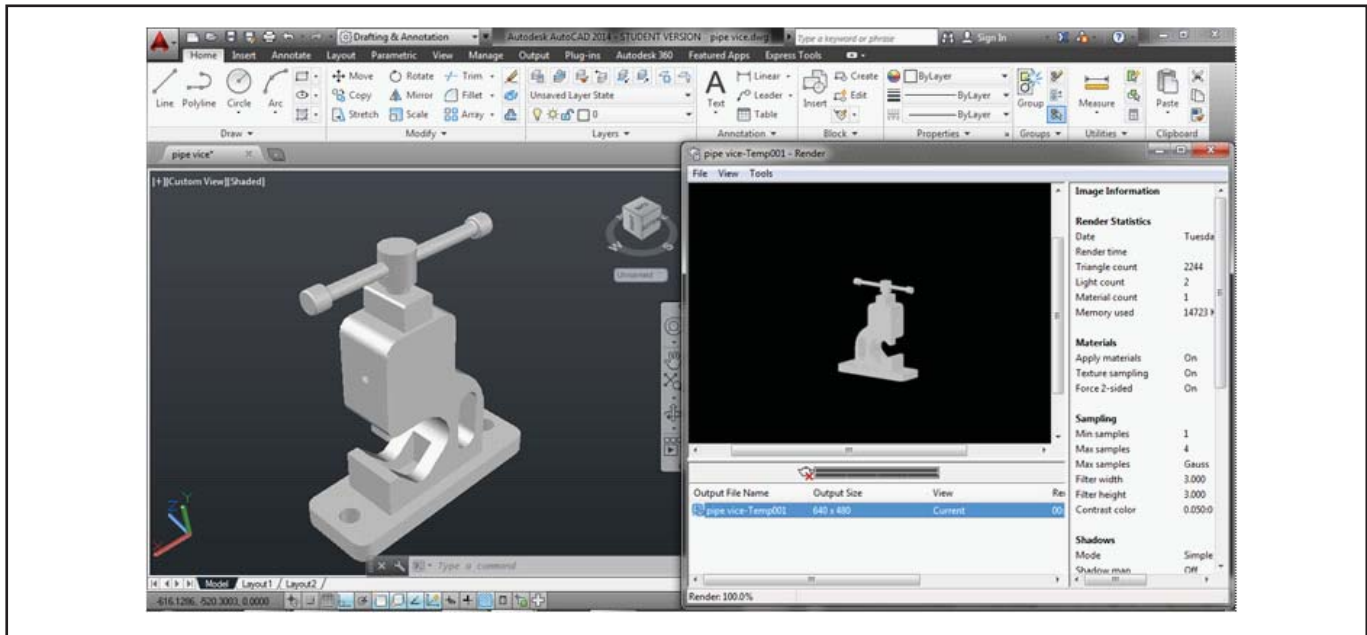
Primary health centre for rural area with R.C.C flat roof

Objective : At the end of this exercise you shall be able to
• **draw the working drawings of a primary health centre through AutoCAD.**

PROCEDURE

TASK 1 : **Prepare the working drawings of a primary health centre as per given line sketch through AutoCAD (Fig 1)**

• Prepare the working drawing as per the sketch given through AutoCAD.

• Take print out in A2 sheet.

┌───┐
│ **Take standard dimensions for the structural** │
│ **elements for a public building.**   │
└───┘

Fig 1

A PRIMARY HEALTH CENTRE FOR RURAL AREA WITH R.C.C. ROOF
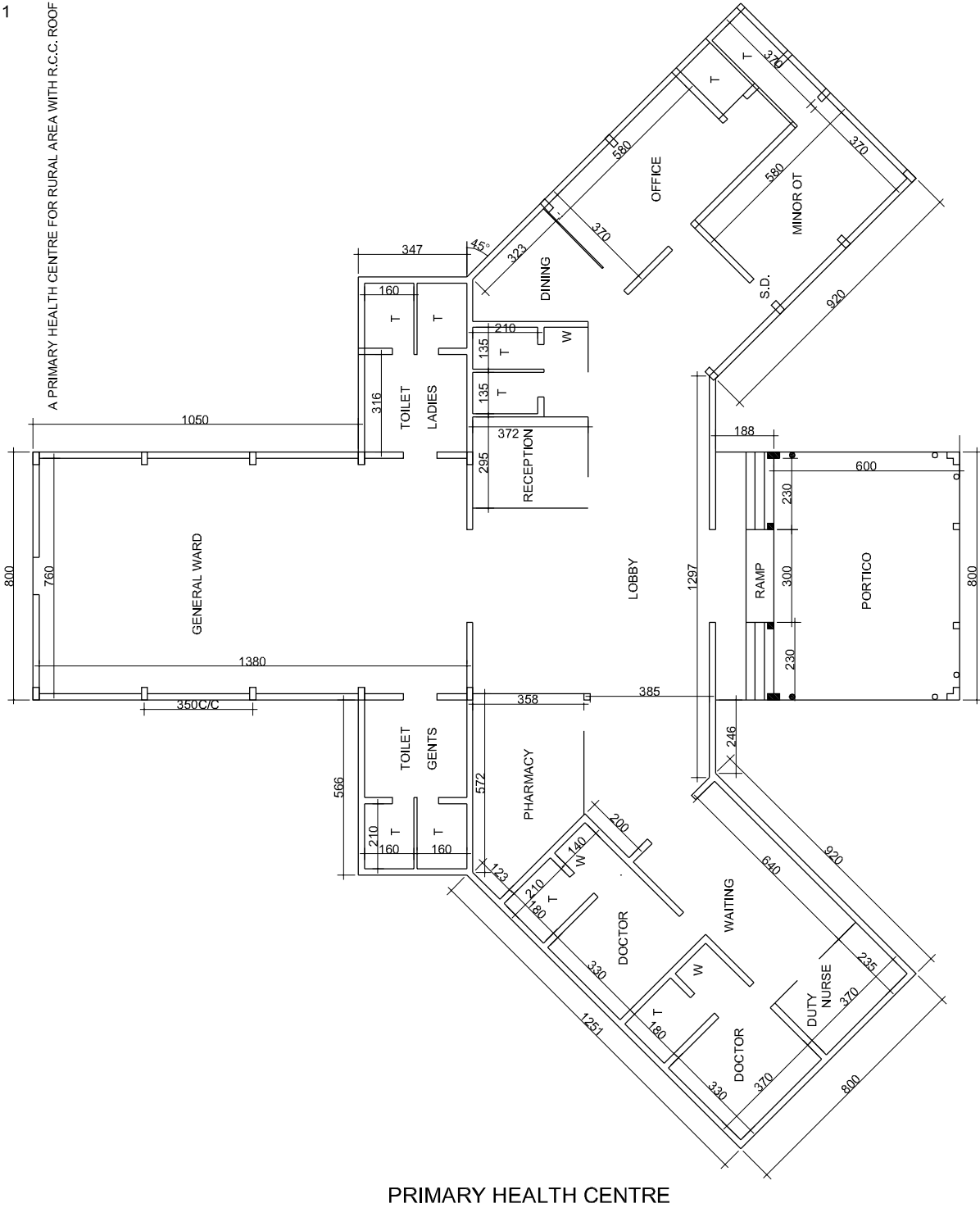
NOTE: ASSUME ANY MISSING DATAS SUITABLY

PRIMARY HEALTH CENTRE

OFFICE

MINOR OT

S.D.

DINING

TOILET LADIES

W

RECEPTION

GENERAL WARD

LOBBY

RAMP

PORTICO

TOILET GENTS

PHARMACY

DOCTOR

WAITING

DOCTOR

DUTY NURSE

DCN34117E1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.4.117

Village library building with R.C.C flat roof

Objectives : At the end of this exercise you shall be able to
* **draw the plan of a village library of R.C.C flat roof**
* **draw the sectional elevation**
* **draw the elevation.**

PROCEDURE

TASK 1 : **Prepare plan, section and elevation of a village library as per given line sketch (Fig 1)**

* Line sketch showing the arrangement of room.

* Height of wall 4m.

* Assume standard data's for other elements of building

* Prepare the working drawing through AutoCAD.

* Prepare the working drawing.

* Take a print in A3 sheet in scale of 1:100.

Fig 1
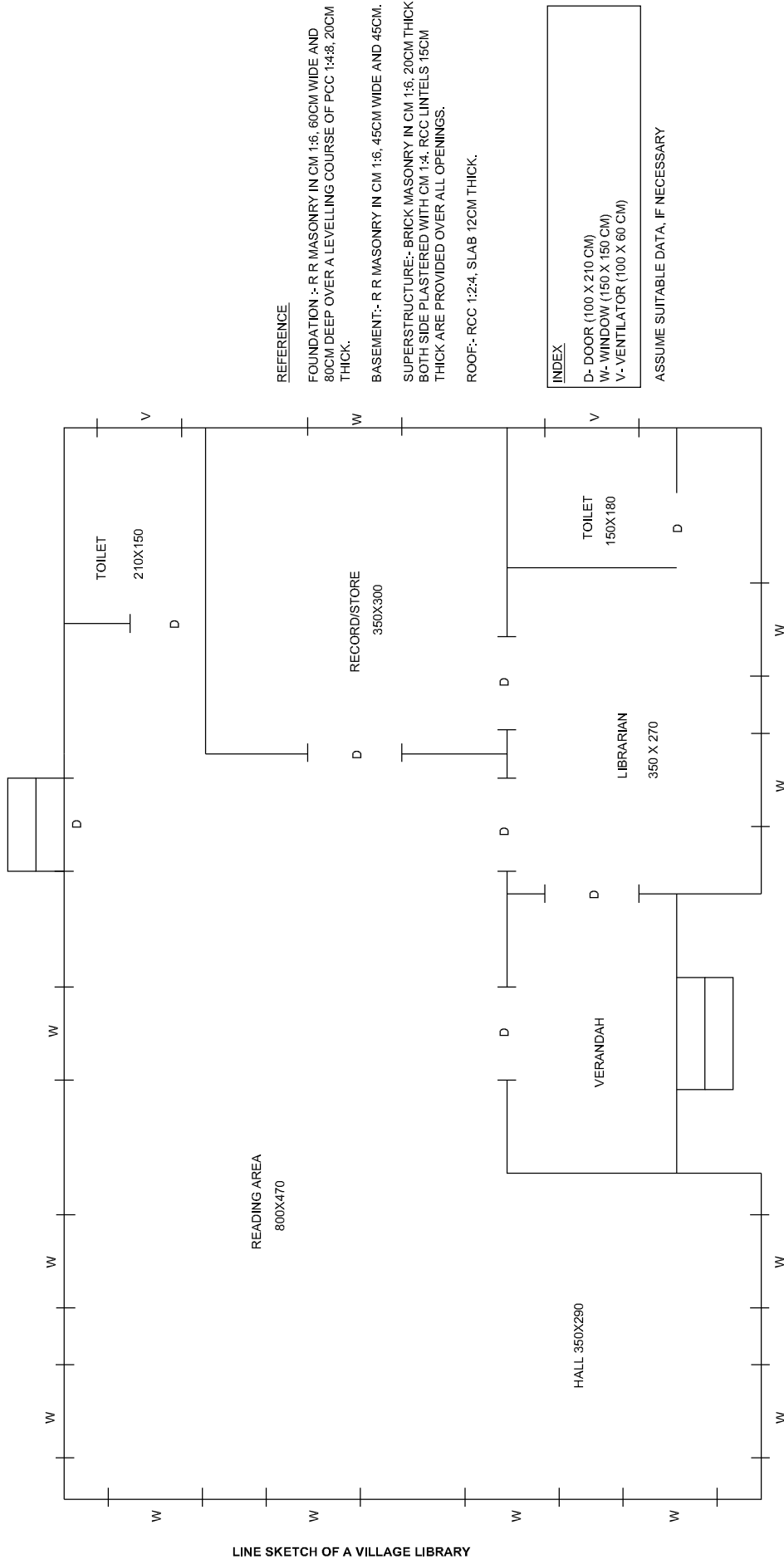
LINE SKETCH OF A VILLAGE LIBRARY

REFERENCE

FOUNDATION :- R R MASONRY IN CM 1:6, 60CM WIDE AND 80CM DEEP OVER A LEVELLING COURSE OF PCC 1:4:8, 20CM THICK.

BASEMENT:- R R MASONRY IN CM 1:6, 45CM WIDE AND 45CM.

SUPERSTRUCTURE:- BRICK MASONRY IN CM 1:6, 20CM THICK BOTH SIDE PLASTERED WITH CM 1:4. RCC LINTELS 15CM THICK ARE PROVIDED OVER ALL OPENINGS.

ROOF:- RCC 1:2:4, SLAB 12CM THICK.

INDEX

D- DOOR (100 X 210 CM)
W- WINDOW (150 X 150 CM)
V- VENTILATOR (100 X 60 CM)

ASSUME SUITABLE DATA, IF NECESSARY

TOILET 210X150

RECORD/STORE 350X300

TOILET 150X180

LIBRARIAN 350 X 270

READING AREA 800X470

VERANDAH

HALL 350X290

DCN34118E1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.4.118

A small restaurant building with R.C.C flat roof

Objective: At the end of this exercise you shall be able to
• **prepare working drawings of restaurant building through AutoCAD.**

PROCEDURE

TASK 1 : **Prepare the working drawing of a restaurant building as per given in line diagram (Fig 1)**

• Prepara wirking drawing of a restaurant building through AutoCAD.

• Take a print in A3 sheet in scale of 1.00

> **Take stadard dimensions for all elements for a restaurant building.**
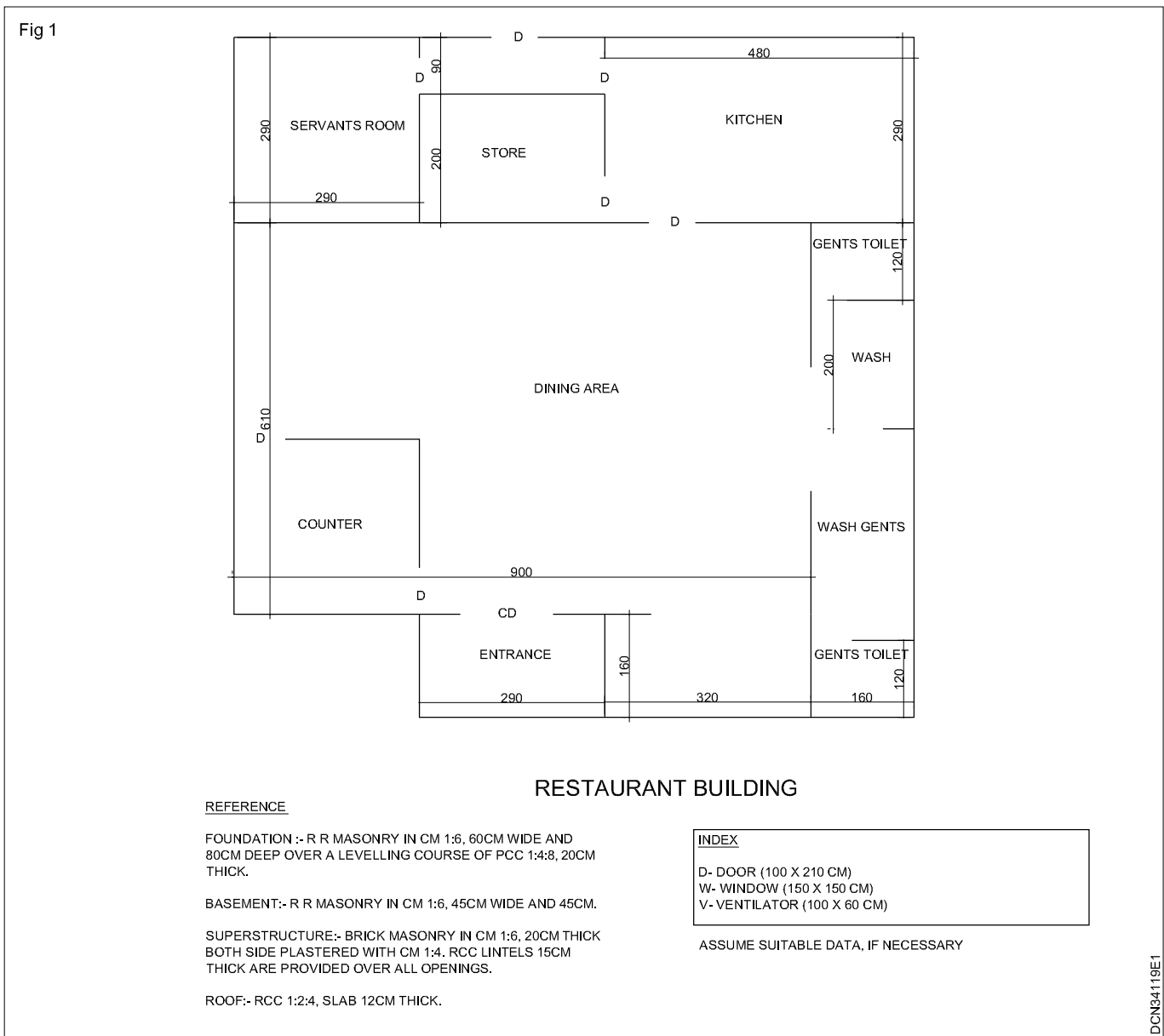
Fig 1

RESTAURANT BUILDING

REFERENCE

FOUNDATION :- R R MASONRY IN CM 1:6, 60CM WIDE AND 80CM DEEP OVER A LEVELLING COURSE OF PCC 1:4:8, 20CM THICK.

BASEMENT:- R R MASONRY IN CM 1:6, 45CM WIDE AND 45CM.

SUPERSTRUCTURE:- BRICK MASONRY IN CM 1:6, 20CM THICK BOTH SIDE PLASTERED WITH CM 1:4. RCC LINTELS 15CM THICK ARE PROVIDED OVER ALL OPENINGS.

ROOF:- RCC 1:2:4, SLAB 12CM THICK.

INDEX

D- DOOR (100 X 210 CM)
W- WINDOW (150 X 150 CM)
V- VENTILATOR (100 X 60 CM)

ASSUME SUITABLE DATA, IF NECESSARY

DCN34119E1

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School building with R.C.C flat roof

Objective : At the end of this exercise you shall be able to
• **draw the working drawings of a school building with R.C.C flat roof.**

PROCEDURE

TASK 1 : **Prepare the working drawings of a school building with R.C.C framed structure flat roof (Through AutoCAD) (Fig 1, 2, & 3)**

DATA

• Take standard dimensions for structural elements for a public building.

• Prepare the drawings precisly and accurtely by the experience from previous drawing.

Fig 1
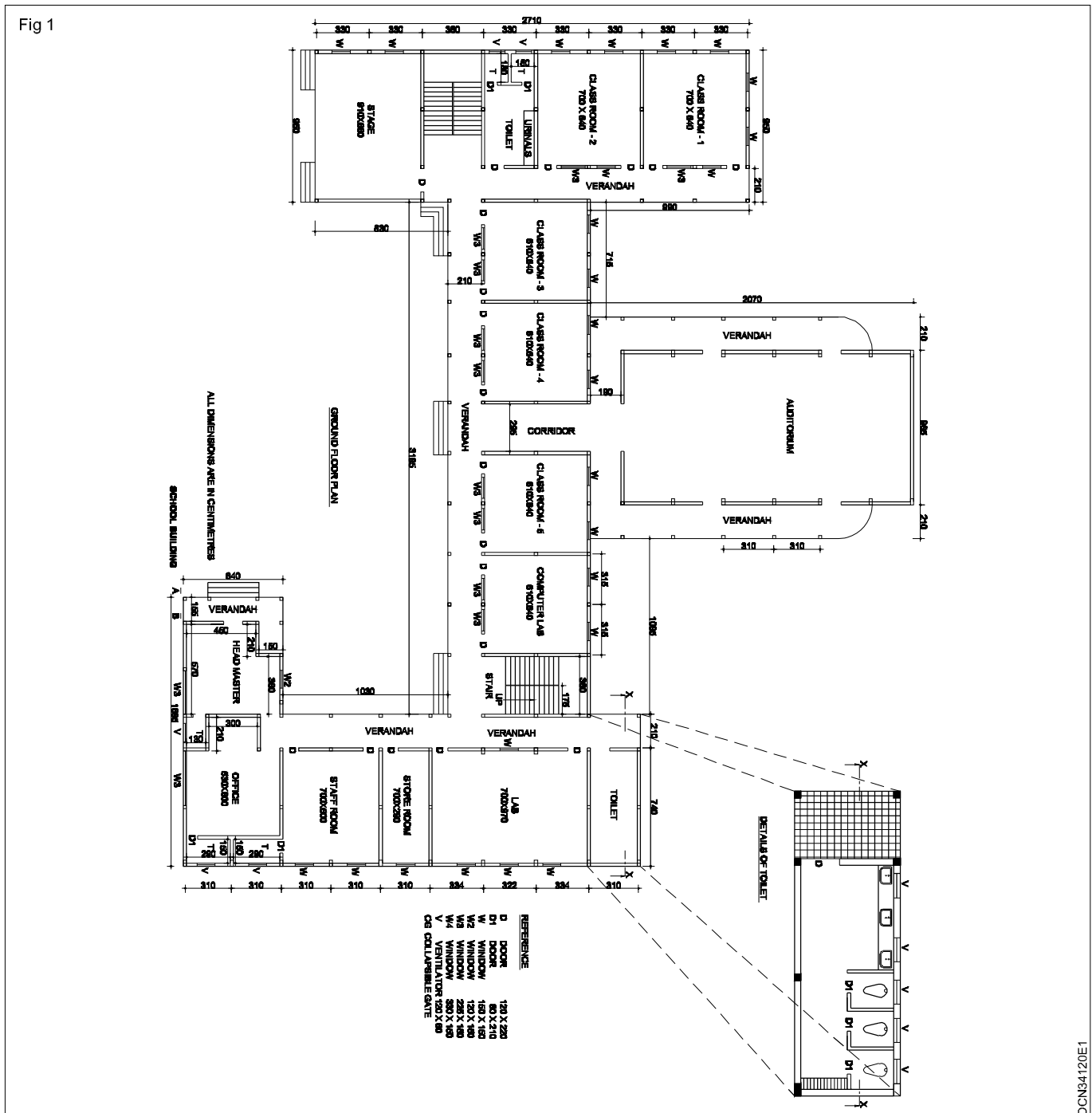
Fig 2

ELEVATION OF THE SCHOOL BUILDING
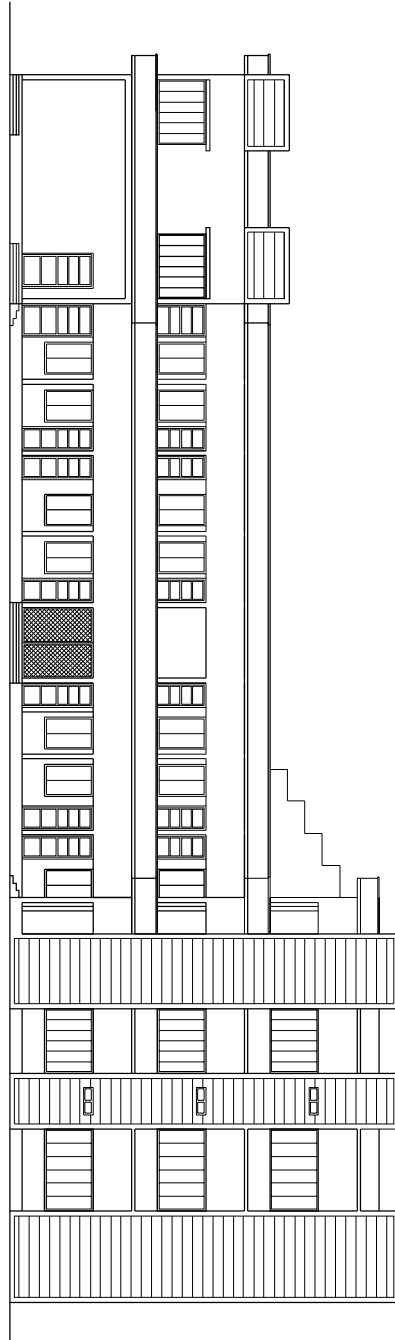
DCN34120E2

Fig 3
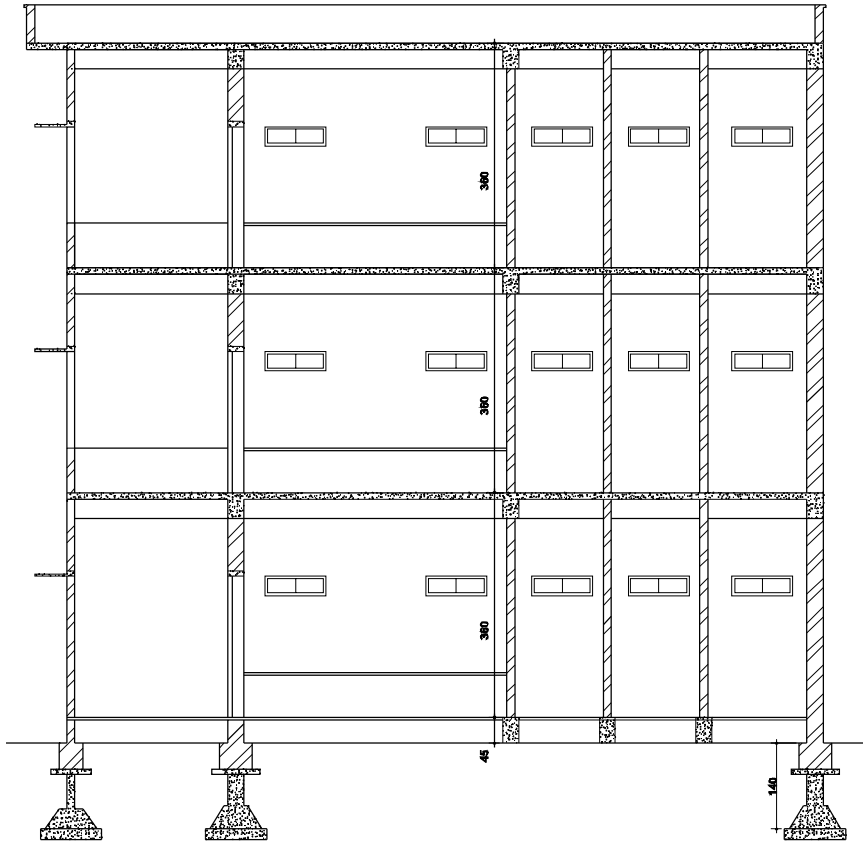
TYPICAL SECTION OF THE SCHOOL BUILDING

Workshop building with north light steel roof truss

Objectives : At the end of this exercise you shall be able to
• **prepare the working drawing of a workshop**
• **building with north light steel roof truss.**

PROCEDURE

TASK 1 : **Prepare the working drawing of a workshop building as per given line sketch (Fig 1)**

DATA

• Give R.C.C flat roof for office buildig with a height of 400cm.

• Give north light trussed roof for workshop with height of wall 600cm.

• Provide a mezzanine floor at 270cm height.

• Column size (30 x 50) cm.

• Develop plan as per line sketch showing the lines of trusses.

• Draw a sectional elevation crossing R.C.C roof and mezzanine floor.

• Draw the elevation and complete the working drawing.

• Take print out in a scale of 1:100.

> **Take standard dimensions of a north light trussed roof.**

Fig 1

Fig 1 — Plan, Front Elevation and Section AA of A WORK SHOP

INDEX

MARK	ITEM	SIZE	NOS.
RS	ROLLING SHUTTER	300 X 240	1
D2	PANELLED DOOR	100 X 200	4
D3	PANELLED DOOR	80 X 200	2
W1	FIXED GLAZED WINDOW	150 X 120	1
W2	GLAZED WINDOW	100 X 120	16
V	VENTILATOR	100 X 80	24
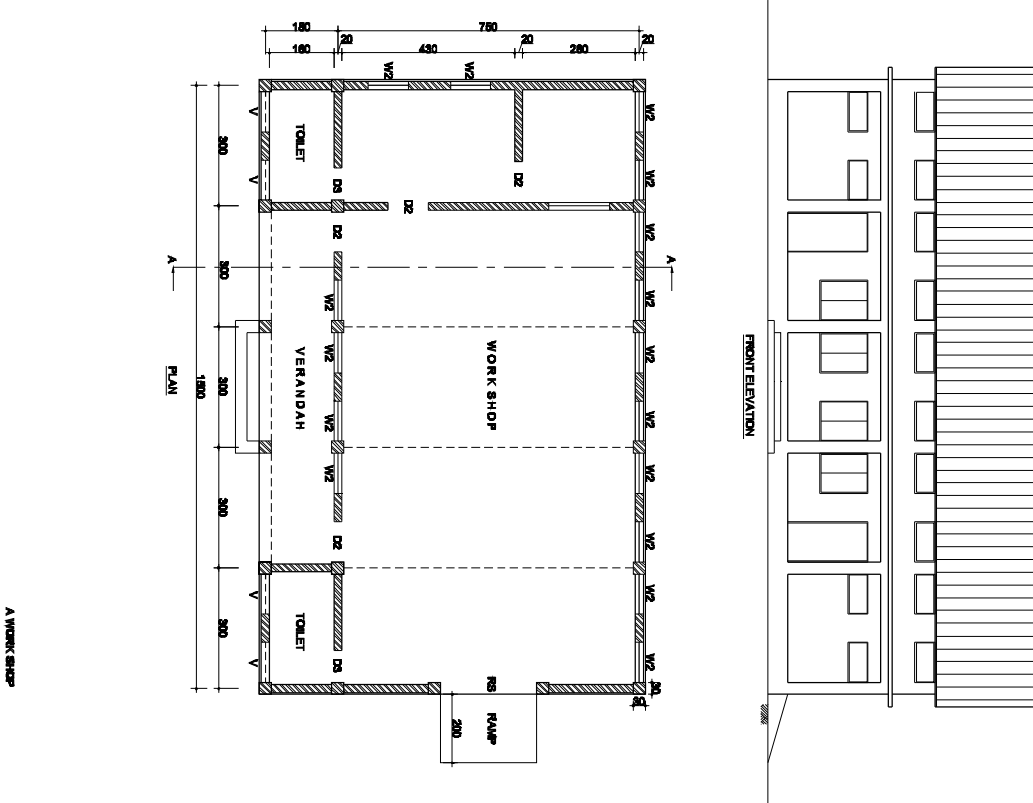
SPECIFICATIONS
1. ALL MAIN COLUMNS OF BRICK 30X30CM.
2. SUPERSTRUCTURE IN BRICK 20CM THICK.
3. R.C.C. 1:2:4 LINTELS OVER WALL OPENINGS.
4. A.C. SHEET ROOFING OVER STEEL TRUSS.
5. TRUSSES AS PER DESIGN.
6. C.C. FLOORING.

DIMENSIONS IN CENTIMETERS.

DCN3421E1

Service plans

113

Objectives : At the end of this exercise you shall be able to
• **draw the sanitary service plan**
• **draw the electrical service plan.**

PROCEDURE

TASK 1 : **Prepare the sanitary service plan of the given building and prepare electrical service plan of the given building (Fig 1)**

• To draw the sanitary service plan

• Draw the line sketch of the building in a scale 1:100 and mark the sanitary fittings

• Give setbacks as per drawing given.

• Draw the layout of public sewer line.

• Draw the layout of house drain to the public sewer.

• Mark the positions of gully traps, inspection chambers, manholes etc where ever necessary.

• Complete the drawing.

• Complete the drawing.

• To draw the electrical fitments.

• Draw the plan of the building in a scale of 1:100 and mark all electrical fittings and position of electrical equipments.

• Draw the layout of wiring according to the locations of the electrical fitments.

• Complete the drawing as per given sketch.

> **Prepare the drawing manually and through AutoCAD.**

Fig 1
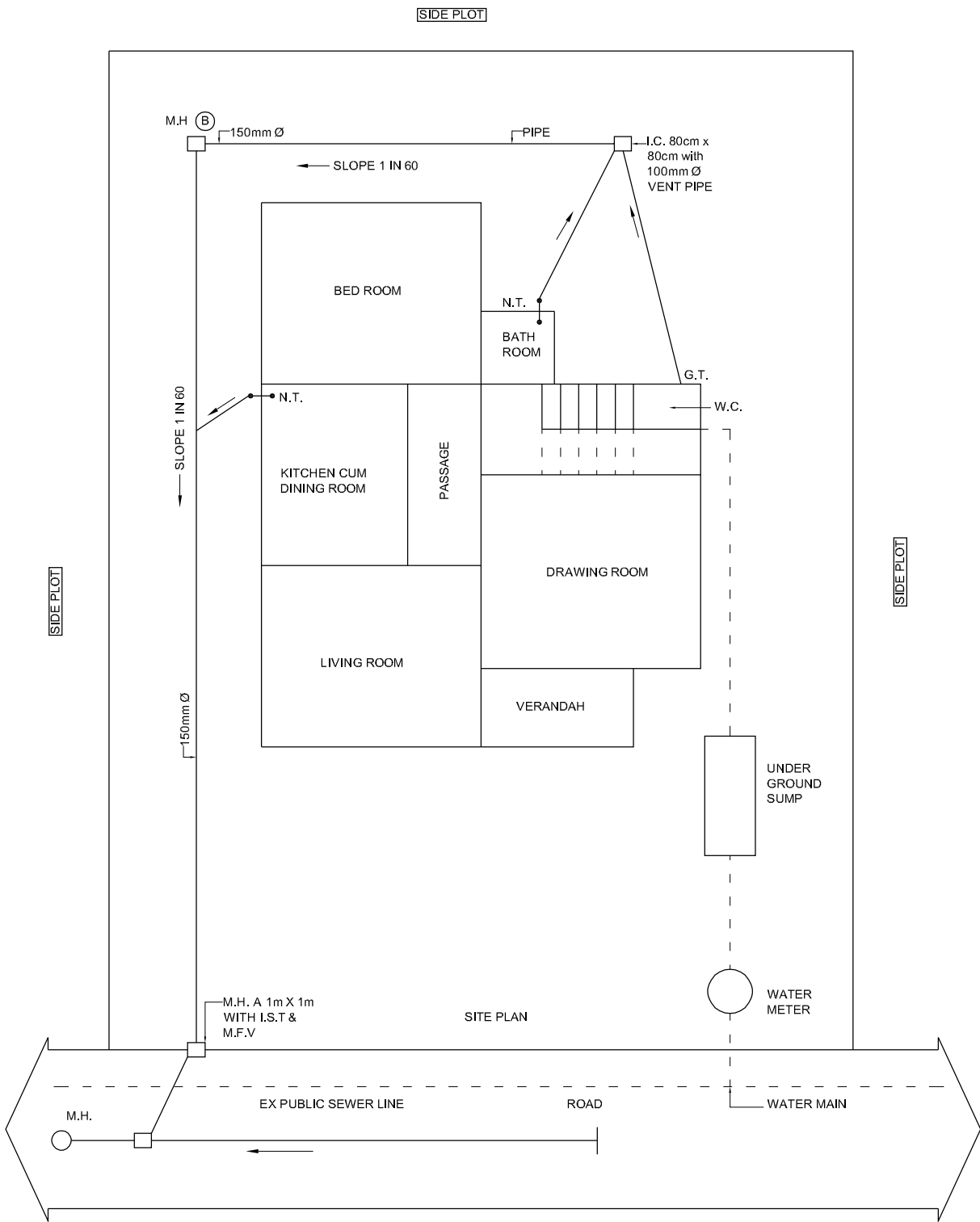
SANITARY SERVICE PLAN

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.4.122

Bank building with R.C.C flat roof

Objectives : At the end of this exercise you shall be able to
• **prepare through Autocad the working drawings of a bank building.**

PROCEDURE

TASK 1 : **Prepare the working drawing of a building (Through AutoCAD) as per give line sketch (Fig 1)**

• Draw ground floor plan and design the stair case.

• Draw first floor plan.

• Draw the sectional elevation through the stair case.

• Draw the elecation and complete the drawing.

Take standard dimensions for the structural elements for a double storey public building.

Fig 1

GROUND FLOOR : BRANCH OFFICE

A BANK BUILDING

FIRST FLOOR : HEAD OFFICE

REFERENCE

WALL THICKNESS :- 30CM
ROOF :- R.C.C. SLAB, 12CM THICK 1:1 1/2:3 MIX
COLUMN :- 30X30CM R.C.C.

INDEX
MD - MAIN DOOR (240 X 220 CM)
D - DOOR (120 X 210 CM)
D1 - DOOR (80 X 210 CM)
W - WINDOW (160 X 180 CM)
V - VENTILATOR (60 X 60 CM)

115
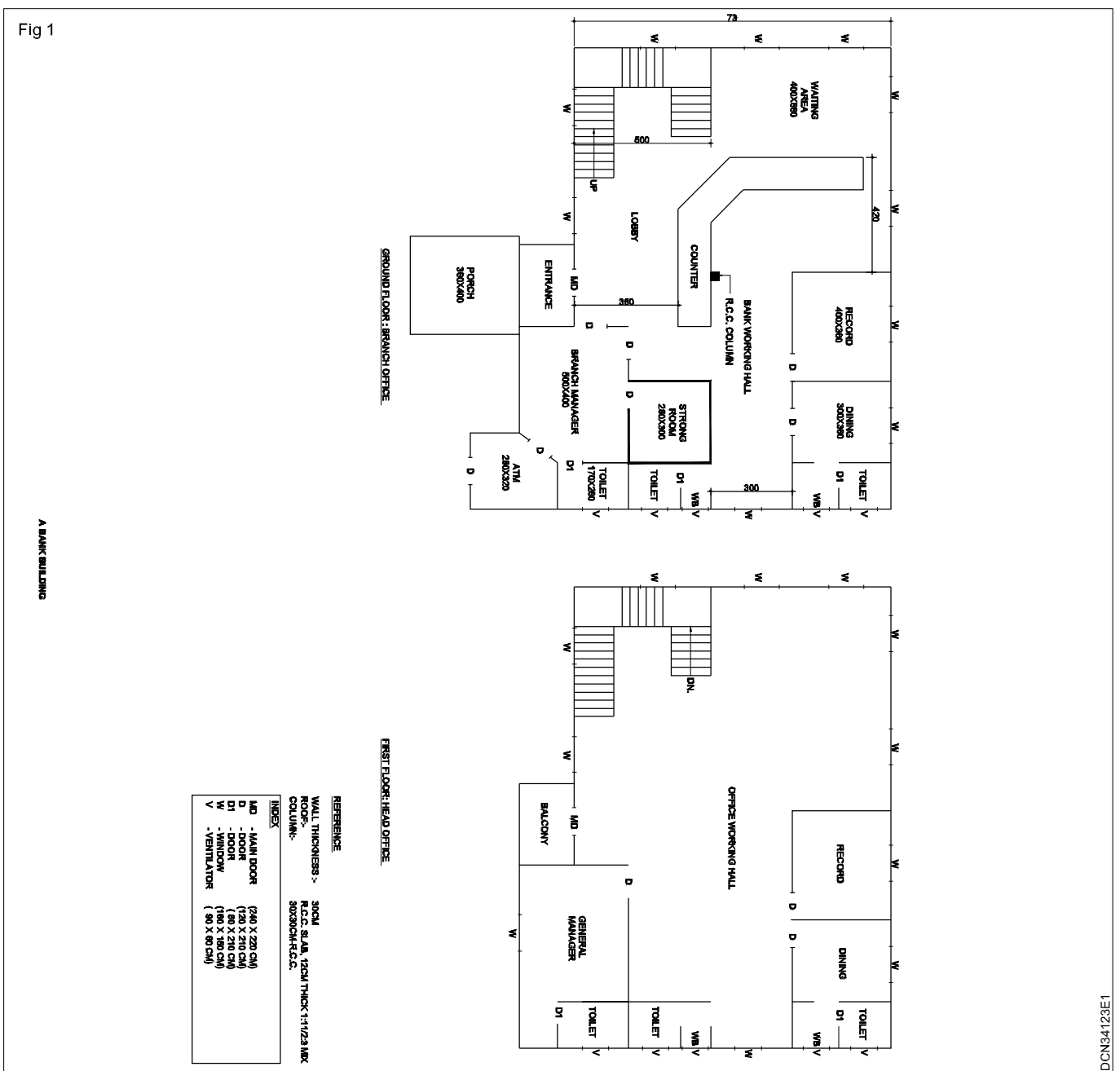
Singly reinforced R.C.C rectangular beam

Objectives : At the end of this exercise you shall be able to
• **prepare the longitudinal section of the beam showing reinfocement datails**
• **prepare the top and bottom plan showing arrangement of bars**
• **prepare the cross sectional view of the beam at midspan and at support.**

PROCEDURE

TASK 1 : **Draw the single reinforced beam to a suitable scale using CAD software (Fig 1)**

• Longitudinal section of the beam showing reinforcement details.

• Top and bottom plans showing arrangement of bars.

• Cross sectional view of the beam at mid span and at support.

DATA

• The following are the particulars of a singly reinforced partially fixed beam.

• Clear span - 5000 mm.

• Width of supports -300 mm.

• Size of beams -300×550 mm.

• Clear cover to steel rods -25 mm.

• Main reinforment (tensile) - 16 mm Fe 415 steel - 6 Nos.

• Hanger rods - 12 mm Fe 415 steel 2 Nos.

• Shear reinforcement - Two legged stirrups 8 mm Fe 415 steel @ 150 mm.

• Reinforcement at top at supports for negative moment 16 mm Fe 415 steel 3 nos for a length of 0. 14l and anchored sufficiently. Anchorage and curtailment of reinforcement may be adopted with standard value and any more data required may be assumed suitably.

• Prepare drawing using basic commands.

• Save drawing as R.C.C beam.

Fig 1

REINFORCEMENT FOR NEGATIVE MOMENT 16 # 3 NOS.4

HANGER RODS 12 #,2 NOS.3

Ld   Ld=750   Ld=750   Ld

25   550   25

2 LEGGED STIRRUPS 8# @ 150MM C/C - 5
TENSILE REINFORCEMENT 16 # 6 NOS.-2

TENSILE REINFORCEMENT 16 #, 3 NOS.-1   5000

EFFECTIVE SPAN   l = 5300

300   300

LONGITUDINAL SECTION

300

420   420

2 LEGGED STIRRUPS 8# @ 150MM C/C-5
TENSILE REINFORCEMENT 16 # 3 NOS.-1

TENSILE REINFORCEMENT 16 # 3 NOS.-2

BOTTOM PLAN

REINFORCEMENT FOR NEGATIVE MOMENT 16 # 3 NOS.4   HANGER RODS 12# 2 NOS.3

300

TOP PLAN

HANGER RODS 12# 2 NOS. - 3   3NOS. OF 16MM #

300   300

25   550

500

TENSILE REINFORCEMENT
16 # 3 NOS.-1

25   2 LEGGED STIRRUPS
25   25   8# @ 150MM C/C-5

TENSILE REINFORCEMENT
16 # 6 NOS

CROSS SECTION   CROSS SECTION
AT MID SPAN   AT SUPPORT

DCN35124E1

DETAILS OF SINGLE REINFORCED BEAM

— — — — — — — —

TASK 2 : **Draw to a suitable scale, the longitudinal sectional, cross section near the support and cross section at the centre of span of a rectangular R.C.C beam simply supported with the following data (Fig 2)**

DATA

- Clear span (l) -4.80 m.

- Effective span (L) - 5.00 m.

- Width of beam - 30 cm.

- Overall depth of beam - 50c m.

- Effective depth of beam - 47.6 cm.

- Main reinforcement consists of 20 mm. dia. bars, out of 5 bars, 2 numbers alternative bars bent up; one bar bent up at L/7 and the other at L/4 from the centre of supports.

- Provide 2 Nos bar of 12 mm Ø as anchor bars.

- Provide two - legged stirrups of 6 mm Ø @ 15 cm c/c.

Fig 2

TWO LEGGED STIRRUPS 6 MM DIA. @ 150 C/C

ANCHOR BARS 2 NO'S 12 DIA

2 NO'S 12 DIA BENT UP BARS

1,2,3,4,5

MAIN BARS 5 NO'S 20 DIA

L = 4.80 M

L = 5.00M

L / 4

L / 7

150   150

HANGER BARS 2NOS. 12mm

HANGER BARS 2NOS. 12mmØ

50 CM

47.6 CM

30 CM

30 CM

MAIN BARS 5NOS. 20 DIA.

MAIN BARS 5NOS. 20 DIA.

SECTION AT YY

SECTION AT XX
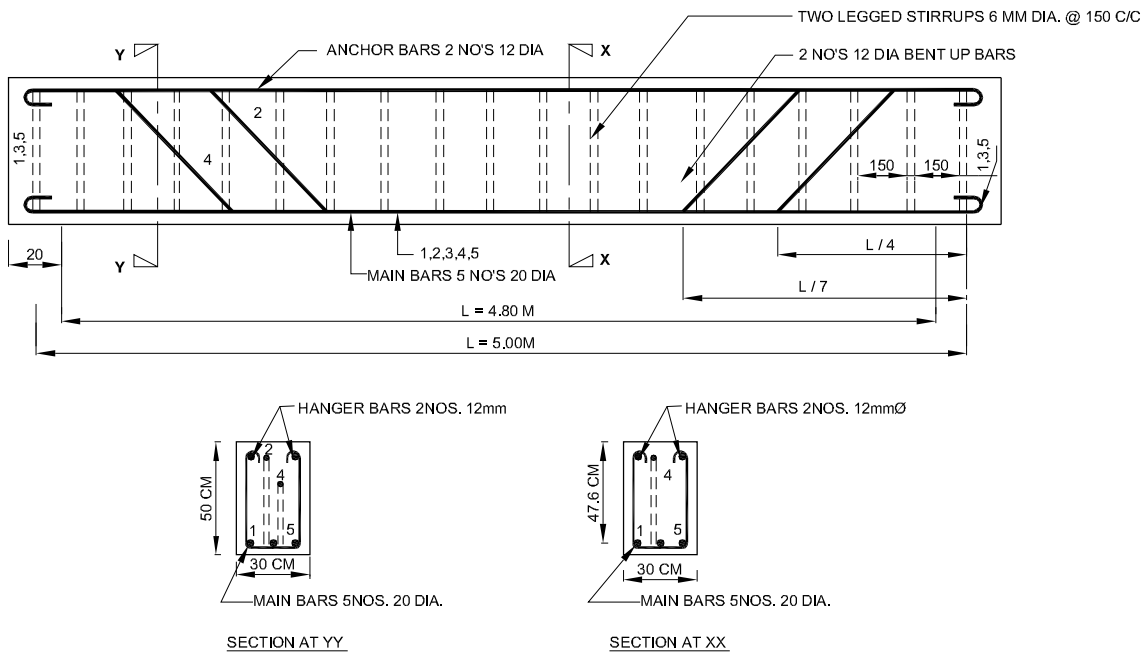
DETAILS OF SINGLE REINFORCED BEAM

DCN3512AE2

Double reinforced R.C.C rectangular beam (partially fixed)

Objectives : At the end of this exercise you shall be able to
• **prepare the longitudinal section of the double reinforced R.C.C beam with reinforcement details**
• **prepare the top and bottom plan showing arrangement of bars**
• **prepare cross sectional view of the beam at mid span and support.**

PROCEDURE

TASK 1 : **Draw following views of double reinforced beam to suitable scale (Fig 3)**

• Longitudinal section of the beam showing reinforcement details.

• Top and bottom plans showing arrangement of bars.

• Cross sectional view of the beams at mid span and at supports.

DATA

• The following are the particulars of a double reinforced partially fixed beam.

• Clear span - 4500 mm

• Width of supports - 300 mm

• Size of beam - 300 x 550 mm

• Tensile reinforcement - 16 mm Fe 415 - 4 Nos

• Compressive reinforcement - 16 mm Fe 415 steel, 3 Nos.

• Shear reinforcemtent - 8 mm Fe 415

• Steel 2 legged stirrups at 150mm clc upto a distance of 625mm from the face of supports. On each side and at 200 mm c/c the remaining portion.

• Anchorage and curtailment of reinforcement may be same as previous exercise.

• Prepare the drawing using AutoCAD

Fig 3

COMPRESSIVE REINFORCEMENT 16Ø, 3NOS.- 3

TENSILE REINFORCEMENT 16Ø, 2 nos- 2

2 LEGGED STIRRUPS 8# @200MM C/C = 5

2 LEGGED STIRRUPS 8# @150MM C/C UPTO 625MM - 5

TENSILE REINFORCEMENT 16Ø, 2 NOS - 1

0.8 ℓ = 380

625

300

500

0.08ℓ

Ld

625

0.8 ℓ = 380

300

4500

L = 4800

LONGITUDINAL SECTION

2 LEGGED STRUPS 8# @200MM c/c -5

TENSILE REINFORCEMENT 16# 2 NOS - 1

TENSILE REINFORCEMENT 16# 2 NOS - 2

COMPRESSIVE REINFORCEMENT 16Ø, 3NOS.

2 LEGGED STIRRUPS 8Ø @150MM C/C = 5

2 LEGGED STIRRUPS 8# @200MM C/C = 5

300

BOTTOM PLAN

2 LEGGED STIRRUPS 8Ø @150MM C/C = 5

300

TOP PLAN

COMPRESSIVE REINFORCEMENT 16Ø, 3NOS.

2 LEGGED STIRRUPS 8Ø @150MM C/C - 5

TENSILE REINFORCEMENT 16Ø, 2 nos- 1

500

300

CROSS SECTION AT SUPPORT

COMPRESSIVE REINFORCEMENT 16Ø, 3NOS.

2 LEGGED STIRRUPS 8Ø @ 200MM C/C = 5

TENSILE REINFORCEMENT 16 Ø 2 NOS - 2

TENSILE REINFORCEMENT 16 Ø, 2 nos- 1

25

250

25

25

500

25

CROSS SECTION AT MID SPAN

DETAILS OF DOUBLE REINFORCED BEAM (PARTIALLY FIXED)

DCN35124E3

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.124   119

TASK 2 : **Draw to a suitable scale, the longitudinal section, a cross section near the support and cross section in the centre of span of a rectangular. R.C.C. simply supported beam (Fig 4)**

DATA

Clear span (ℓ)   = 7.00 m.

Effective span (L)   = 7.30 m.

Width of beam   = 300 mm.

Overall depth of beam = 850 mm.

Tensile bars bent up at = 5 No's 20Ø with two bars
L/7 from middle of
bearings.

Anchor bars   = 2 No's 12Ø

Side face reinforcement = 4 No's 12Ø (two on each face)

Stirrups   = 8 Ø 240mm c/c

> **When the depth of beam increases 750 mm side face reinforcement is to be provided along the two faces. Spacing between side face reinforcement should not be more than 300mm.**

Area of side face reinforcement

As = 0.1 % of the web area $\dfrac{0.1 \times 300 \times 850}{100} = 25.50 \text{mm}^2$

Provide 4 No's 12 Ø in all, two on each face giving a total area of as = 45.2 mm^2

Stirrups = 2 legged 8 mm Ø at 240 mm c/c throughout .

Fig 4

DETAILS OF SINGLE REINFORCED BEAM
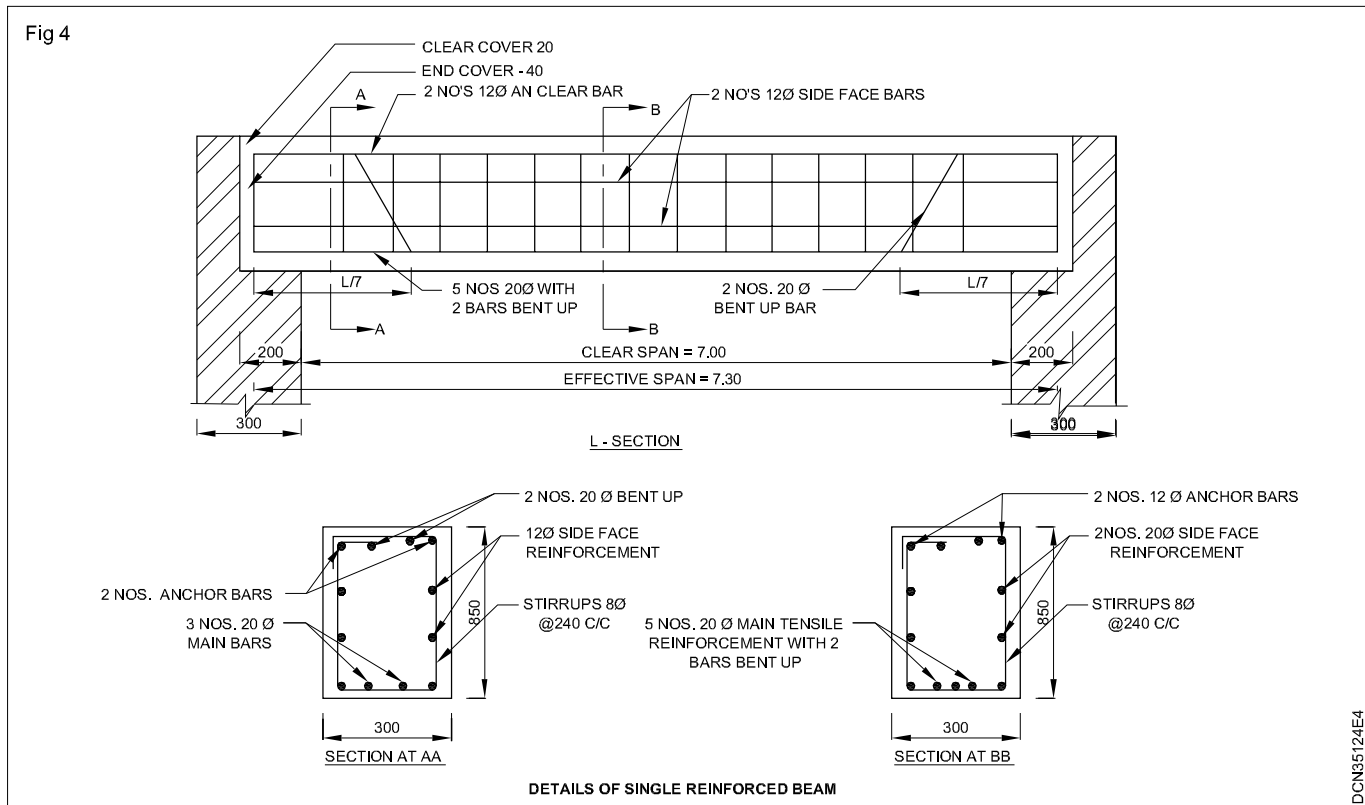
R.C.C lintel and sunshade

Objective : At the end of this exercise you shall be able to
• **prepare the R.C.C lintel (longitudinal and cross section)**
• **prepare the R.C.C lintel with sunshade.**

PROCEDURE

TASK 1 : **A.R.C.C lintel is supported on walls of 300 mm thick wall over a span of 2 metre. It is reinforced with 3nos, 12 mm diameter steel bars and two 10mm bar for anchoring. 8 mm stirrups at 200 mm c/c and depth of lintel is 250 mm. (Fig 1)**

• Draw the following views.

• Longitudinal views.

• Cross section at mid - span and at support.

DATA

• Clear span of lintel - 2m (2000 mm).

• Bearing on either side - 300 mm.

• Size of lintal -250×200 mm

• Width of brick wall - 300 mm.

• Reinforcement details:

• main bar: 12 mm Ø Fe 415 steel - 3 Nos. With one number bent up at support.

• Stirrups: 8 mm Ø at 200 mm c/c, 2 Nos of 10 mm Ø bars at top.

• Same as previous exercise.

• Use hatch commands wherever necessary.

Fig 1

DETAILS OF R.C.C. LINTELS
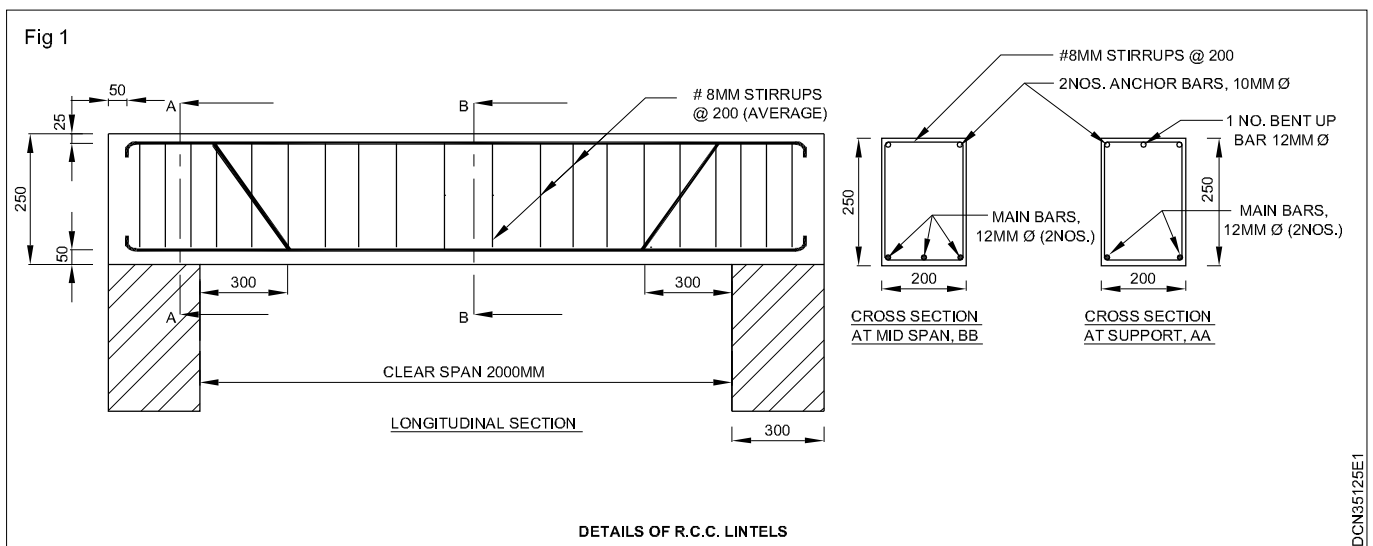
TASK 2 : **Draw the following views to a suitable scale**

• Longitudinal section of lintel.

• Cross section of lintel and sunshade at mid span and at support.

• Plan of lintel and sunshade.

• Hanger rods.

• Shear reinforcement.

DATA

• The following are the particulars of a lintel with sunshade.

• Clear span of lintel - 2 m.

• Bearing on either side - 300 mm.

• Size of lintel -300×200 mm.

• Width of brick wall - 300 mm.

• Width of sunshade - 0.9 m.

• Thickness of sunshade - 100 mm at support and 50 mm at free end.

Reinforcement details

• Lintel - 12 mm Fe 415 steel (5 Nos), 2 Nos curtailed at 0.08 ℓ from face of the wall.

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- Hanger reinforcement - 10 mm.

- Fe 415 steel 2 Nos.

- Shear reinforcement - Fe 415 steel 8 mm, 2 legged stirrups 175 mm c/c.

Sunshade (Fig 2)

- Main reinforcement - Fe 415 steel 10 mm @.

- 230 mm c/c..

- Distributors - Fe 415 steel 8 mm.

- 300 mm c/c.

- Anchorage and curtailment of reinforcement may be adopted with standard values and any more data required may be assumed suitably.

Fig 2

LONGITUDINAL SECTION OF LINTEL

PLAN OF LINTEL AND SUNSHADE

CROSS SECTION OF LINTEL SUNSHADE AT MID SPAN

CROSS SECTION OF LINTEL SUNSHADE AT SUPPORT

DETAILS OF R.C.C. LINTELS
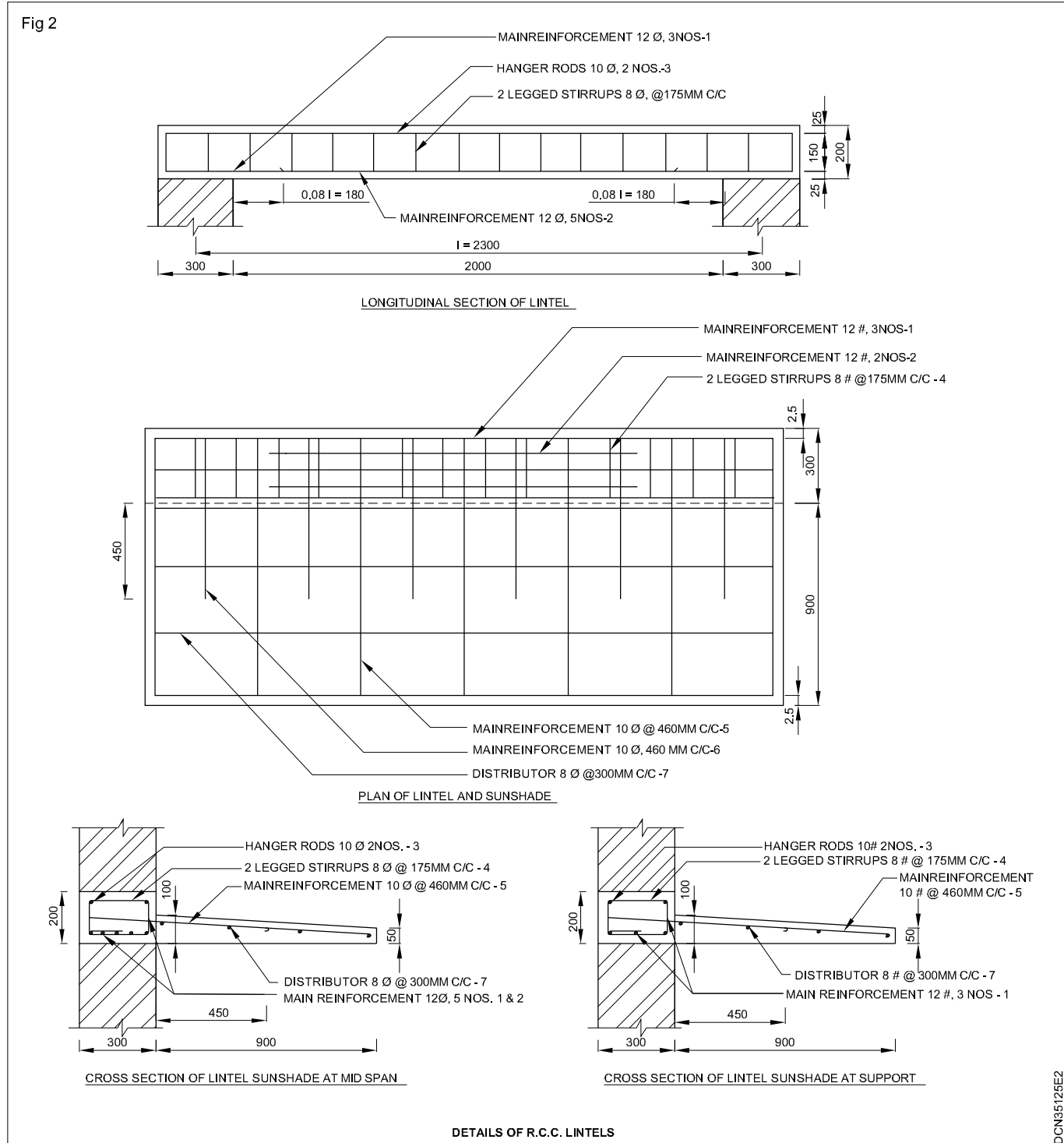
R.C.C stair and details of step

Objectives : At the end of this exercise you shall be able to
• **prepare section along the flight length**
• **prepare bar bending details.**

PROCEDURE

TASK 1 : **Draw the reinforcement details of cross section of the flight of a slab type stair (Fig 1)**

DATA

• Clear span (including landing) = 5.7 m.

• Width of landing on both sides = 1.2 m.

• Rise = 1.5 cm.

• Going = 30 cm.

• Thickness of slab = 20 cm.

• Main reinforcement = 16 mm. Ø @ 12 cm. c/c.

• Distribution reinforcement = 8 mm. Ø @ 15cm. c/c.

• Clear cover = 16 mm.

• Bearing of slab = 20 cm. on brick wall.

• Draw single straight flight R.C.C slab stair using CAD software.

SINGLE STRAIGHT FLIGHT OF R.C.C. INCLINED SLAB STAIRS
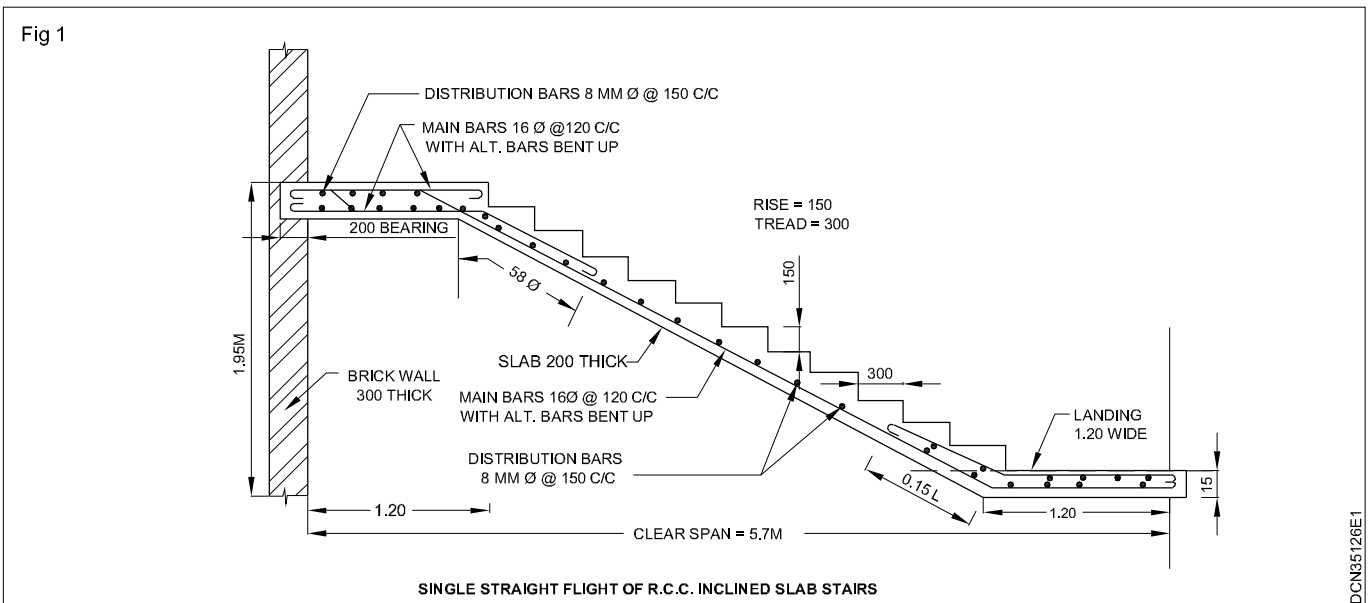
TASK 2 : **Draw the following views of dog legged stair cas to a suitable scale (Fig 2)**

• Plan and elevation of dog legged stair.

• Section of waist slab (first flight).

• Section of waist slab (second flight).

• Details of steps.

DATA

• The following are the particulars of a dog legged staircase.

• Clear size of staircase room - 5.9 m x 3.4 m.

• Width of suppoprting walls - 230 mm.

• Vertical distance between the floors - 3.3 m.

• Width of flight - 1600 mm.

• Width of landing - 1600 mm.

• Number of flights - 2.

• No. of riser in each flight - 11.

• N0. of treads in each flight - 10.

• Rise - 150 mm.

• Tread - 270 mm.

• Thickness of waist slab - 250 mm.

• Main reinforcement 10 mm Fe steel @ 120 mm c/c.

- Distributors - 8 mm Fe 415 steel @ 160 mm c/c

- 50% of the main reinforcement are provided at the bottom of landing slab and extended to the top of waist for a length of 0.15 ℓ or Ld whichever is greater.

- Anchorage and curtailment of reinforcement may be with standard values and any more data required may be suitably assumed.

- Draw single R.C.C doglegged stair using Auto CAD software.

Fig 2
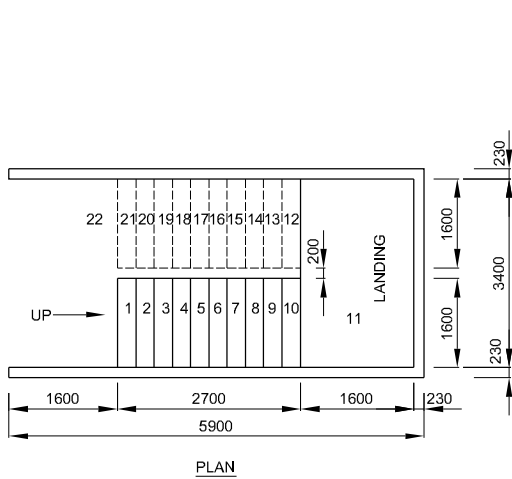
PLAN
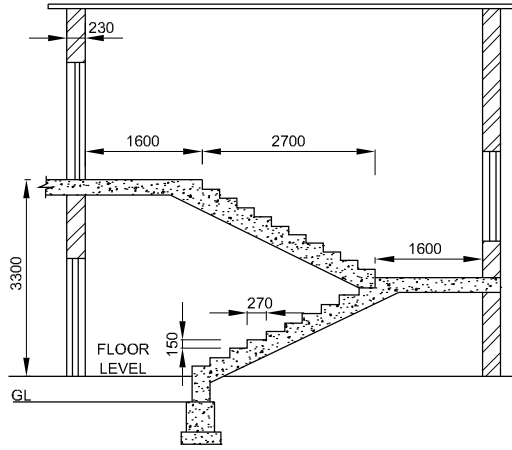
SECTIONAL ELEVATION
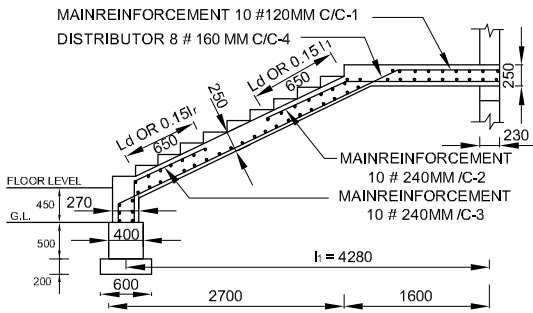
SECTION OF STAIR SLAB (FIRST FLIGHT)
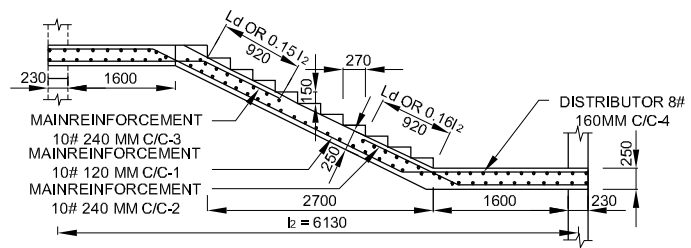
SECTION OF STAIR SLAB (SECOND FLIGHT)
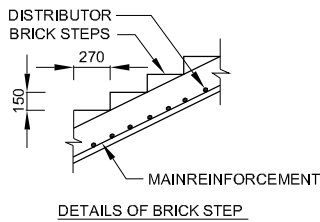
DETAILS OF BRICK STEP
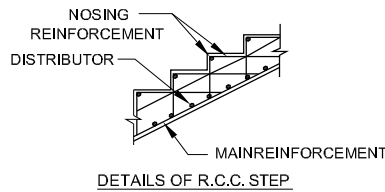
DETAILS OF R.C.C. STEP

DOG LEGGED STAIRCASE

DCN35126E2

Details of bending of bars

Objectives : At the end of this exercise you shall be able to
• **prepare the schematic sketch of R.C.C member**
• **prepare the development length anchorage hooks lap of bars.**

PROCEDURE

TASK 1 : **Draw the schematic sketch of R.C.C member of building as shown in Fig 1**

General detailing reguirements

Aschematic sketch of R.C.C members is shown. The columns and footings are the prime structural members along vertical axis. Floor slabs and beams constitute members in the horizontal planes. The main longitudinal beams connect the columns along the larger spans and the cross beams along the short spans. The beams may project out as cantilevers. Plinth beams connecting the columns at otherwise needed to support the ground floor walls. The slabs are supported by beams along their edges. Slabs alao may project outside the beam as cantilevers. Lintels are for spanning the wall openings.

Sunshades project from the lintels or beams.

1   Switch on the computer.

2   Load Auto CAD.

3   Setting units (Set unit as decimal and millimeter)

4   Setting limits, zoom all.

5   Using basic command of CAD, draw schematic sketch of R.C.C member as per given sketch

Cover to reinforcement

a   At ends max of 25mm or twice bar diameter j

b   For longitudinal bars in columns 40 mm or j

c   For longitudinal bars in beams max of 25 mm or j

d   For tensile, compressive or shear bars in slabs min cover 15mm or diameter of such bars.

For structural members immersed in water or in contact with soil, cover may be increased for 15-40mm. But cover shall not exceed 75 mm

Fig 1

SCHEMATIC SKETCH OF RCC MEMBERS

125
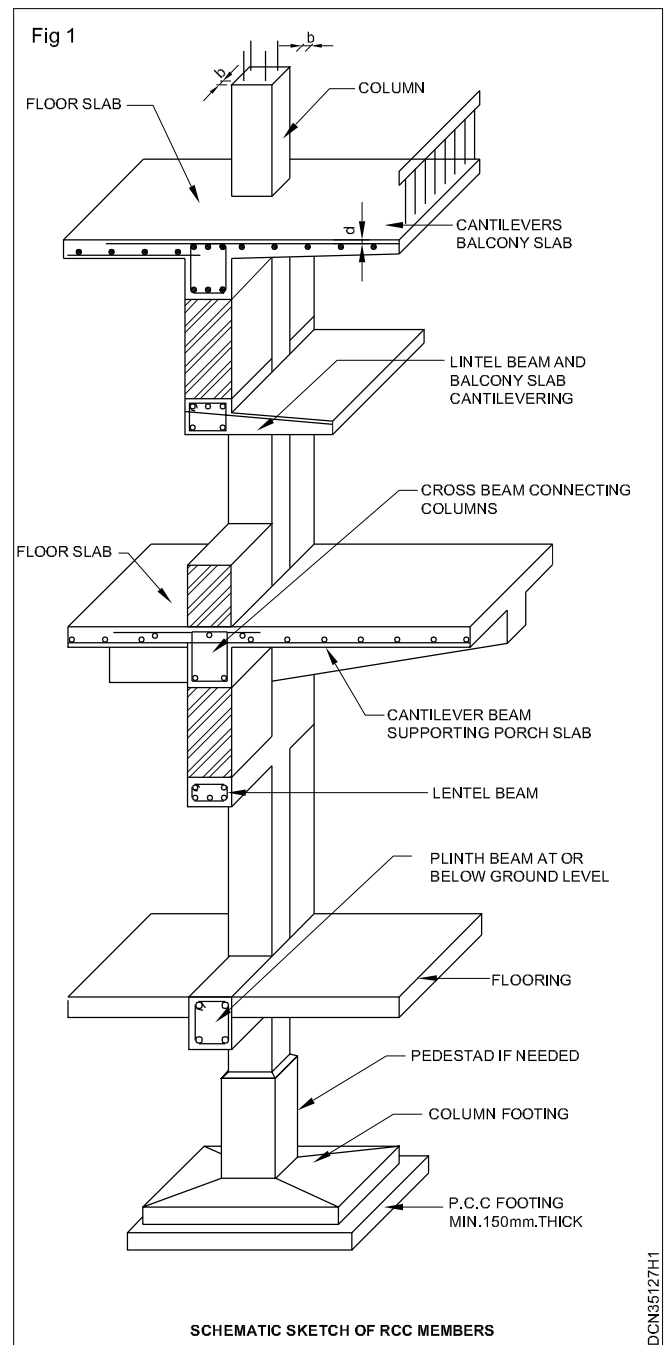
TASK 2 : **Draw development length of bars, anchorage value of bonds and hooks and length for lap splices for all structural detailing, typical details of L, T junction and types of bars as per given Fig 2 & 3**

DATA

Bend - 8 Ø, Hook - 16Ø (where Ø = diameter of bar)

K = 2 for mild steel, 4 for cold twisted bars.

90° Hook.

Recommended bending.

D = 6 d for 6 mm to 22 mm Ø.

D = 8 d for 25 mm to 28 mm Ø.

D = 10 d for 32 mm to 36 mm Ø.

Development length of bars LD (Limit state method)

180° Hook.

Recommended bending.

D = 6 d for 6 mm to 22 mm Ø.

D = 8 d for 25 mm to 28 mm Ø.

D = 10 d for 32 mm to 36 mm Ø.

Concrete grade	Type of bars	σ y N/mm²	Ld in tension	Compression
M15	Plain	250	54.4Ø	43.5Ø
	Deformed	415	56.4Ø	45.1Ø
M 20	Plain	250	45.3Ø	36.3Ø
	Deformed	415	47.0Ø	37.6Ø

Length for lap splices.

In compression - max of LD or 24Ø.

In tension - max of Ld or 30Ø.

PROCEDURE

1 Switch on the computer.

2 Load Auto CAD.

3 Setting units (Set unit as decimal and millimeter).

4 Setting units, zoom all.

5 Using basic command of CAD, draw details of development length of ban, hooks, length of lap splices.

Fig 2

"U" SHAPED HOOK

BENDS AND HOOKS FOR PLAIN
BARS IN TENSION

180° HOOK   90° BEND   135° BEND

HOOKS AND BENDS FOR STIRRUPS

Ld = 40 TO 45 d

LAP

CRANK DETAILS

TOP COVER

ANCHOR LENGTH

NEUTRAL AXIS

DEPTH OF BEAM

END COVER

BOTTOM COVER

SPAN / 7 TO SPAN / 4

CEMENT PLASTER

BRICK WALL
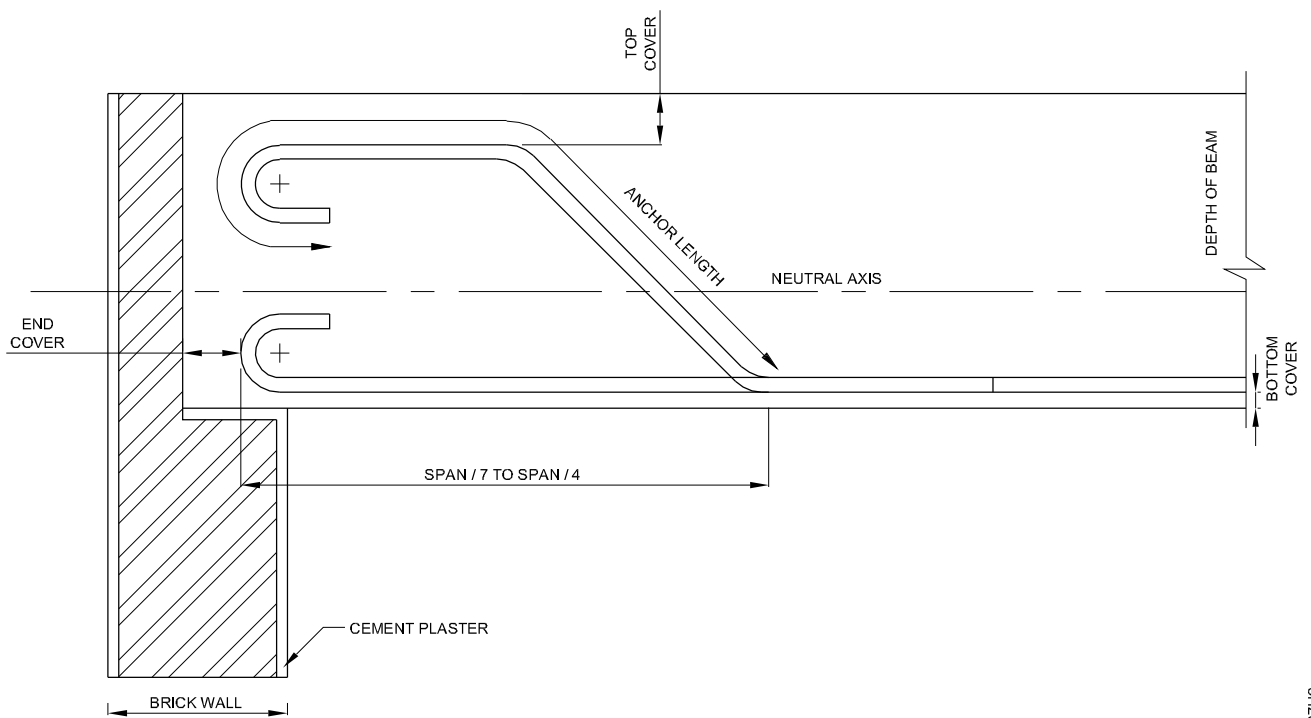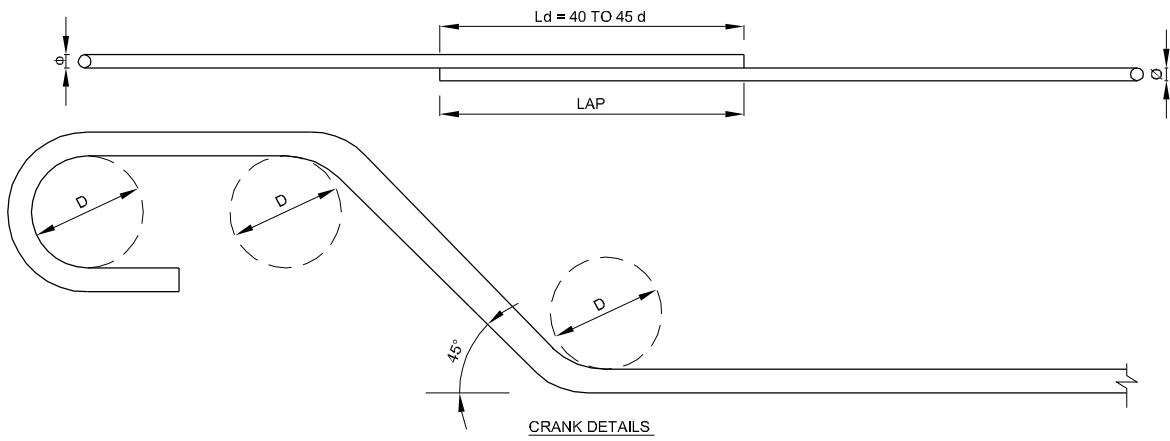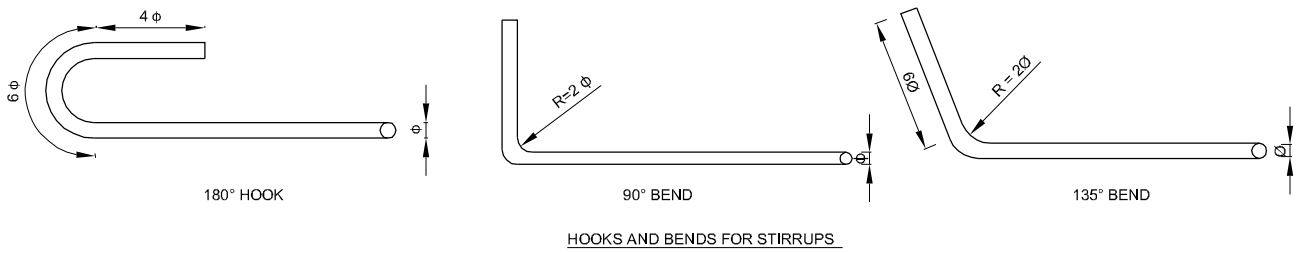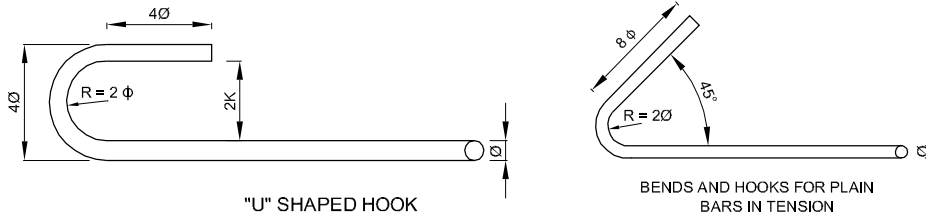
HOOKS, BENDS AND CRANK DETAILS

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.127

DCN35127H2

Fig 3
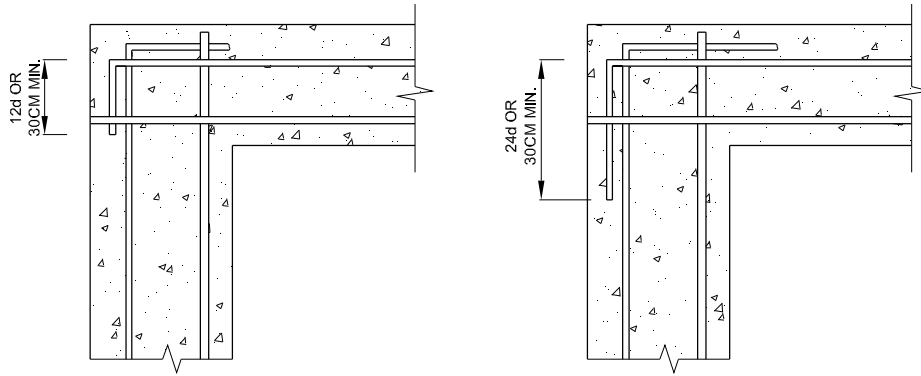
TYPICAL DETAILS OF L-JUNCTIONS
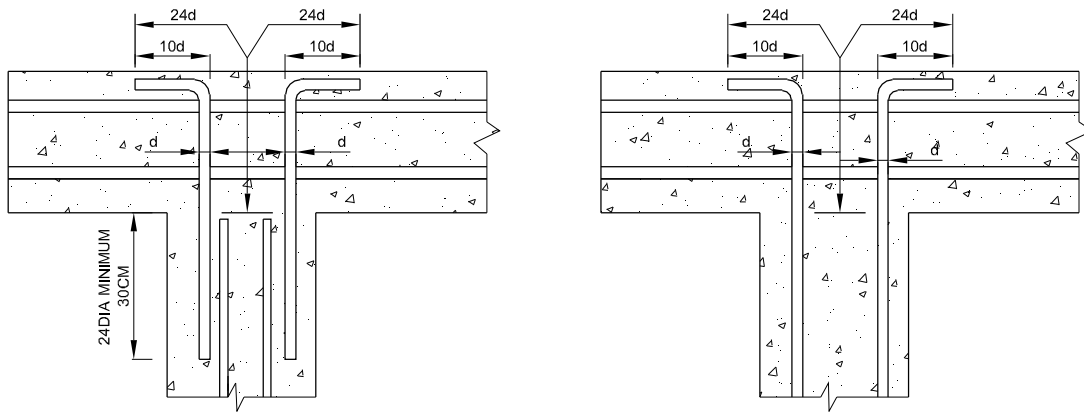
TYPICAL DETAILS OF T - JUNCTIONS
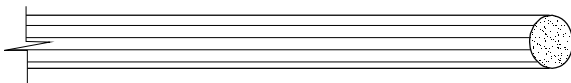
CIRCULAR BAR
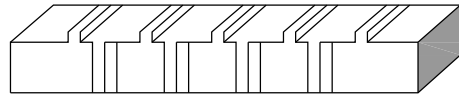
SQUARE BAR WITH INDENTATIONS

SQUARE BAR
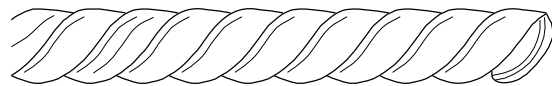
TWISTED BAR

DETAILS OF JUNCTIONS

DCN35127H3

Bar bending schedule

Objectives : At the end of this exercise you shall be able to
• **prepare L-section and X-section of an R.C.C lintal**
• **calculate length of mainbar, crank bar stirrup holder and stirrup**
• **calculate numbers of each bar**
• **prepare bar bending schedule.**

TASK 1 : **Calculate the quantity of reinforcement required for a R.C.C lintel over a door of a size 200 x 210 cm and prepare bar bending schedule (Fig 1)**

DATA : Size of lintel = 25 x 15 cm.

Mainbar- 12mm ø - 4 Nos.

(2 No straight, 2 Nos cranked).

Stirrup holder - 8 mm ø - 2 Nos.

Stirrup - 6 mm ø 13 cm c/c (average).

Wall thickness = 25 cm.

Bearing - 15cm.

Covering - 2.5 cm alround.

Length of lintel = $200 + (2 \times 15) = 200 + 30$.

= 230 cm.

Effective length = L - 2 end cover.

= 230 - 2 x 4 = 230 - 8.

= 222 cm.

Width of lintel = 25 cm

Effective width of lintel = 25 - 2 x cover - 1 dia of stirrup

= $25 - 2 \times -(1 \times 0.6)$.

= 20.4 cm.

No. of main bar   = 4 Nos.

No. of straight bar = 2 Nos.

No. of cranked bar = 2 Nos.

Length of straights bar = ℓ + 18 ø .

= $222 + (18 \times 1.2)$.

= 243 .6 cm.

Length of cranked bar = l + 18 ø + 0.84d .

$\therefore$ d = 15 - 2 x cover - 1 dia of stirrup.

= 15 - (2 x2.5) - 1 x 0.6 = 9.4cm

Length of cranked bar =222 + . (18 x 1.2) + (0.84 x 9.4)

= 251. 49 cm .

Number of stirrup = $\dfrac{l}{spacing} + 1$.

$= \dfrac{222}{13} + 1 = 18.08$

= 19 Nos .

Length of stirrup = 2 (b+d) + 18 ø.

= 2 (20.4 + 13.4) + (18 x 0.6)

= 78.4 cm.

Length of stirrup holder = l + 18 ø .

= 222 + (18 $\times$ 0.8).

= 236.4 cm.

Fig 1

DETAILS OF R.C.C LINTEL

SECTION ZZ   SECTION XX

DCN35127X1
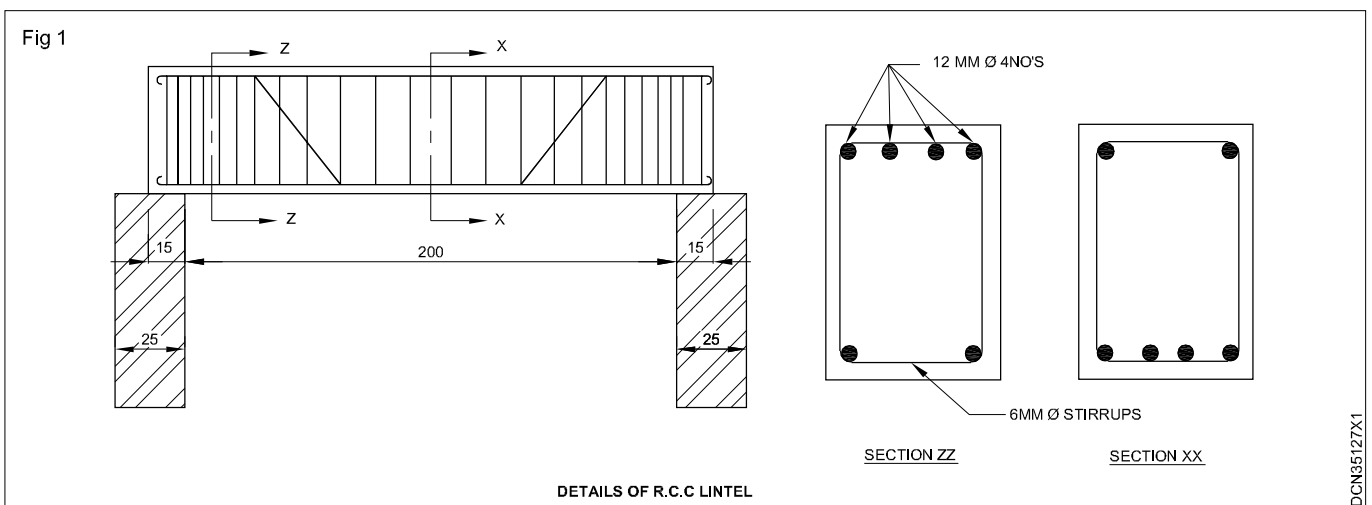
Table 1 Barbending schedule

Sl. No	Description particular	Shape of bars with sketch	No.of bar	length of each bar in m	Total length in m	Weight/ metre kg	Total weight kg
1	Main straight bar 12 mm		2	2.436	4.872	0.39	1.900
2	Main cranked bar 12 mm ø Stirrup 6 mm ø Stirrup holder 8 mm ø		2	2.515	5.03	0.89	4.477
			19	0.784	14.896	0.22	3.277
			2	2.364	4.728	0.39	1.843

Total weight = 11.497 = say 12kg

Total weight In quintal $\dfrac{12}{100} = 0.12$ quintal

— — — — — — — —

TASK 2 : **Calculate the quantity of reinforcement based on shapes of reinforcement required for R.C.C beam Fig 2 & 3**

DATA

Consider a beam of clear length of 4m, 300 mm wide and 450 mm depth. It consists of 2 - 12 diameter bars at top, and 2 - 16 diameter and 1-12 diameter bars at the bottom. Diameter of stirrup is 8 mm spaced at 180 mm center to center. Clear cover to reinforcement provided is 40 mm.

Stirrups are spaced at 180 mm center to center. Stirrups are provided between walls or support for a beam.

No. of stirrups required for given beam =

$$\frac{\left[(4000+460)-2\times40\right]}{180}+1+25.33 = 26$$

Length a = $450-2\times40 = 370$ mm

Length b = $300-2\times40 = 220$

Therefore length of 1 stirrup S1 = $2\times(370+220+90) = 1360$ mm.

Where 90 mm is the minimum hook length as per IS 2502 (Fig 4) Table 2

Fig 3

RCC BEAM CROSS - SECTION

Fig 4

SHAPE OF R.C.C. BEAMS   SHEAR STIRRUPS

RCC BEAM REINFORCEMENT DETAILS

Fig 2

LONGITUDINAL SECTION
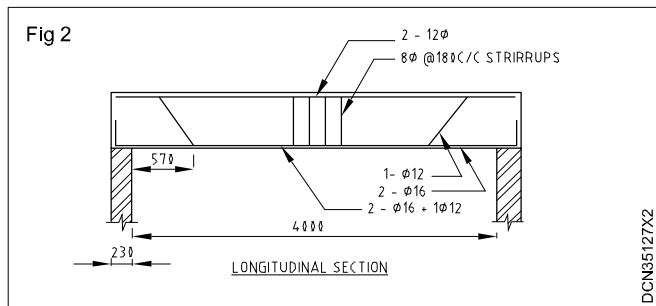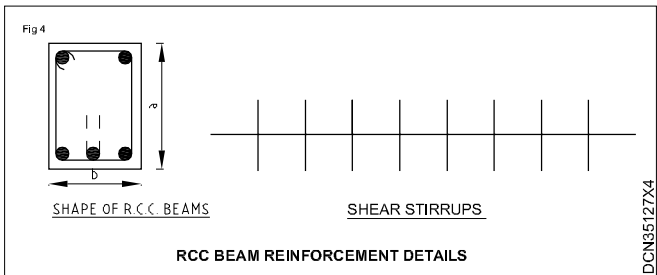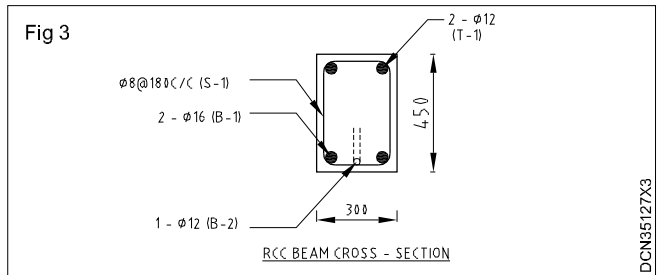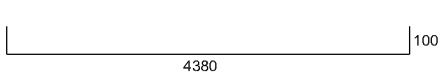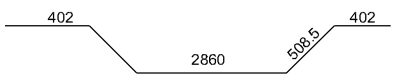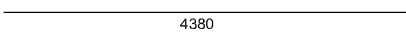
Table 2

Bar bending schedule for R.C.C beam

No	Discription	Shape of bar with sketch	No.of bar	Length of each bar (mm)	Total length (m)	weight per meter (kg)	Total weight in kg
1	Main bar straight 16 mm#	4380 — 100	2	4580	9.160	1.58	14.47
2	Main cranked bar 12mm #	402 — 2860 — 508.5 — 402	1	4681	4.681	0.89	4.17
3	Top bar 12mm# (Hanger bar)	4380	2	4380	8.76	0.89	7.80
4	Stirrups 8mm#	220 × 370	26	1360	35.36	0.39	13.79
						Total	40.23 kg

Now we will calculate the length of reinforcement based on shapes of reinforcement required for reinforced concrete beam in above example.

we will start with bottom reinforcement, B1.

Bar shape of B1 is as shown below. (Fig 5)

Fig 5

SHAPE OF BARS

DCN35127X5
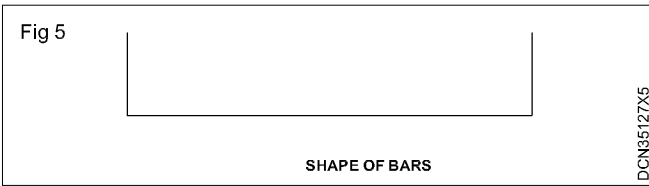
Length of B1 = clear distance between walls + 2 x width of walls - 2 x bar cover + 2 x hook.

Hook length = 6 $\times$ 16 = 96 consider as 100 mm.

Hook length is calculated as 6 x diameter of bar for reinforcement conforming to IS : 1786 - 1961.

Length of B1 = 4000 + 2 $\times$ 230 - 2 $\times$ 40 + 2 $\times$ 100 = 4580mm.

Length of bar B2 is calculated based on shape of this bar.

The bar bends up near the support as shown below.

Length of bar B2 : Length of straight bar + 2 bend length

H = 450 - 2 $\times$ 40 - 2 $\times$ 12/2 = 358 mm

B2 = 4000 + 2 $\times$ 230 - 2 $\times$ 40 + (2 $\times$ 0.42 $\times$ 358) = 4681mm

Length of bar T1 = 4000 + 2 $\times$ 230 -2 $\times$ 40 = 4380 mm
Fig 6

Fig 6

H

A   C   B

SHAPE OF BARS

DCN35127X6

— — — — — — — —
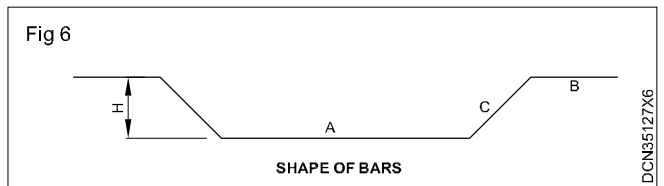
Simply supported one way slab

Objectives : At the end of this exercise you shall be able to
• **prepare L-section and X-section of one way slab**
• **draw plan of the one way slab**
• **calculate length and numbers of different bars**
• **prepare bar bending schedule.**

PROCEDURE

TASK 1 : **Draw the following views of R.C.C one way slab in CAD software using basic commands (Fig 1)**

• The reinforcement plan.

• Longitudinal sections.

DATA

• Clear span - 5.54 x 1.54m

• Wall thickness - 230 mm.

• Slab thickness - 100 mm.

• Main bar - 10 mm Ø @ 150 mm c/c. (Alternate bent up).

• Distributors - 8 mm Ø @ 200 mm c/c.

• Provide minimum distributers on top layer at end strips.

• Draw the different views using CAD soft

Fig 1

SHORTER SPAN (l x)

DISTRIBUTORS 8MM Ø @ 200 C/C

D   F

A   B

LONGER SPAN (l y)

E
MAIN BARS Ø 10 @ 150 C/C

C

PLAN

TOP DISTRIBUTOR BARS 3 NOS, 8MM Ø
MAIN BENT UP BARS 10 Ø AT 300 C/C

20
20
60
20

100

lx/6

MAIN STRAIGHT BARS
10 Ø AT 300 C/C
BOTTOM DISTRIBUTORS
8MM Ø AT 200 C/C

200

SHORTER SPAN (l x)

C/S AT MIDDLE STRIP ALONG AB

TOP DISTRIBUTOR BARS 3 NOS, 8MM Ø
MAIN BENT UP BARS 10 Ø AT 300 C/C

BOTTOM DISTRIBUTORS
8MM Ø @ 200 C/C
MAIN STRAIGHT BARS
10 Ø AT 300 C/C

WALL
200

L/S AT END STRIP ALONG CD

l y

BOTTOM DISTRIBUTORS
8 MM Ø @ 200 C/C
MAIN STRAIGHT BARS
10 Ø AT 150 C/C

WALL
200

L/S AT MIDDLE STRIP ALONG EF

6000

532

2000

532

8MM Ø DISTRIBUTOR
BARS @ 180 C/C

10MM Ø MAIN BARS @
150 C/C(ALTERNATE BENT UP)

8MM Ø DISTRIBUTOR BARS @ 200 C/C

10MM Ø MAIN BARS @ 150 C/C
(ALTERNATE BENT UP)

100

10MM Ø MAIN BARS @
150 C/C(ALTERNATE BENT UP)

8MM Ø DISTRIBUTOR BARS @ 200 C/C

20
60
20

20

230   302   302   230

2000

CROSS SECTION OF SLAB ALONG SHORT SPAN

10MM Ø MAIN BARS @ 150 C/C
(ALTERNATE BENT UP)

8MM Ø DISTRIBUTOR BARS @ 200 C/C

100

6000

CROSS SECTION OF SLAB ALONG LONG SPAN

ALL DIMENSIONS ARE IN MM

DCN35128E1

SIMPLY SUPPORTED ONEWAY SLAB (SINGLE SPAN)

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128

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TASK 2 : **Calculate the quantity of reinforcement required for R.C.C slab and prepare the bar bending schedule (Fig 1)**

DATA

Size of room 320 × 350 cms.

Wall thickness - 300 mm.

Main reinforcement 10 mm bar 15cm c/c.

Distributor bar 8 mm bar 20 cm c/c.

Top and bottom cover 20 mm.

End cover 50 mm.

Slab thickness 10 cm.

Prepare drawings using cad software.

Calculations:

Total length of slab = 350 + (2 × 30).

= 410 cm.

Total width of slab = 320 + (2 × 30).

=380 cm.

Effective length of slab : 410 - 2 end cover.

= 410 - (2 × 5) = 410 - 10.

= 400 cm.

Effective width of slab = 380 - 2 end cover.

= 380 - (2 × 5) = 380 - 10.

= 370 cm.

Number of main bar = $\dfrac{l}{spacing} + 1$.

(Where 'l' is the effective length of longer span).

$= \dfrac{400}{15} + 1 = 27.66$

= 28 Nos.

No of straight bar = $\dfrac{28}{2} = 14$ Nos.

No of cranked bar = 28 - 14 = 14 Nos.

Length of straight bar = l + 18.

= 370 + (18 × 1).

= 388 CM.

Length of cranked bar = l + 18 + 0.84d.

d = D - 2 x cover - 1 dia of the main bar.

= 10 - (2 x 2) - (1 x 1) .

= 10 - 4 - 1 = 5 cm.

d = 5 cm.

Length of cranked bar = 370 + (18 × 1) + (0.84 × 50.

= 392 cm.

Number of distributers = no. of distributers over straight bar + no. of distributers under cranked bar.

No. of distributers over straight bar = $\dfrac{l}{spacing} + 1$.

(Where 'l' is the length of shoter span).

$= \dfrac{370}{20} + 1$.

= 19.5 = 20 Nos.

No. of distributers under cranked bar (Assume bars are cranked at 1/5th span) .

y = (30 - 5) + 320 × 1/5.

= 25 + 64.

= 89 cm.

x = y - d.

= 89 - 5 = 84 cm.

No. of distrubuters under cranked bar = $2\left(\dfrac{x}{Spacing} + 1\right)$

$= 2\left(\dfrac{84}{20} + 1\right) = 100 - 40 = 11$ Nos.

Total no. of distributers.

$= \left(\dfrac{l}{Spacing} + 1\right) + 2\left(\dfrac{x}{Spacing} + 1\right)$

= 20 + 11 = 31 Nos.

Length of distributers bar = l + 18Ø.

= 400 + 18 x 0.8 = 414.4 cm.

Fig 1

DETAILS OF R.C.C. ROOF SLAB

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128

Fig 2

DISTRIBUTOR 8 Ø @ 20CM C/C

50

MAIN REINFORCEMENT 10 Ø @ 15CM C/C - 1

MAIN REINFORCEMENT 10 Ø @ 15CM C/C

300

3200

300

50

SECTION ALONG SHORTER SPAN

0.1 Iz

DISTRIBUTORS 8Ø @ 20CM C/C

0.1 Iz

300

0.1 Iy

3500

0.1 Iy

300

300

DISTRIBUTION ROD 8 Ø @ 20 CM C/C

MAIN REINFORCEMENT 10 Ø @ 15CM C/C

MAIN REINFORCEMENT 10 Ø @ 15CM C/C

300
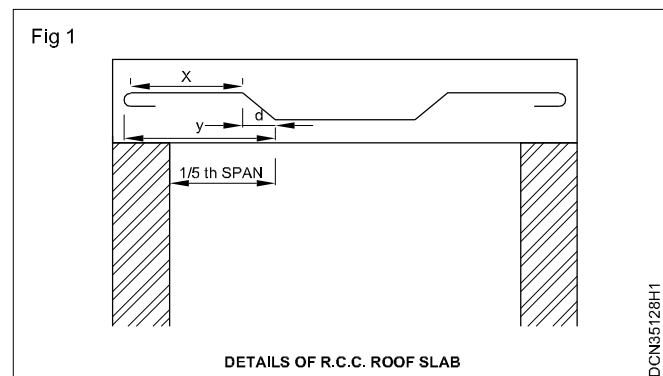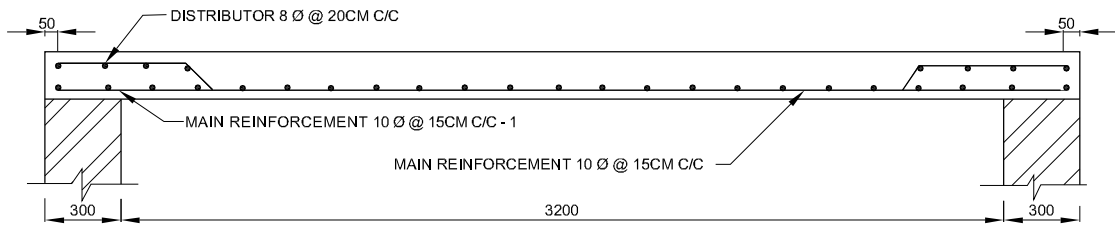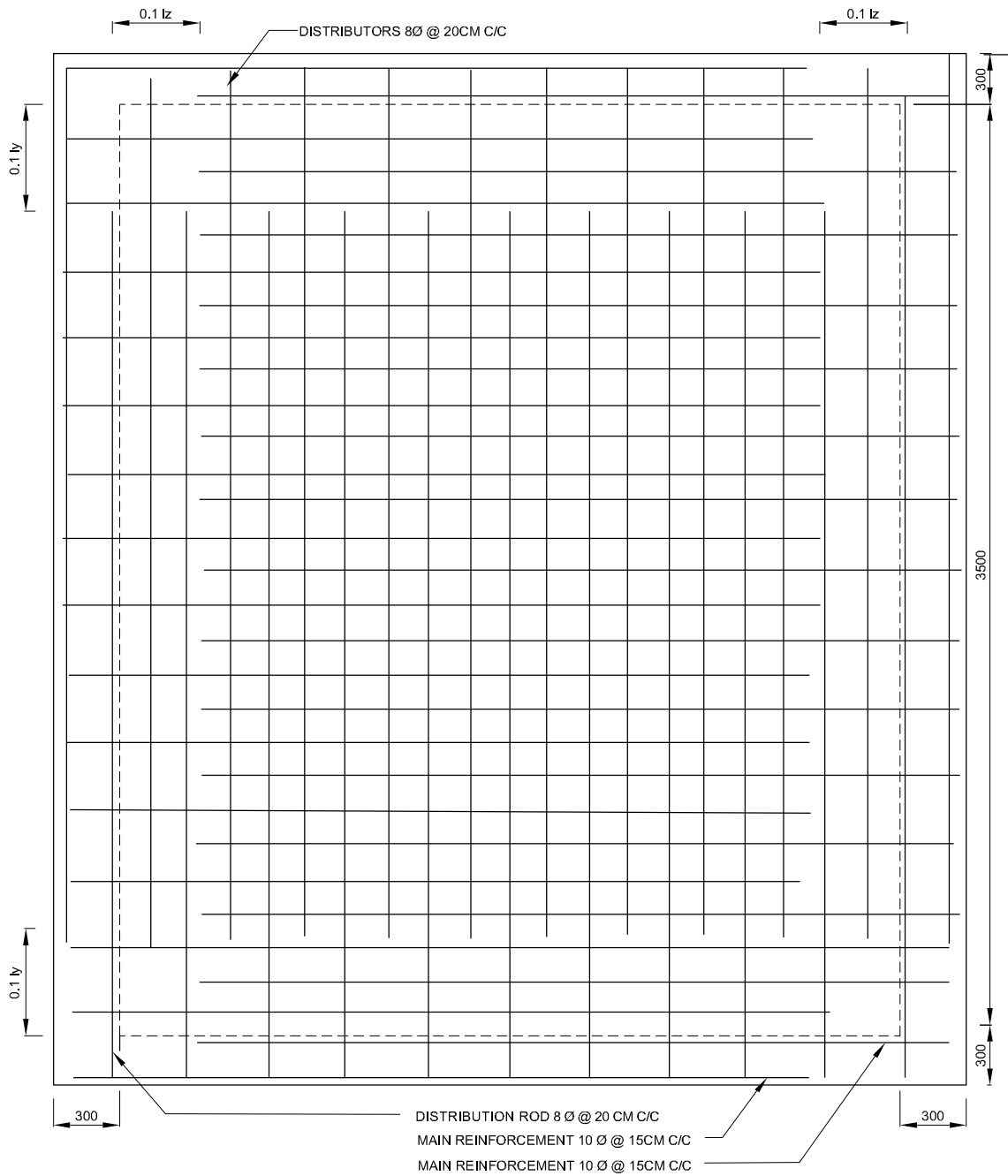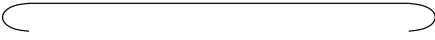
PLAN AT BOTTOM

DETAILS OF R.C.C. ROOF SLAB

DCN35128H2

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128

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Sl.No	Description	Shape of bar	No.of bars	Length of each bar in m	Total length in m	Weight metre in kg	Total weight in kg
1	Main bar straight bar 10 mm dia at 15 cm c/c		14	3.88	54.32	0.62	33.68
2	Main bar cranked bar 10 mm dia at 15 cm c/c		14	3.922	54.91	0.62	34.04
3	Distributers bar 8 mm dia at 20 cm c/c		31	4.144	128.46	0.39	50.10
							117.82

Add 5% for wastage $= \dfrac{117.82 \times 5}{100} = 5.89\text{kg}$

Weight = 117.82 + 5.89 = 123.71 kg.

say = 124 kg.

- - - - - - - -

R.C.C two way slab

Objectives : At the end of this exercise you shall be able to
• **prepare L- section and X- section of a two way slab (corners not held down)**
• **prepare top and bottom plan.**

PROCEDURE

TASK 1 : **Draw the simply supported two way slab (corners not held down) using CAD software (Fig 1)**

• Section along shorter span showing reinforcement details.

• Section along longer span showing reinforcement details.

• Plan showing the reinforcement details at bottom and at top.

• Bar bending schedule.

DATA

• The following are the particulars of a simply supported two way slab, and in which corners are not held down.

• Size of the room - 4.3 x 5.6 m.

• Thickness of slab - 140 mm.

• Width of supporting walls - 300 mm.

• Clear cover - 15 mm.

• Reinforcement along shorter span Fe 415 steel - 10 mm @ 210 mm c/c.

• Reinforcement along longer span - 8 mm Fe 415 steel @ 220 mm c/c.

• Distributors at top for the main reinforcement in both directions 8 mm Fe 415 steel @ 290 mm c/c.

• Anchorage and curtailment of reinforcement may be adopted with standard values and any more data required may be assumed suitably.

• Draw the simply supported two way slab (corners not held down) using CAD software, with suitable scale, assume any other missing data.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128

Fig 1

PLAN AT BOTTAM

SIMPLY SUPPORTED TWO WAY SLAB (CORNERS NOT HELD DOWN)

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128
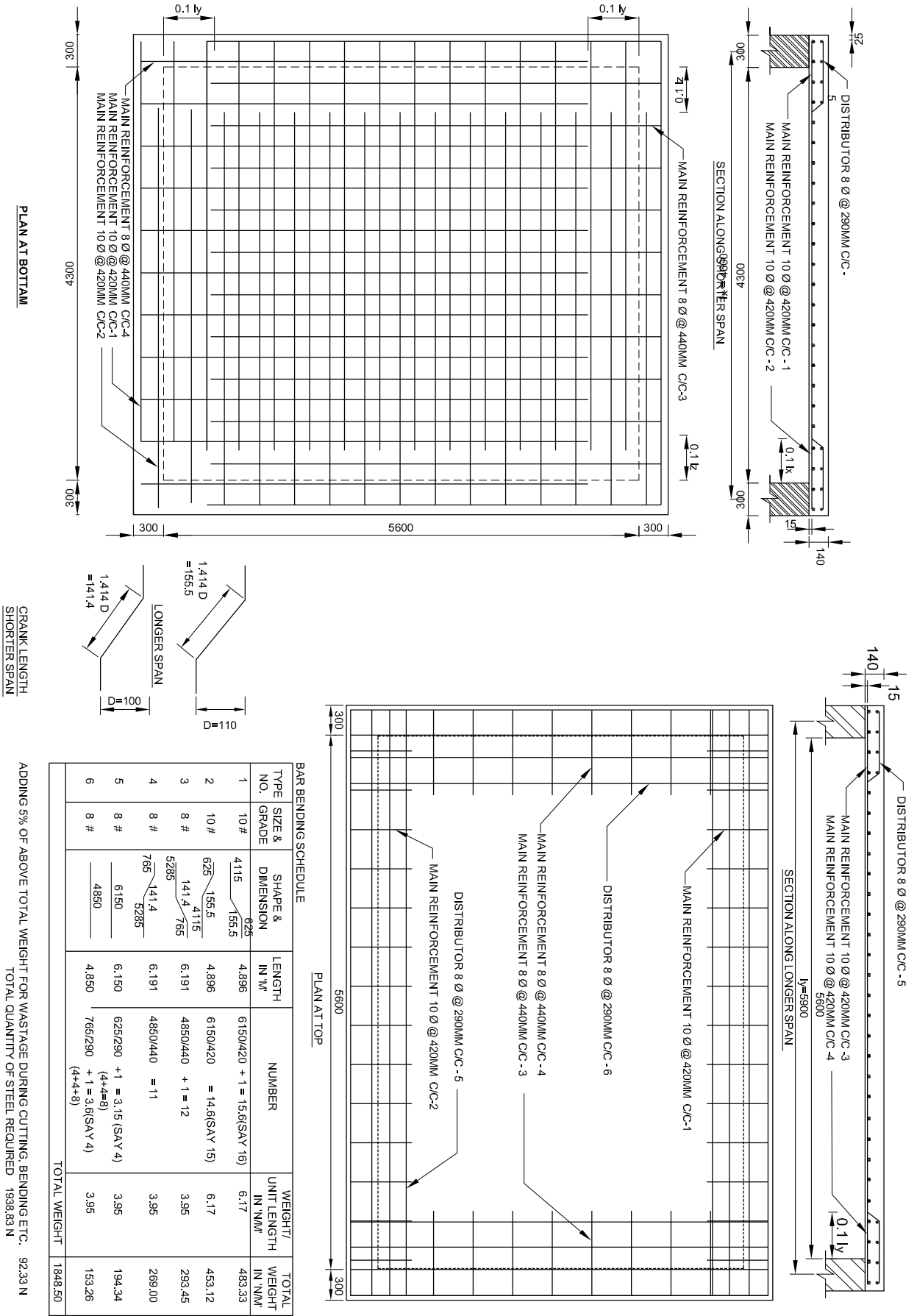
TASK 2 : **Draw restrained two way slab (corners held down) (Fig 2 & 3)**

- Section along shorter span middle strip showing reinforcement details.

- Section along longer span middle strip showing reinforcement details.

- Plan showing arrangement of reinforcement at bottom.

- Plan showing arrangement of reinforcement ar top.

- Bar bending schedule.

DATA

- The following are the particulars of a simply supported two way slab and in which corners are held down.

- Size of room - 7. 00 x 5.00 m

- Width of support - 300 mm

- Thickness of slab - 150 mm

- Clear cover - 15 mm

- Reinforcement in the middle strip.

- Reinforcement along shorter span 12 mm Fe 415 steel @ 100 mm c/c

- Reinforcement along longer span 12 mm Fe 415 steel @ 150 mm c/c

- Reinforcement in the edge strips

- 12 mm Fe 415 steel @ 160 mm c/c. along both spans.

- Distributors at top for the main reinforcement 12 mm. Fe 415 steel @ 160 mm c/c.

- Torsion reinforcement

- Both at top and bottom 10 mm Fe 415 steel @ steel @ 110mm c/c in both directions forming a mesh.

- Anchorage and curtailment of reinforcement may be adopted with standard values and any more data required may be assumed suitably.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128

Fig 2

SIMPLY SUPPORTED TWO WAY SLAB (CORNERS HELD DOWN)

BOTTOM PLAN

SECTION ALONG SHORTER SPAN (MIDDLE STRIP)

BOTTOM PLAN SHOWING TORSION REINFORCEMENT
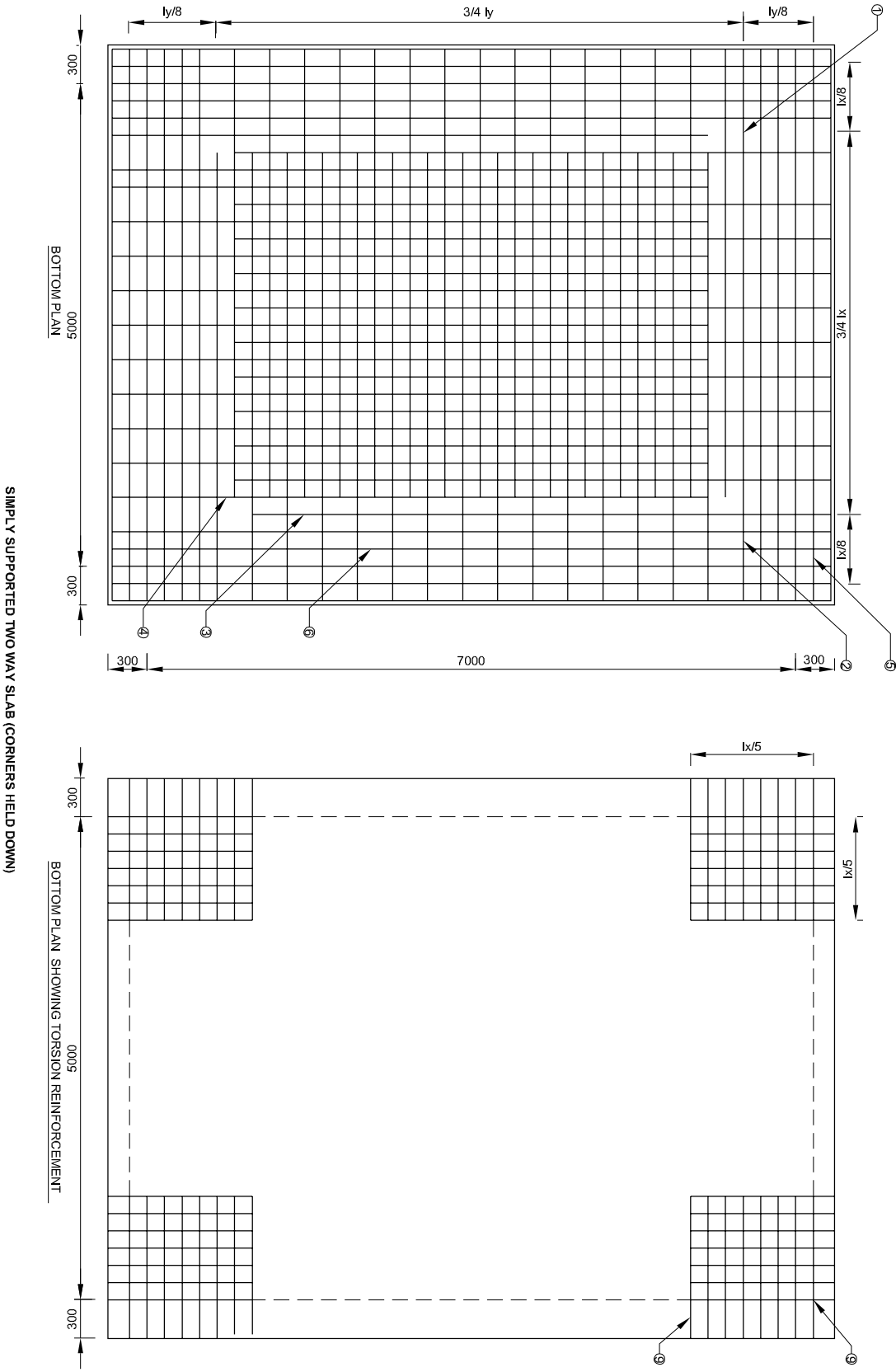
1 - MAINREINFORCEMENT ALONG SHORTER SPAN 12# @ 200 MM C/C
2 - MAINREINFORCEMENT ALONG SHORTER SPAN 12# @ 200 MM C/C
3 - MAINREINFORCEMENT ALONG LONGER SPAN 12# @ 300 MM C/C
4 - MAINREINFORCEMENT ALONG LONGER SPAN 12# @ 300 MM C/C
5 - REINFORCEMENT ALONG SHORTER SPAN EDGE STRIP 12# @ 160 MM
6 - REINFORCEMENT ALONG LONGER SPAN EDGE STRIP 12# @ 160 MM
7 - DISTRIBUTOR AT TOP ALONG SHORTER SPAN 12# @ 160MM C/C
8 - DISTRIBUTOR AT TOP ALONG LONGER SPAN 12# @ 160MM C/C
9 - TORSION REINFORCEMENT 10# @ 110MM C/C

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128

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DCN35128J2

Fig 3

SECTION ALONG LONGER SPAN (MIDDLE STRIP

TOP PLAN

TOP PLAN SHOWING TORSION REINFORCEMENT

SIMPLY SUPPORTED TWO WAY SLAB (CORNERS HELD DOWN)

DCN35128J3

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.128
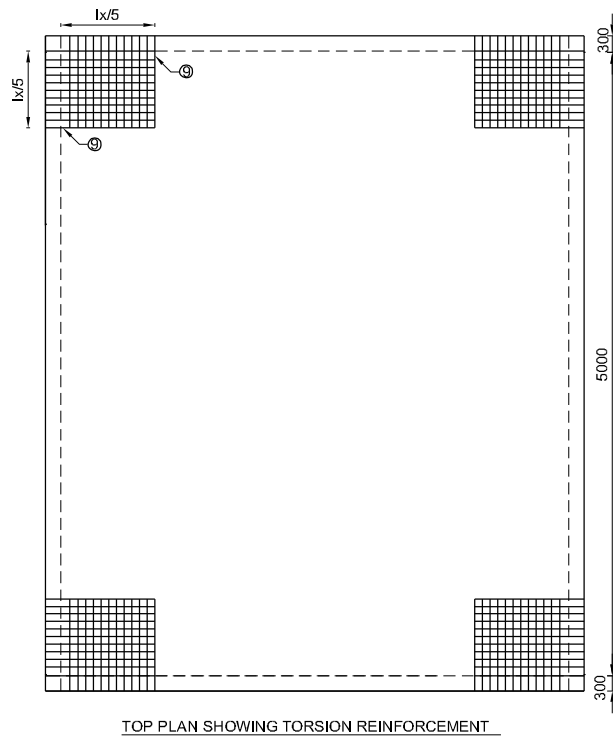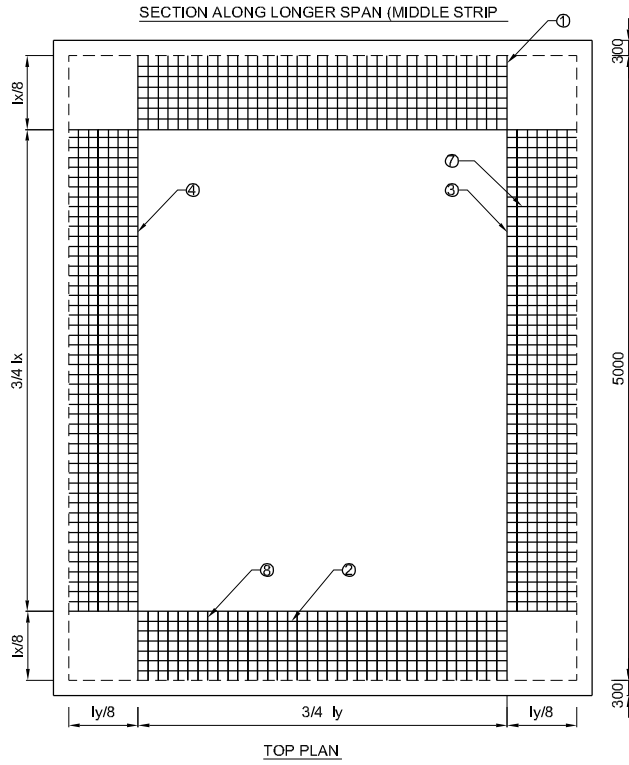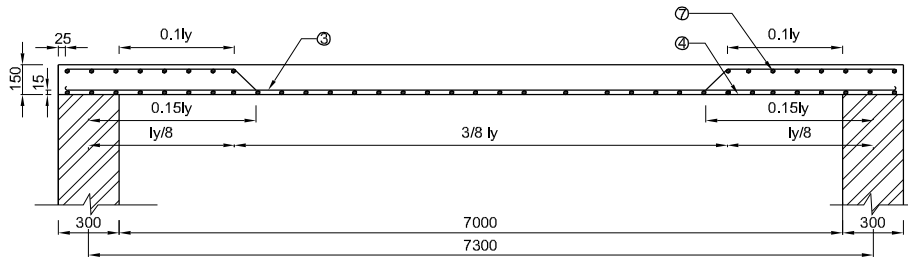
Tee beam and inverted beam

Objectives : At the end of this exercise you shall be able to
• **prepare longitudinal and cross section of T - beam**
• **prepare details of reinforcement in beam.**
• **prepare L-section Y-section and plan of a combination slab.**

PROCEDURE

TASK 1 : **Draw cross section and longitudinal section of a T beam (Fig 1)**

DATA

Draw to a suitable scale X - section and L - section of a T beam continuous on two 6 metres clear span supported on R.C.C. square column 40 × 40 cm. from the following data.

Beam size	=	40 cm. × 66 cm. overall
Tension bars	=	5 Nos 20 mm. dia. with two bars bent up at 0.90 m. from support.
Compression bars	=	2 Nos 18 mm. diameter.
Stirrups	=	10 mm. dia @ 150 mm. c/c near supports for a distance of 1.05 meter and balance at 300 mm c/c.

Slab

Thickness	=	150 mm.
Main bars	=	12 mm. dia @ 150mm. c/c with alt. bars bent up.
Distribution bars	=	10 mm. dia. @ 250 mm. c/c.
Column		(Reinforcement not to be shown)

How the T beam supporting an R.C.C square column using CAD software.

Fig 1

L- SECTION OF "T" BEAM

X- SECTION OF "T" BEAM

TEE BEAM
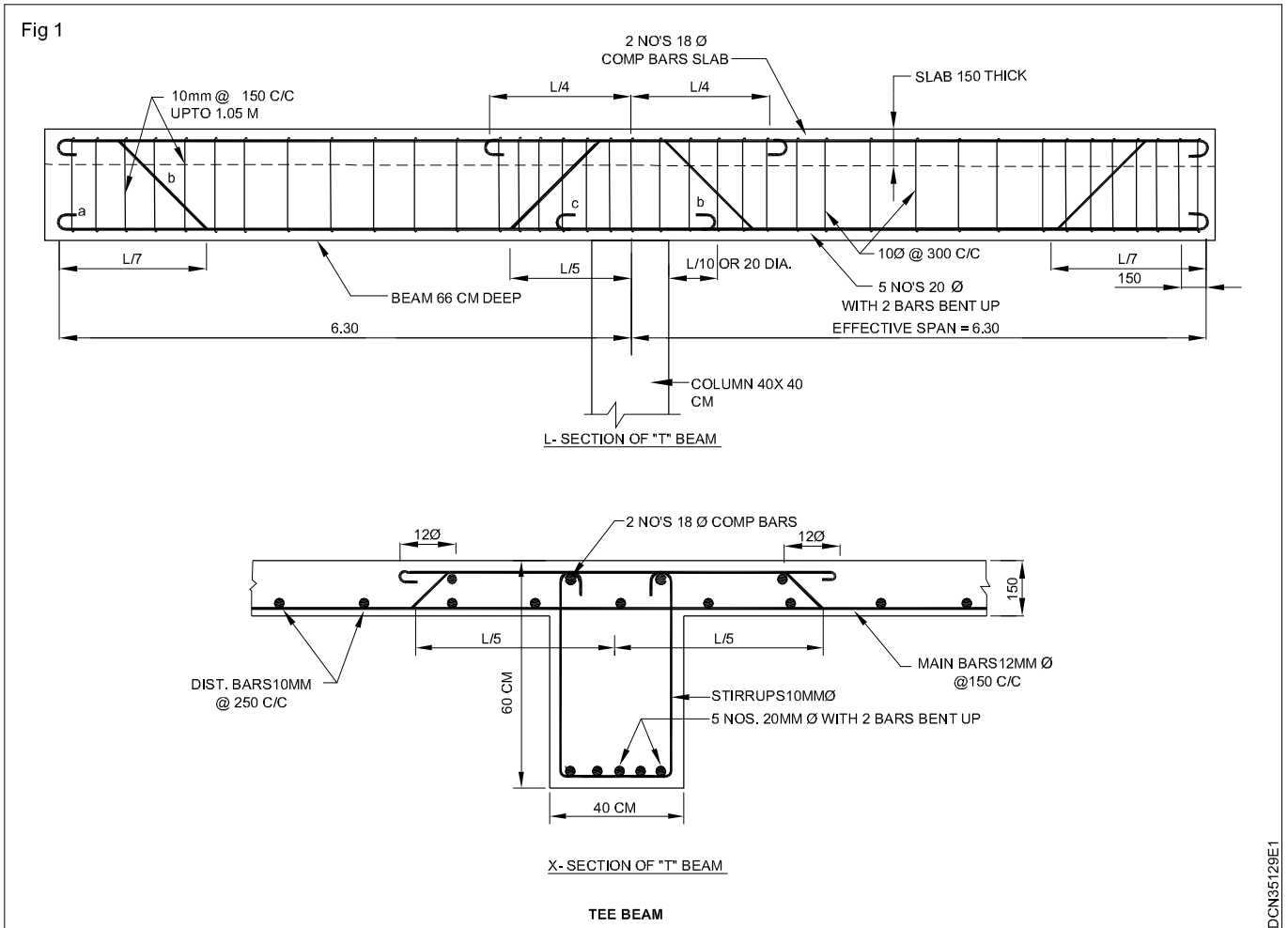
TASK 2 : **Draw the cross section of an inverted beam along with part of a simply supported slab from following data (Fig 2)**

Beam.

Overall depth = 600 mm.

Width = 350 mm.

Steel tensile bar = 5 Nos with 2 bars bent up 20 mm. dia.

Hanger bars = 2 Nos 10 mm. dia.

Stirrups = 6 mm. dia @ 200 mm. c/c.

Clear cover = 25 mm.

Slab.

Thickness overall = 160 mm.

Steel.

Main bars = 12 mm. at 180 mm. centre to centre with alternate bars bent at 800 mm. from centre of beam.

Distribution bars = 10 mm. dia. at 220 mm. centre to center.

Provide distribution bars in the bent up part of main bars near the top of slab.

Clear cover = 13 mm.

Draw the cross section of an inverted beam using CAD software.

Fig 2

INVERTED BEAM
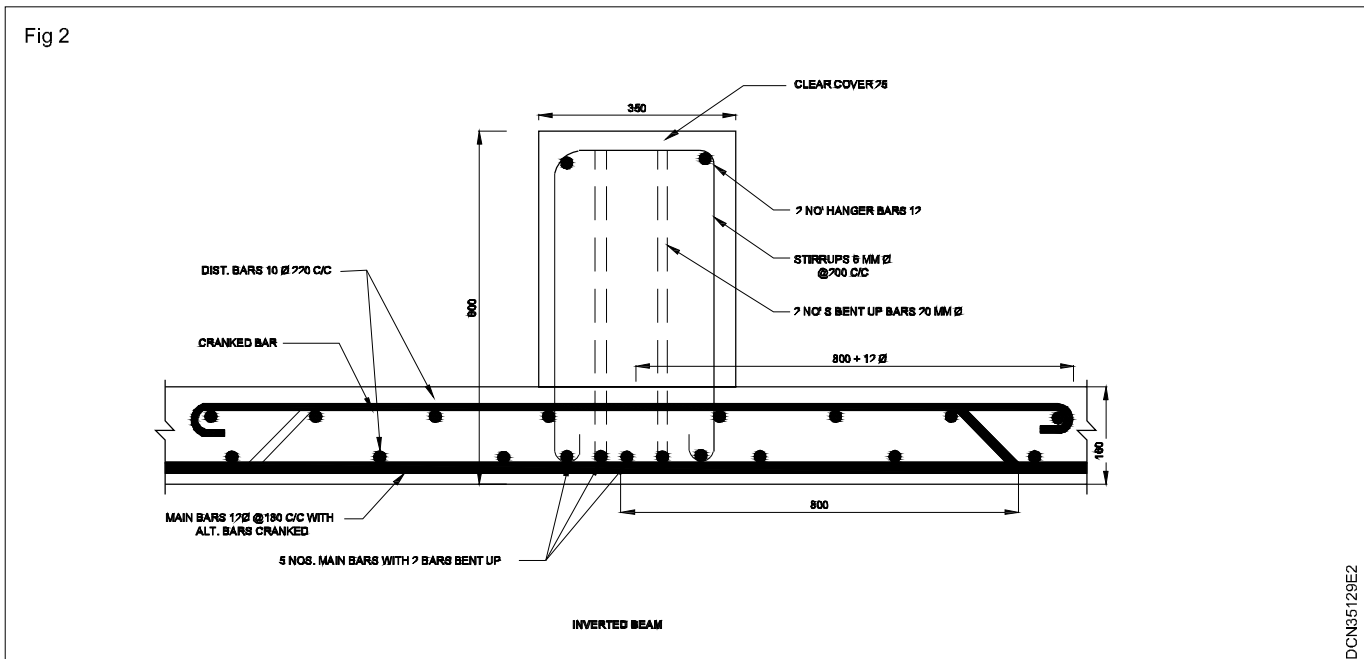
R.C.C cantilever beam

Objectives : At the end of this exercise you shall be able to
• **prepare R.C.C cantilever beam fixed with R.C.C column**
• **prepare R.C.C centilever beam resting on brick wall.**

TASK 1 : **Draw the following views of R.C.C cantilever beam fixed with R.C.C column. (Fig 1)**

•   Longitudinal section.

•   Plan of main reinforcement.

•   Cross section at fixed end.

•   Cross section at free end.

DATA

The beam is 2.5 m long, depth 300 mm at fixed end and 150 mm at free end respectively. It is provided with 5 nos. of 18 mm dia. bars in tensile zone in which two of them

are curtailed $\dfrac{3}{5}$ span. 3 nos of 16 mm dia. bars in bottom.

Stirrups are 10 mm dia. at 150 mm c/c. R.C.C column is 230 $\times$ 230 mm reinforced with 8 nos. of 18 mm dia. bars and stirrups of 12 mm dia bars at 200 mm c/c.

Draw the R.C.C cantilever beam using Auto CAD.

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Fig 1

18 Ø MAIN BARS 3 NOS.
18 Ø MAIN BARS 5 NOS.
SLAB 100 MM THICK

3 NOS OF 16 Ø COMPRESSION BARS

8 Ø TWO LEGGED STIRRUPS @150

1500   1000

300

230

150

1.527

L/S OF A CANTILEVER BEAMSUPPORTED IN RCC COLUMN

1500   1000

230

PLAN OF MAIN REINFORCEMENT

230
20   20

2 NOS. OF 18 Ø BARS CURTAILED
AT 1.5 M FROM SUPPORT

300

25

C/S AT FIXED END

230
20   20

3 NOS OF 18 Ø
MAIN BARS

150

3 NOS OF 16 Ø
COMPRESSION BARS

8 Ø TWO LEGGED
STIRRUPS @ 150

C/S AT FREE END

R.C.C. CANTILEVER BEAM

DCN35129H1

TASK 2 : **Draw the following views of R.C.C contilever beam resting over brick wall (Fig 2)**

• Longitudinal section.

• Plan of main reinforcement.

• Cross section ar free end.

• Cross section at fixed end.

DATA

Draw the L/S and C/S at free end and fixed end of R.C.C centilever beam resting over brick wall. The beam is 2.5 m long, 300mm at fixed end and 150 mm at free end, It is provided with 5 nos. of 18 mm dia. bars in tensile zone in

which two of the are curtailed at $\dfrac{3}{5}$ span. 3 nos of 16 mm dia. bars in compression zone. Stirrups are 10 mm dia. at 150 mm c/c. Same as previous task.

Fig 2

2500   1500   1000

150

BED BLOCK

1250

RCC SLAB 100 THICK
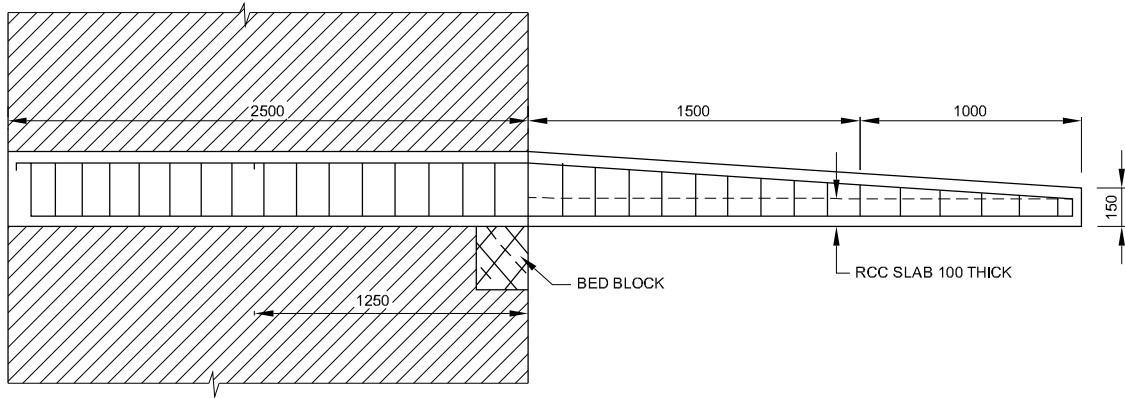
L/S OF A CANTILEVER BEAM SUPPORTED OVER WALL

2500   1500   1000

X   Y

230

X   Y

1250

PLAN OF MAIN REINFORCEMENT

230

20   230   20

20   20

2 NOS.OF #18 BARS
CURTAILED AT 1.5M
FROM SUPPORT

3 NOS.#
18 MAIN BARS

175

300

3 NO'S #16
COMPRESSION
BARS

25

25

#8 TWO LEGGED
STIRRUPS @150
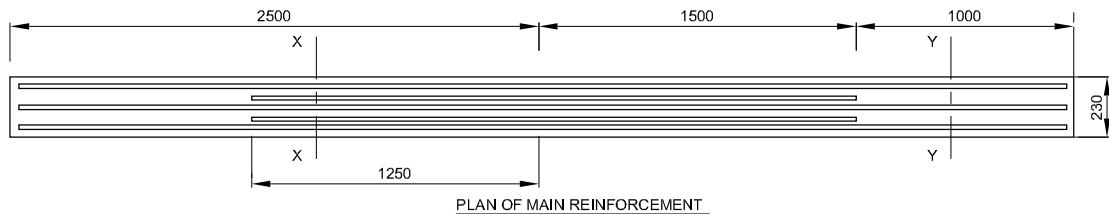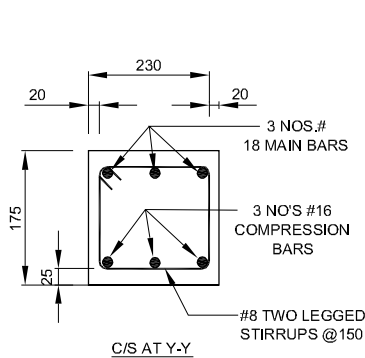
C/S AT Y-Y
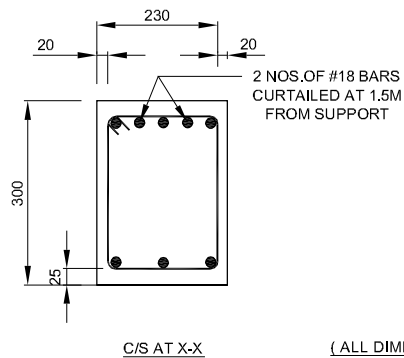
C/S AT X-X

(ALL DIMENSIONS ARE IN MM)

DCN35129H2

R.C.C. CANTILEVER BEAM

— — — — — — — — —

R.C.C retaining wall

Objectives : At the end of this exercise you shall be able to
• **prepare vertical section of cantilever retaining wall**
• **prepare reinforcement details of stem, toe, and heal.**

TASK 1: **Draw R.C.C centilever retaining wall (Fig 1 & 2)**

• The section across the stem showing all details.

• The plan showing the base slab reinforcement.

• The enlarging drawing showing details at stem and slab joint

• The sectional elevation for a length of 5 meter showing the main reinforcement.

DATA

• A cantilever retaining wall has the following details : Size of base slab 330 × 50 cm, stem 70 cm thick at bottom and 40 cm at top, height of stem 400 cm, earth face vertical.

• Stem reinforcement: Main bars @ 16 mm @ 100 c/c, alternate bars are curtailed at 1.50m, 3.0m from bottom. Distribution bars # 12 mm @ 250 c/c.

• Exposed face reinforcement : Main bars # 12 mm @ 250 c/c, distribution bars # 10 mm @ 300 c/c

• Heel reinforcement : # 16 mm @ 180 c/c both ways.

• Toe reinforcement : mainbars # 16 mm @ 150 c/c and distribution bars # 12 mm @ 200 c/c

• Draw the R.C.C centilever retaining wall by using CAD software to a suitable scale, as per the given data.

     Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.129

Fig 1

300 400

EARTH FACE

EXPOSED FACE

1000

MAIN BARS # 16 @100 C/C

1500

DIST . #12 @ 250 C/C

TEMP: BARS # 12 @ 250 C/C

1500

TEMP :DIST. BARS # 10 @ 300 C/C

HEEL DISTRIBUTOR BARS # 12 @ 200C/C
HEEL MAIN BARS # 16 @ 180 C/C

1200

350

1400

TOE BARS (DIST.) # 12 @ 200 C / C

500

TOE BARS (MAIN) # 16 @ 150 C/C

200 700 350

2250

3300

SECTIONAL VIEW ACROSS STEM

C/S OF R.C.C. CANTILEVER RETAINING WALL (WITHOUT KEY)

DCN35129J1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.129   145

Fig 2

HEEL MAIN BARS # 16 @180C/C
HEEL DISTRIBUTOR BARS # 12 @200 C/C

1200   1400

TOE BARS # 16 @180C/C
(DIST) # 12@ 200 C/C

TOE BARS (MAIN) # 16 @150C/C

200   350

3300

DETAILS AT STEM - SLAB JOINT

MAIN BARS # 16 @400 C/C

1000

1500

MAIN BARS # 16 @ 200 C/C

DISTRIBUTION BARS
12 @ 250 C/C
(EARTH FACE)

1500

MAIN BARS # 16 @ 100 C/C

BASE SLAB
500

5200

ELEVATION

HEEL MAIN BARS # 16 @180C/C

HEEL
REINFORCEMENT
PLAN

HEEL DISTRIBUTION BARS
12 @ 200 C/C

3300

TOP REINFORCEMENT PLAN

TOE BARS (DIST)
12 @ 200 C/C

TOE BARS (MAIN) # 16 @180C/C
(DIST) # 12@ 150 C/C

PLAN

ALL DIMENSION ARE IN MM
NOT TO SCALE

DCN35129J2

R.C.C. CANTILEVER RETAINING WALL (WITHOUT KEY)

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.129

TASK 2 : **Draw a keyed cantilever retaining wall (Fig 3 & 4)**

- The section across the stem showing all details

- The plan showing the base slab reinforcement

- The enlarging details of stem - slab joint

- The sectional elevation for a length of 5 meter showing the reinforcement

DATA

- A keyed cantilever retaining wall has the following details: Size of base slab 300 x 50 cm, stem 70 cm thick at bottom and 40 cm at top, height of stem 400 cm, earth face vertical. Key 100 cm x 40 cm

- Stem reinforcement : Main bars @ 16 mm @ 200 c/c, alternate bars are curtailed at 1.50 m and 3.0m from bottom. Distribution bars # 12 mm @ 250 c/c,

- Exposed face reinforcement : Main bars # 12 mm @ 250 c/c/ distribution bars # 10 mm @ 300 c/c

- Heal reinforcement : # 16 mm @ 180 c/c both ways.

- Toe reinforcement : mainbars # 16mm @ 150 c/c and distribution bars # 12mm @ 200 c/c

- Same as task no 1

Fig 3

300 400

EARTH FACE

EXPOSED FACE

1000

MAIN BARS # 16 @100 C/C

1500

DIST . #12 @ 250 C/C

TEMP: BARS # 12 @ 250 C/C

1500

TEMP :DIST. BARS # 10 @ 300 C/C

HEEL BARS # 16 @ 180C/C
HEEL MAIN # 12 @ 200 C/C (DISTRIBUTOR)

1200

90°

1400

TOE BARS (DIST.) # 12 @ 200 C / C

500

TOE BARS (MAIN) # 16 @ 150 C/C

1400

400

3300

SECTIONAL VIEW ACROSS STEM

C/S OF R.C.C. CANTILEVER RETAINING WALL (KEYED TYPE)

DCN35129J3

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.129

Fig 4

HEEL MAIN BARS # 16 @180C/C

HEEL DISTRIBUTOR BARS # 12 @200 C/C

1400

500

TOE BARS # 16 @180C/C
(DIST) # 12@ 200 C/C

200

TOE BARS (MAIN) # 16 @150C/C

1200

1000

400

DETAILS AT STEM - SLAB JOINT

1000

MAIN BARS # 16 @400 C/C

1500

MAIN BARS # 16 @ 200 C/C

DISTRIBUTION BARS
12 @ 250 C/C
(EARTH FACE)

1500

MAIN BARS # 16 @ 100 C/C

BASE SLAB

500

5200

ELEVATION

HEEL MAIN BARS # 16 @180C/C

HEEL
REINFORCEMENT
PLAN

HEEL DISTRIBUTION BARS
12 @ 200 C/C

3300

TOP REINFORCEMENT PLAN

TOE BARS (DIST)
12 @ 200 C/C

TOE BARS (MAIN) # 16 @180C/C
(DIST) # 12@ 150 C/C

PLAN

ALL DIMENSION ARE IN MM
NOT TO SCALE

DCN35129J4

R.C.C. CANTILEVER RETAINING WALL (KEYED TYPE)

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.129   149

R.C.C Continuous column & footing

Objectives : At the end of this exercise you shall be able to
• **prepare plan and vertical section of R.C.C square and circular column**
• **prepare details of bars used in column**
• **prepare reinforced beams to column connection.**

PROCEDURE

TASK 1 **: Draw the sectional elevation and sectional paln of R.C.C square column 60 x 60 cm showing full derails of reinforcement (Fig 1)**

DATA

Column

Size - 60 cm. $\times$ 60cm.

Main reinforcement = 8 Nos 25 mm bars.

Ties = 8 mm @ 20 cm . c/c

Cover = 4 cm.

Footing

Size at bottom = 3.5 m. $\times$ 3.5 m.

Size at top = 70 cm. $\times$ 70 cm.

Thickness at column face = 70 cm.

Thickness at ends = 30 cm.

Reinforcement = 12 mm @ 15 cm. bothways

Cover = 5 cm.

Lean concrete 1: 8: 16 below foundation is 30 cm. thick and projects15 cm. on all the four sides.

Depth below G.L. = 1.5 m.

Plinth level = 30 cm. above G.L.

Ht. of ceililng above plinth level = 5.5 m.

Draw the R.C.C square columns drawings using CAD software to a suitable scale. Assume all other missing data.

Fig 1

VERTICAL SECTION

SECTIONAL PLAN
DETAILS OF RCC SQUARE COLUMNS
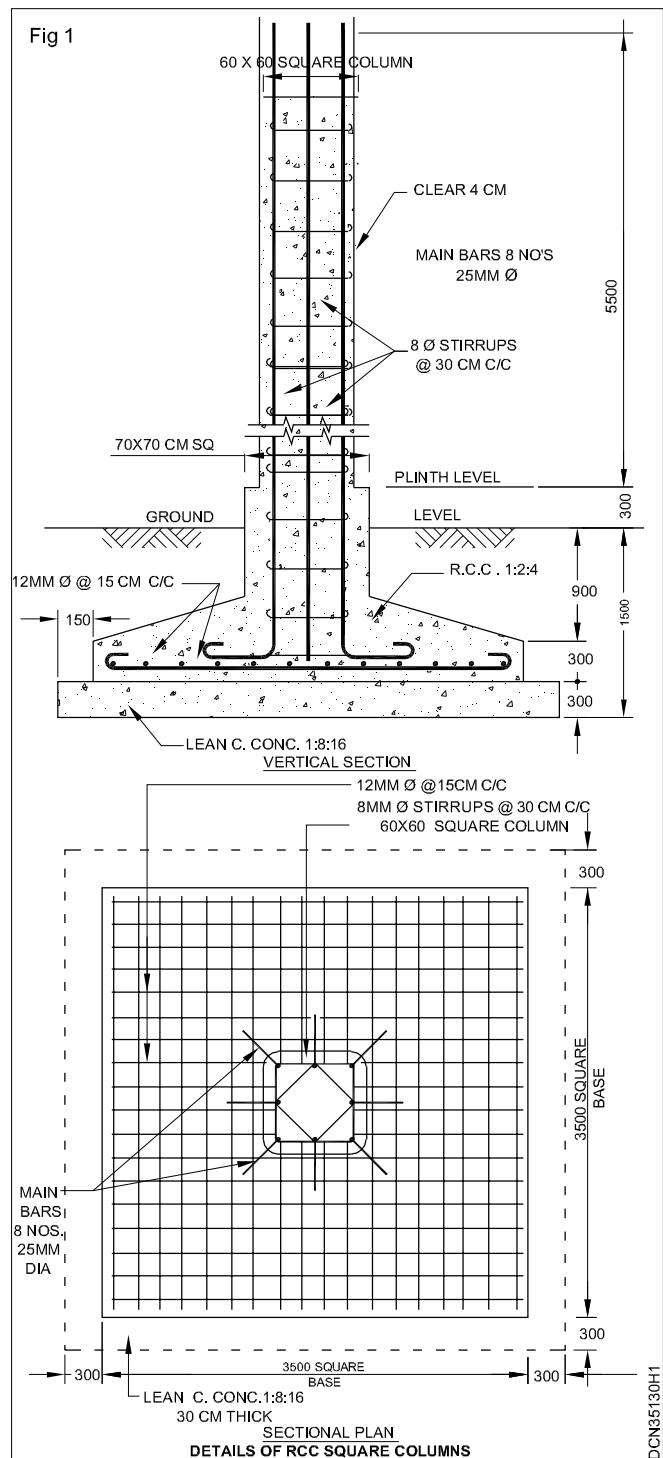
TASK 2 : **Draw to a suitable scale the sectional plan and cross section of a circular column of dia. 50 cm along with its footings showing there-in reinforcement details from the following data (Fig 2)**

DATA

50 cm. Dia. column

Main steel: 8 No's bars of 18 mm. dia.

Lateral ties : 5 mm. at 24 cm. centre to centre.

Base of circular footing

Diameter of footing = 330 cm.

Reinforcement = 12 mm. dia. bars at 15 cm centre to centre both ways with a cover of 5 cm.

The reinforcement in footing is placed in the form of a square mesh.

The depth from floor level = 150 cm.

The depth from ground level = 120 cm.

The concrete base of 330 cm. diameter is taken up vertically upto 30 cm. height and then reduced to

50 cm diameter column within the remaining height of 90 cm.

Draw the R.C.C circular column from the given data and sketches, using Auto CAD.

Fig 2

DETAILS OF RCC CIRCULAR COLUMNS

— — — — — — — — —
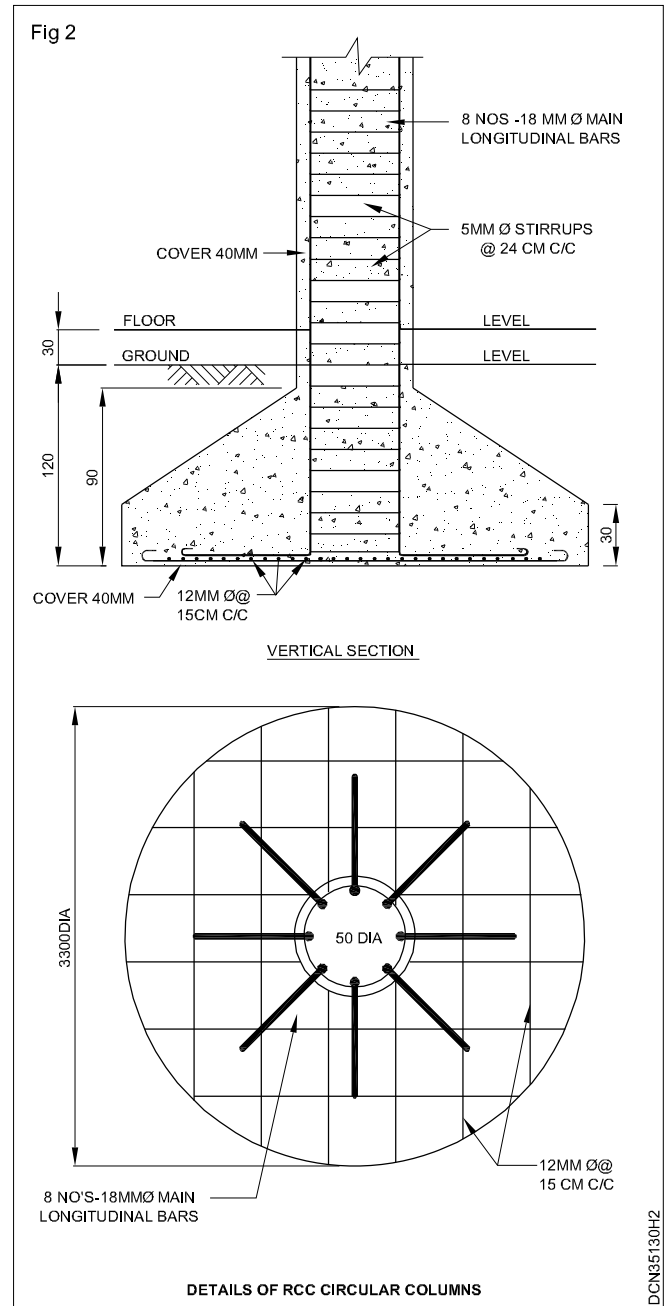
TAKE 3 : **Draw R.C.C cotinuous columns showing position of reinforcement (Fig 3)**

Sectional plan

Sectional elevation

DATA

Column

Size - 60 cm $\times$ 60 cm

Main reinforcement - 8 Nos 20 mm Ø bars

Cover - 4 cm

Ring - 8 mm Øbar 18 cm c/c

Beams

Over all depth - 60 cm

Width - 40 cm

Steel tensile - 4 Nos 20 mm Ø bars

Compression - 4 Nos 20 mm bars

Stirrups - 8 mm Ø 20 cm c/c

Clear cover - 25 mm

Assume all other missing data.

Draw R.C.C. continuous column using CAD software.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.5.130

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Fig 3
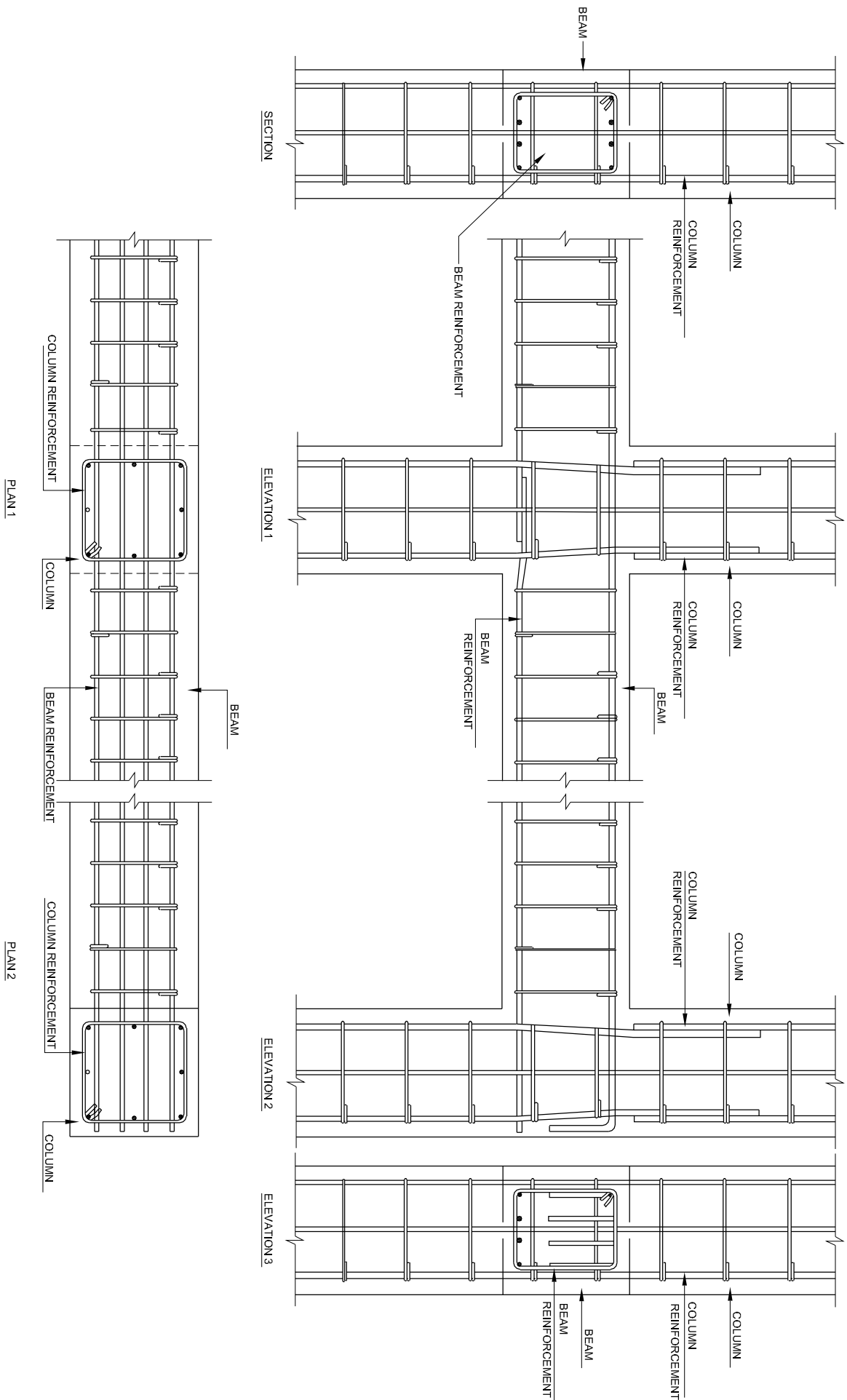
REINFORCED CONCRETE BEAM TO COLUMN CONNECTIONS

R.C.C continuous beam

Objectives : At the end of this exercise you shall be able to
• **prepare longitudinal section of a continuous beams**
• **prepare section near the end support**
• **prepare section near intermediate support.**

PROCEDURE

TASK 1 : **Draw the following views of R.C.C continuous beam spanning over two openings (Fig 1)**

• Longitudinal section

• Cross section at support

• Cross section near centre

DATA

• Beam spanning on two openings of 3.00m each with intermediate support 300 mm. wide. The end supports are 400 mm. wide. The other details are given below:

• Overall depth of beam = 300mm.

• Width of beam = 220 mm.

• Main reinforcement = 5 No's 12 mm. dia with two bars bent up.

• Anchor bars = 2 No's 10 mm. dia

• Stirrups = 6 mm. dia @ 180 c/c uptp 800 mm. near the supports.

• 6 mm dia @ 220 c/c in the remaining middle portion.

Fig 1

LONGITUDINAL SECTION OF A CONTINUOUS R.C.C BEAM

DCN35131E1
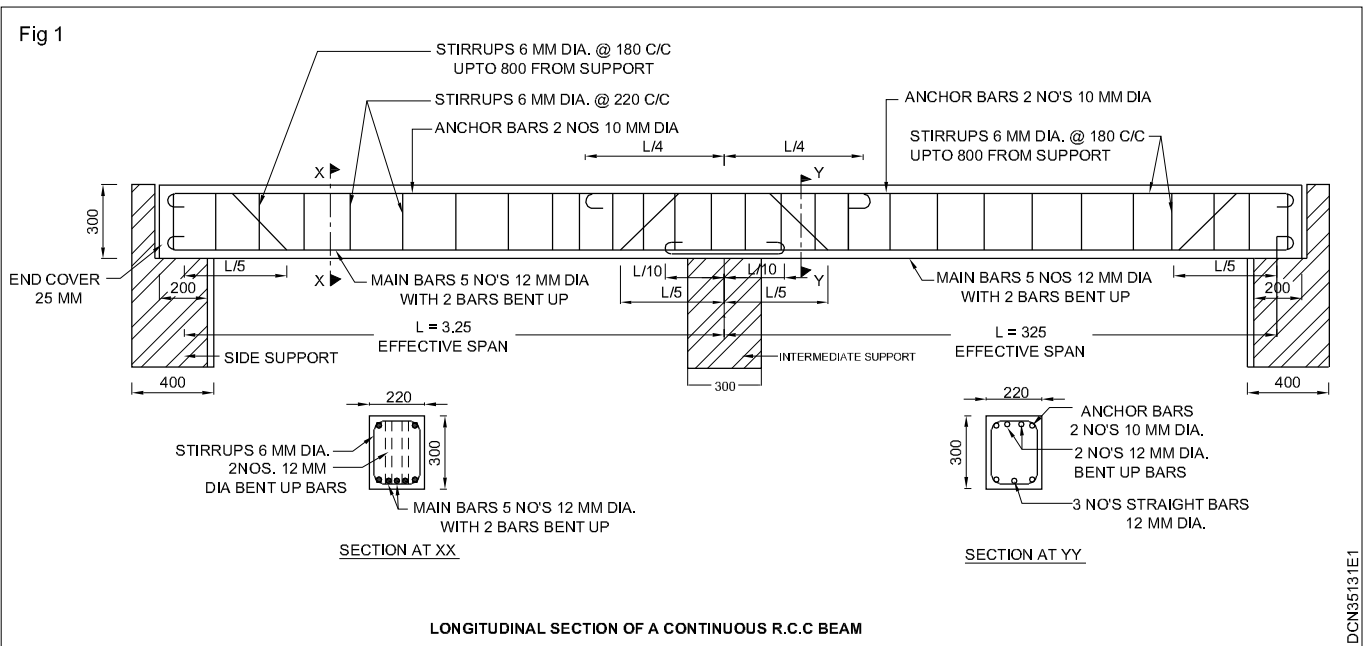
R.C.C framed structure and   continuous column

Objectives : At the end of this exercise you shall be able to
• **prepare vertical section of an R.C.C framed structure**
• **prepare reinforcement details in beam and column.**

PROCEDURE

TASK 1 : **Draw the sectional elevation of R.C.C framed structure (portal frame) beam to column connection (Fig 1)**

DATA

•   All datas and details are given in Figure.

•   Draw the sectional elevation of R.C.C framed structure beam to column connection using AutoCAD software to a suitable scale. Assume all missing details.

Fig 1

280

COVER 25 MM

120 SLAB THICKNESS

6 MM Ø LATERAL TIES @ 200 C/C

300 x 300 SQUARE COLUMN
INTERMEDIATE COLUMN

R.C.C. FRAMED STRUCTURE (BEAM TO COLUMN CONNECTION)

300X300 SQUARE COLUMN

COVER 40 MM

L/7

L/7

8 NO'S 15 MM Ø
MAIN VERTICAL BARS

24Ø VERTICAL LAPPING

24Ø

100

5 NO'S MAIN BARS 20MM Ø
WITH TWO BARS BENT UP

2 NO'S 12 MM Ø HANGER BARS

STIRRUPS
6 MM Ø @ 150 C/C

200

150

8 NO'S 15 MM Ø
MAIN VERTICAL
BARS

300 x 300 SQUARE COLUMN

END COLUMN

VERTICAL LAPPING

260

120 SLAB THICKNESS

6 MM Ø STIRRUPS @
200 C/C

COVER 40 MM

L/7

8 NO'S 15 MM Ø
MAIN VERTICAL
BARS

6 MM Ø LATERAL
TIES @ 180 C/C

200X200 SQUARE COLUMN

EFFECTIVE SPAN - L = 4.00

L/7

STIRRUPS 6 MM
Ø @ 150 C/C

5 NO'S 18 MM Ø WITH TWO BARS BENT UP

8 NO'S 12 MM Ø
HANGER BARS

COVER 25 MM

8 NO'S 12 MM Ø MAIN
VERTICAL BARS

200 x 200 SQUARE COLUMN

6 MM Ø LATERAL TIES @ 180
C/C

L/7

DCN35132E1

Different steel sections
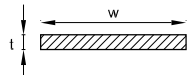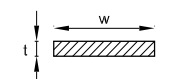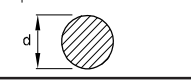
Objective : At the end of this exercise you shall be able to
• **draw the different steel section used for steel structures as per I.S standards.**

PROCEDURE

DATA

• Dimensions are given in Figure.

• 'b' - width of flange.

• h - total depth of section including the flange thickness.

• tf - thickness of flange.

• tw - thickness of web.

• Sketch the drawing attached using AutoCAD.

SI. No	Structural Sections	Description	Example	Weight(kg) per merer	important dimension (mm)				
					h	b	t_t	t_w	g

INDIAN STANDARD [IS] ROLLED AND SLIT STEEL SECTIONS FOR STRUCTURALUSES

SI. No	Structural Sections	Description	Example	Weight(kg) per merer	h	b	t_t	t_w	g
1		IS Junior beam	ISJB 225	12.8	225	80	5.0	3.7	40
2		IS Light beam	ISLB 225	23.5	225	100	8.8	5.8	55
3		IS Medium WT beam	ISMB 225	31.2	225	110	11.8	6.5	60
4		IS Wide flange beam	ISMB 225	33.9	225	150	9.9	6.4	60
5		IS Column section	ISHB 225	43.1	225	225	9.1	6.5	140
6		IS Junior channel	ISJC 200	13.9	200	70	7.1	4.1	40
7		IS Light channel	ISLC 250	28.0	250	100	10.7	6.1	90
8		IS Medium WT chennel	ISMC 250	30.4	250	80	14.1	7.1	45
9		IS Equal angle	ISA 100100	9.2	A-100	B-100	t-60	Cxx= Cyy	2.67
10		Do	Do	12.1	100	100	80	Do	2.76
11		Do	Do	14.9	100	100	10.0	Do	2.84
12		Do	Do	17.7	100	100	12.0	Do	2.92
13		IS Unequal angle	ISA 100 75	8.0	A-100	B-75	t=6.0	Cxx= 3.01	Cyy= 1.78
14		Do	Do	10.5	100	75	80	3.10	1.87
15		Do	Do	13.0	100	75	10.0	3.19	1.95
16		Do	Do	15.4	100	75	12.0	3. 27	2.03
17		IS Normal tee	ISNT 150	22.8	150	150	10.0	10.00	Cxx-3.95
18		IS Tee from ISHB	ISHT 125	27.4	125	250	9.7	8.8	2.37
19		IS Standard tee	ISST 150	15.7	150	75	11.6	8.0	4.75
20		IS Light WT tee	ISLT 100	12.7	100	100	10.8	5.7	2.13
21		IS Junior tee	ISJT 100	5.0	100	60	5.0	3.4	2.81
22		IS Rolled plate	W-900- 2500mm t-5.63mm					Length 2-12.5m		

23		I.S Strip		W= 100-1550 t=1.6 - 10mm
24		Mild steel flat		W= 10- 400mm t=3-40mm
25		IS Round bar	ISRQ	d=5-200 mm
26		IS Square bar	ISSQ	s=5-100 mm

Different types of rivet heads

Objective : At the end of this exercise you shall be able to
• **draw the different types of rivet heads.**

PROCEDURE

• Dia of rivet d = 20 mm

• Compute the various elements of the rivet for d = 20 mm.

• Draw the various rivet heads according to the dimension using Auto CAD. (Fig 1)

Fig 1

SNAP HEAD

PAN HEAD (WITH TAPERED NECK)

PAN HEAD

PAN HEAD (TYPE II)

ROUND COUNTER-SUNK HEAD

FLAT COUNTER-SUNK HEAD

ELLIPSOIDAL HEAD

CONICAL HEAD

RIVET HEADS

CONICAL HEAD (TYPE II)

DCN36133H1

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.6.133
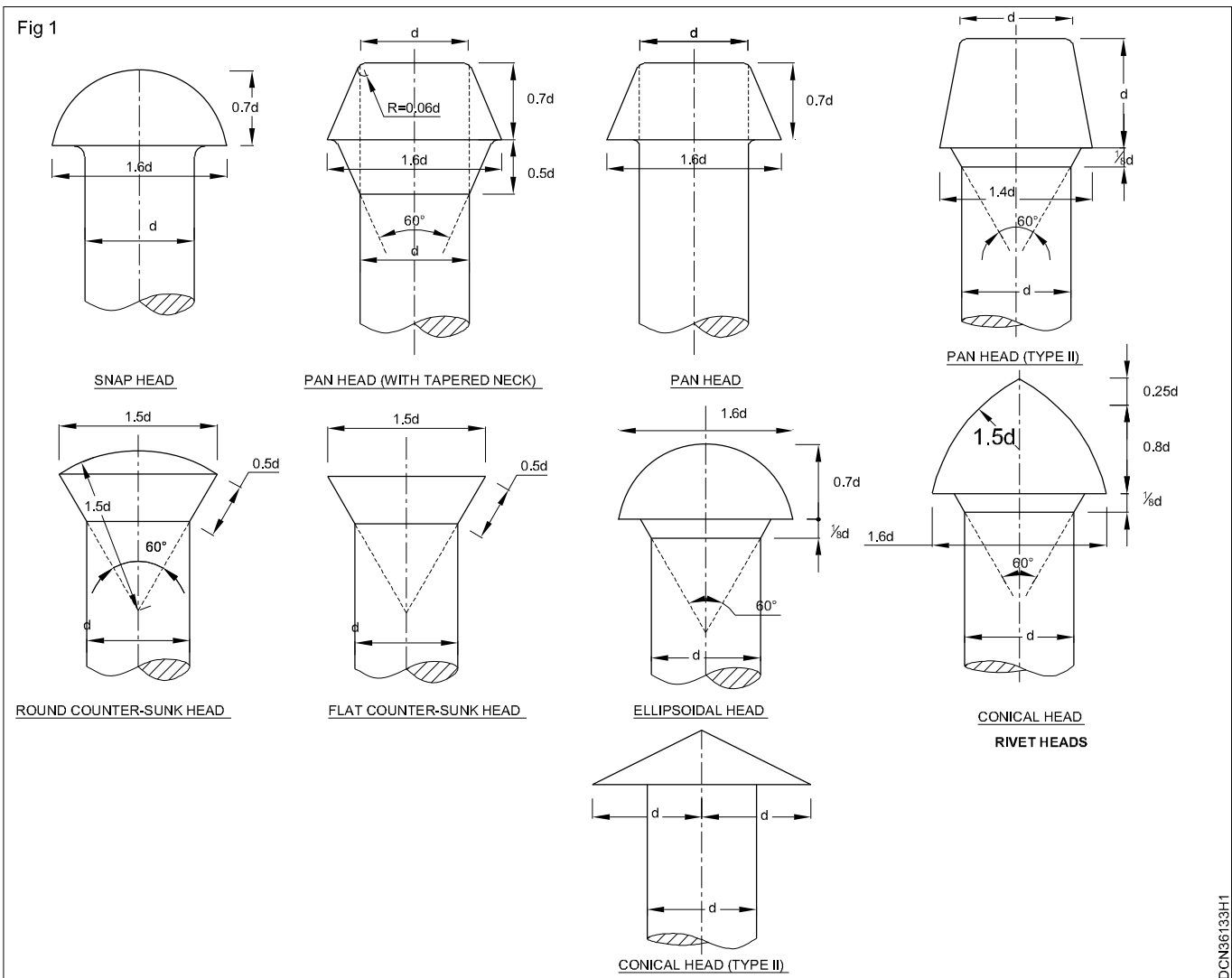
Various riveted joints

Objective : At the end of this exercise you shall be able to
• **draw various riveted joints.**

PROCEDURE

DATA

• Plate thicknes t = 16 mm.

• $d = 6\sqrt{t}$.

• Compute the various elements of the joints.

• Draw the various joints using AutoCAD. (Fig 1)

Fig 1

SINGLE RIVETED LAP JOINT

DOUBLE RIVETED LAP JOINT (CHAIN TYPE)

DOUBLE RIVETED LAP JOINT (ZIG-ZAG TYPE)

SINGLE RIVETED SINGLE COVER BUTT JOINT

PLAN

PLAN

SECTION

SECTION

DOUBLE COVER SINGLE RIVETED

DOUBLE COVER DOUBLE RIVETED (ZIG ZAG FORMATION)

VARIOUS RIVETTED JOINTS
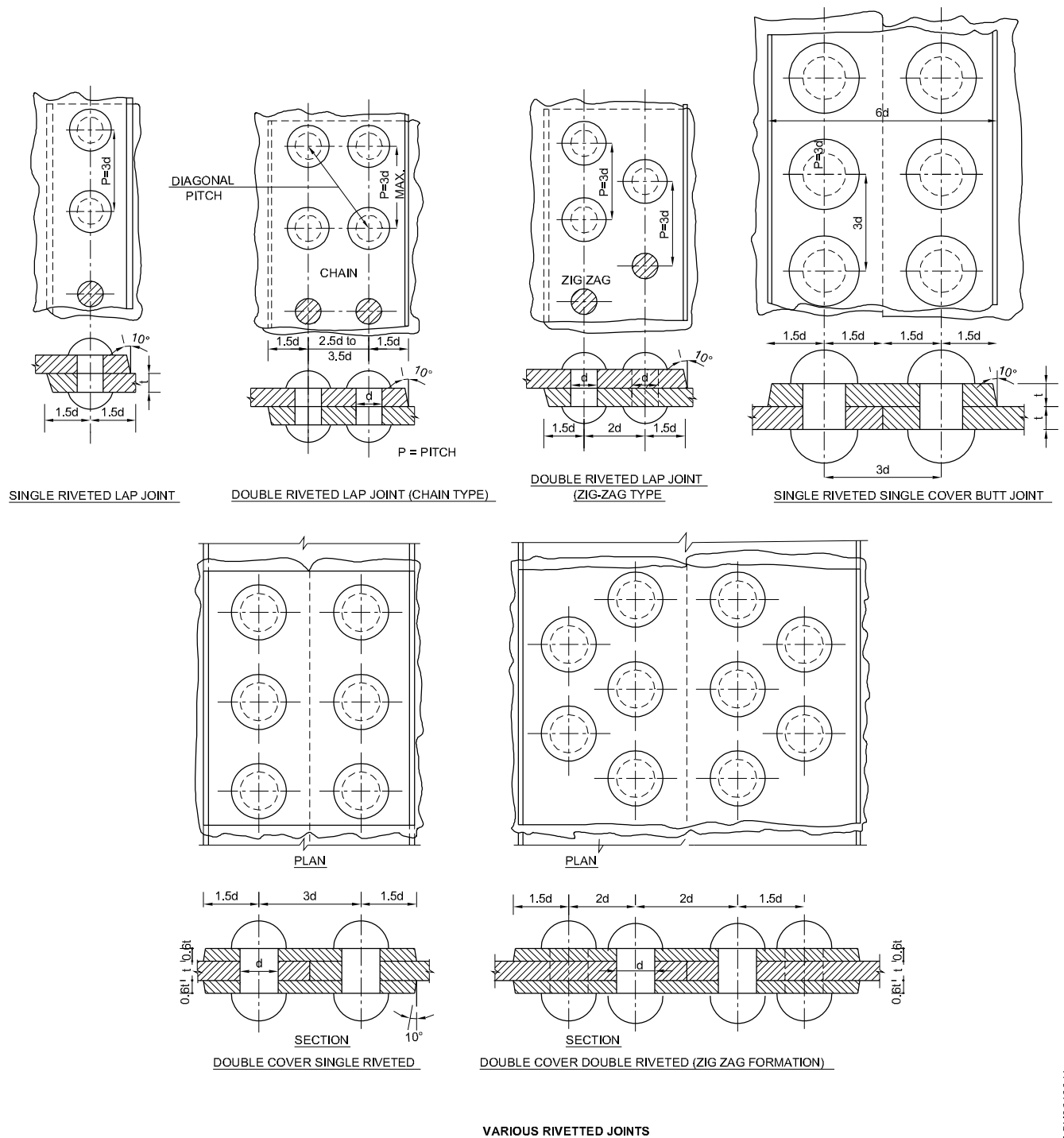
DCN3613J1

Bolts

Objective : At the end of this exercise you shall be able to
• **draw the views of the following by free hand as well as using instruments.**

PROCEDURE

Exercises

Draw the views of various types of bolts like hexagonal bolt, square head bolt, tee bolt, hook bolt, eye bolt, etc. using conventions by free hand and also using instruments.

Exercise 1

Draw M30 hexagonal bolt of shank length 100 mm according to a) General propportions (b) Indian Standard IS: 1364.

Hexagonal head bolt M30.

Proportion of bolt head and other features.

Given dia = 30 mm

Bolt head across flats $= \sqrt{3}$ d or 1.5d + 3 mm

Thickness 0.8 to 0.9 d

Radius of chamfer R = 1.5d or 1.4d. Length of bolt 3 to 4d approx. or more.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.6.133
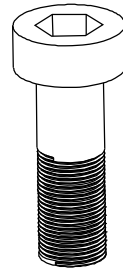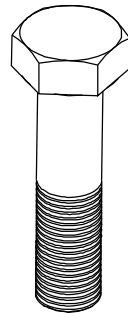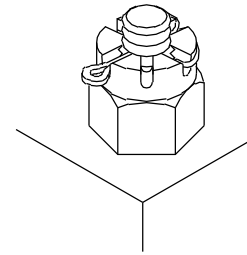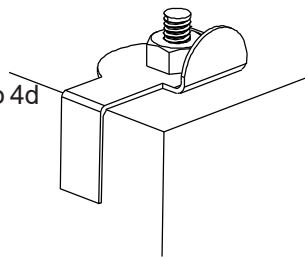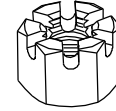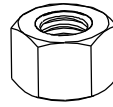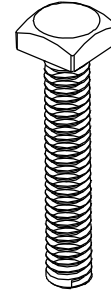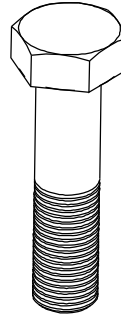
- Draw a thin circle of dia $\sqrt{3} \times d = 1.732 \times 30 = 51.96$ say 52 mm or 1.5d + 3 = 1.5 × 30 + 3 = 48 mm

- Construct a regular hexagon externally using 30° - 60° set square.

- Draw a concentric hidden circle of dia 30. (Fig 1a)

- Draw projectors from corners of the hexagon parallel to the axis.

- Form a rectangle, on the projectors equal to the distance 'corner' of hexagon and thickness 24 mm (0.8d) as sides. (Fig 1b).

- Draw projectors from the points on dia of the circle of 'W' width of both end on to the 'Top' line.

- Draw projectors from the points B & C of the hexagon. Draw the centre lines of ab, bc & cd.

- Draw 30° lines as shown in Fig 1b.

- Draw perpendicular bisector on 30° line, intersecting the above centre lines, mark the points as C_1, C_2 (Fig 1c).

- Draw arcs with centres C_1, C_2 touching the top line by trial and error method. (Fig 1d).

- With b or c as centre, take 1.5d or 1.4d as radius and mark point 'T' on the centre line.

- With 'T' as centre with the same radius, draw an arc joining bc.

- Draw tangential line firm.

- Draw projection lines from the hidden circle, to the head forming the shank.

Exercise 2

- Draw the views of a square head bolt M30, 100mm long IS 2585 - 1968. (Fig 2)

> **Note : The length of the bolt ranges from 90 mm to 400 mm.**

- As per general propartion

- Bolt head side A/F = 1.5d +3 = 1.5 × 30 + 3 = 48 mm.

- Length of bolt = 5 to 8 d.

- Bolt head thickness = 0.8d to d = 24 mm or 30 mm.

- Radius of chamfer = 2d = R 60.

- Draw a square of side 48 mm on centre 'O'.

- Draw arc with half the diagonal as radius, with centre 'O' meting the vertical centre line at 'X'.

- Draw projectors from the corner and mark a recrangle of thickness 24 mm. (a,a', a" and a"').

- Draw 30° angle at a, on the corner of a rectangle and extend as shown.

Fig 1a

Fig 1b

Fig 1c

Fig 1d

DCN36133X1

DRAWING A HEXAGON BOLT HEAD
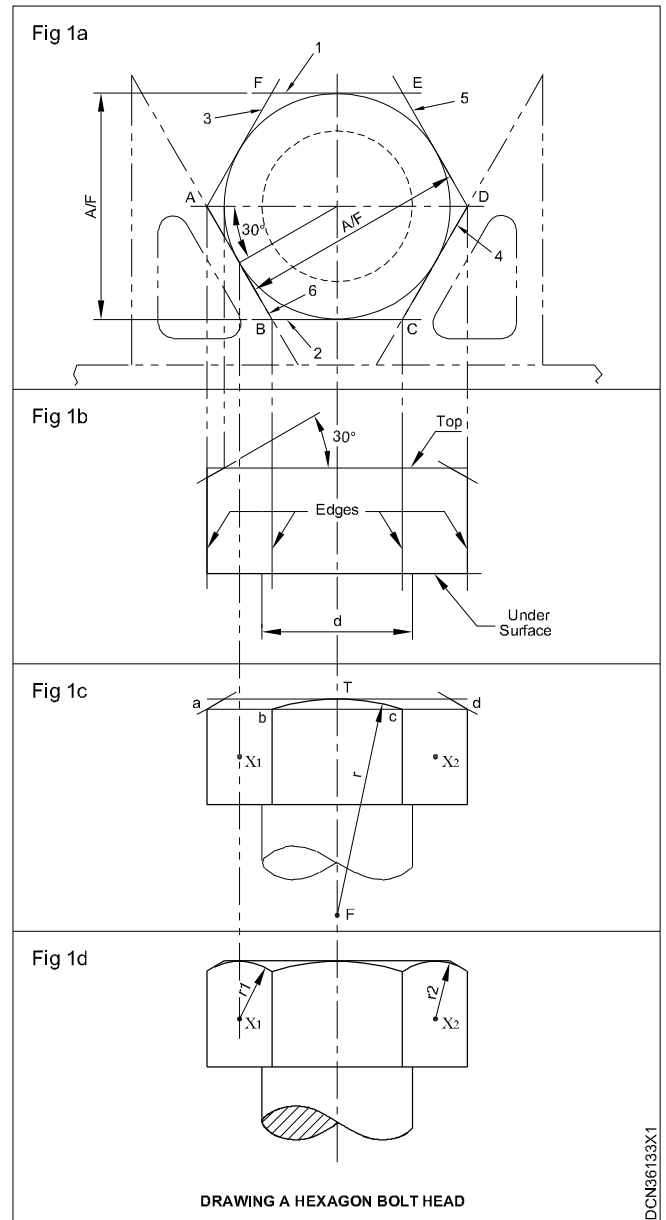
- Draw a horizontal projector from x on to 30° line meeting at b.

- Draw vertical projector from b on to the rectangle projector from b on to the rectangle and mark c,d.

- Draw an arc passing throught c, d and touching point e.

- Draw the shank. (body)

- Draw core dia (d-2 x depth of the thread) equal to 26 mm (approx.) for all the M30 bolts.

- Draw the completed views of the bolt as shown in hexagonal bolt. (Fig 1d)

Fig 2

SQUARE HEAD BOLT
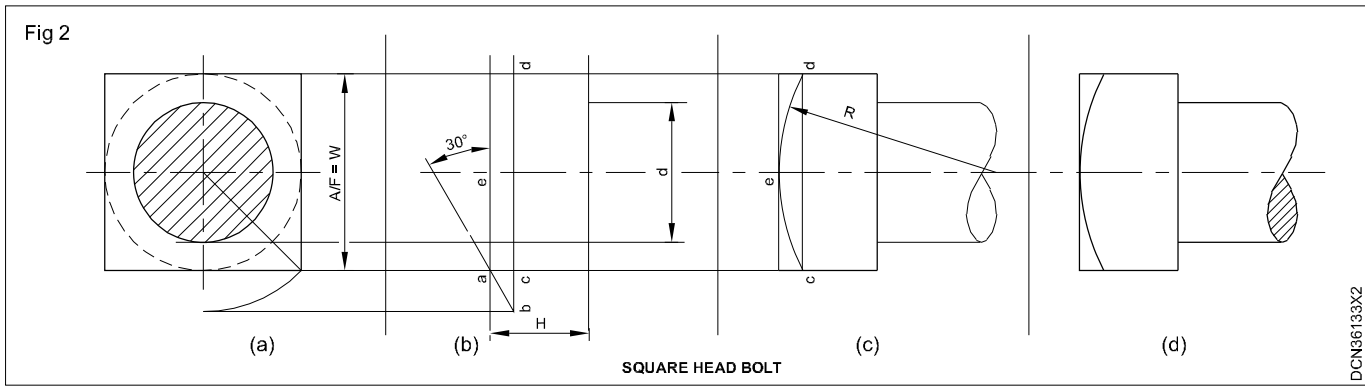
Exercise 3

- Draw 48 mm square with sides 45° to horizontal, draw a circle touching the sides. (Fig 3)

- Project and mark the head thickness, width across corners and projection of the circle.

- Mark 30° line on the points of circle at a.

- Mark the point b extend to the other end.

- Mark c,d on the line.

- Draw arcs as shown Fig 3

Fig 3

SQUARE HEAD BOLT ACROSS CORNERS
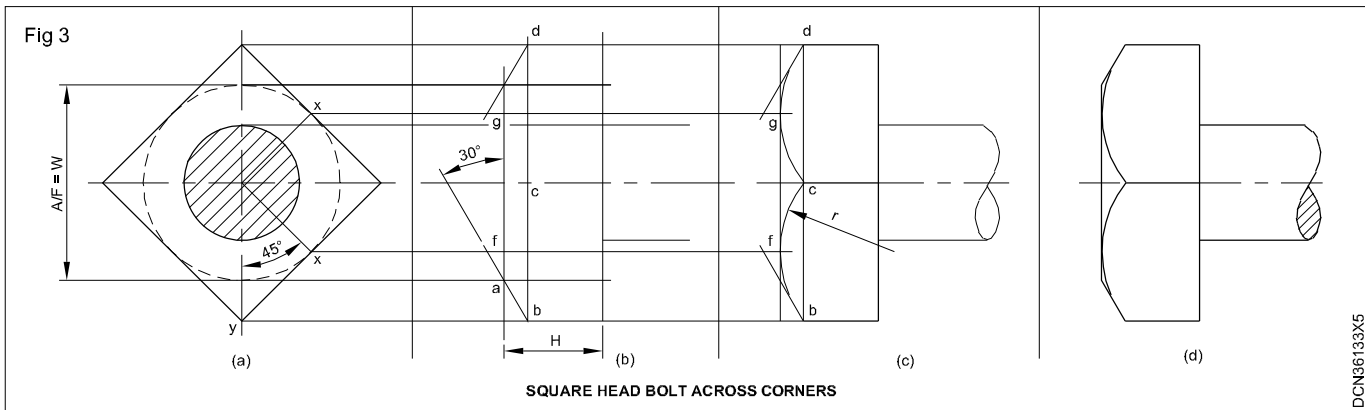
Exercise 4

- Draw a 'T' bolt - Standard and non - standard dia 30. (Fig 4)

- Draw tangents to the circle showing the square cross section.

Exercise 5

- Srandard 'T' bolts IS : 2014 1977 used on std 'T' slots IS: 2013

- Follow as in above example taking dimensions as per IS: 2014 - 1977. (Fig 5)

Fig 4

T - HEADED BOLT
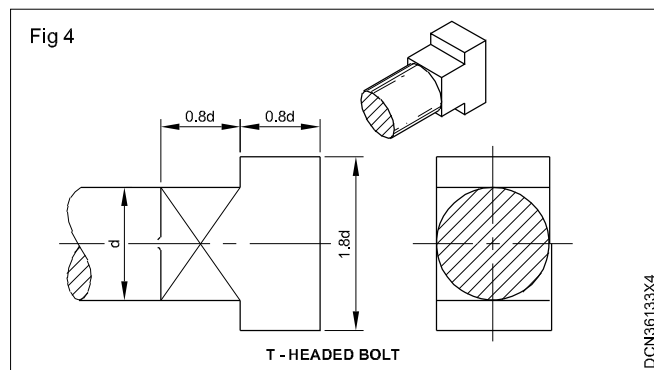
Non standard bolt

- Draw the shank of a bolt dia (d) 30 mm.

- Mark a length 24 mm draw a line show diagonal lines indicating flat surface.

- Form a rectangle of 54×24 (1.8 × 0.8d) as shown in Fig 4.

- By drawing projec-tors draw the end view forming a rectangle 1.8d × d with a circle dia d (30) in the centre, which shows the section of shank dia.

Fig 5

ASSUME d1 = 20
d2 = 45
e1 = 35
h1 = 32
k = 14
c = 2,5
a = 22

T - BOLT AS PER IS : 2014

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Exercise 6

- Draw the views of a hook bolt dia 50, holding a plate in position.

- Draw the shank of dia 50 mm, mark flat surface on one end, to width 0.8d = 40 mm.

- Draw a semi-circle of radius 0.9d on its end as shown.

- Draw the end view of rectangle d x 1.8d without the plates.

- Form a square from base, draw a circle (d) and hatch it. (Fig 6.)

Fig 6

0.8d 0.8d

1.8d

d

T - HEADED BOLT

DCN36133X6
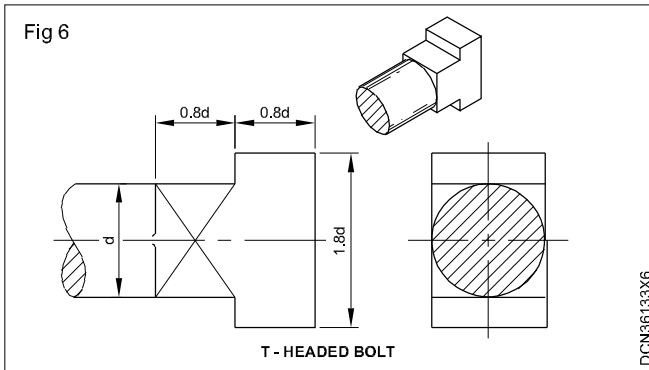
Exercise 7

- Draw the views of a eye bolt dia 40 mm. (Fig 7)

- Draw concentric circles of dia 80 and 40.

- Draw bolt shank of dia 40 meeting dia 80, hatch the end. On end view mark a rectangle of 2d x 1.2d.

- Draw the circle dia 40, symmetrically in the centre.

- Hatch the circle and dimension the view.

Fig 7

d

d

2d

1.2d

EYE - BOLT

DCN36133X7
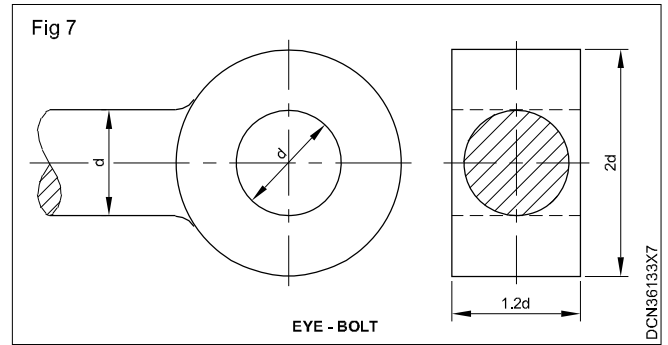
Exercise 8

- Draw the view of a lifting eye bolt dia 30. (Fig 8)

- Draw concentric circles of dia 45 and dia 63 mm (1.5d and 2.1d).

- Draw collar of dia 2d and thickness 0.4d at 2d from the centre.

- Draw fillet curves, add the end view. .

- Dimension the view..

Fig 8

0.8d   3.1d

1.5d

0.4d   2d

1.5d

2d

d

LIFTING EYE BOLT

DCN36133X8

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.6.133

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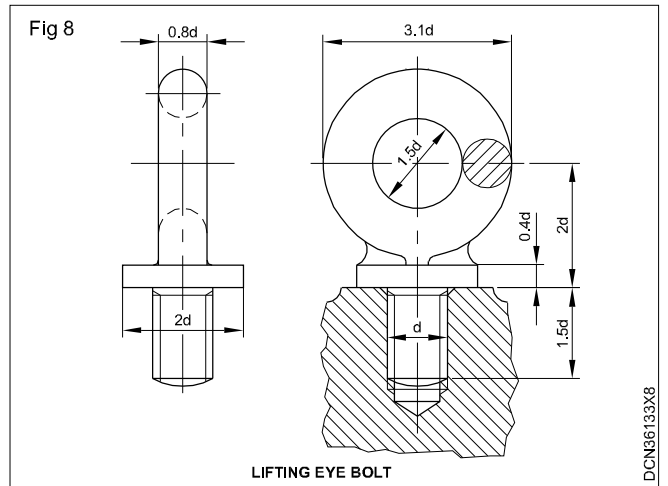
Section and elevation of girders

Objectives : At the end of this exercise you shall be able to
• **draw section and elevation of girders.**

PROCEDURE

TASK 1 : **Draw section and elevation of girders**

• Draw section of built up or compound beams (or) girders. (Fig 1)

• Draw elevation and section of box girder (Fig 2,3).

• Draw elevation and section of a plate Girder (Fig 4).

• Draw the elevation of warren in girder, lattile girder and 'N' girder (Fig 5).

> **Note : By refering the steel table select suitable dimension and with guidence of instructor prepare the drawing.**

Fig 1

Sections of built up or compound beams (or Girders)

DCN36134H1

Fig 2

Elevation and section of a box girder

DCN36134H2

Fig 3

Section of box girders

DCN36134H3

Fig 4

Elevations and Section of a plate Girders

DCN36134H4

Fig 5

Warren girder, Lattice girder, "N" girder

DCN36134H5
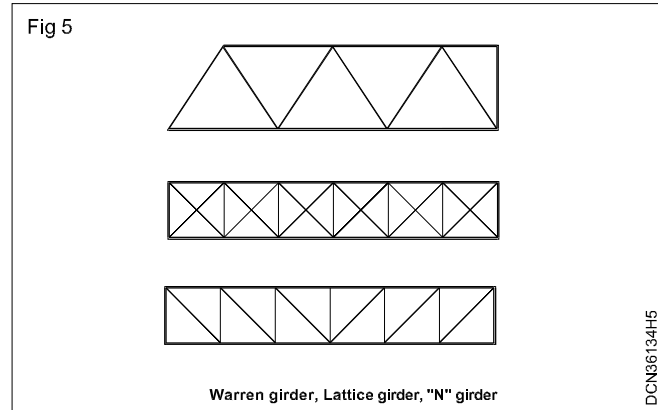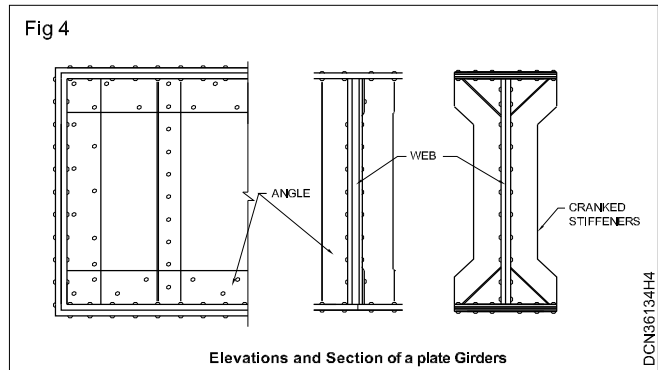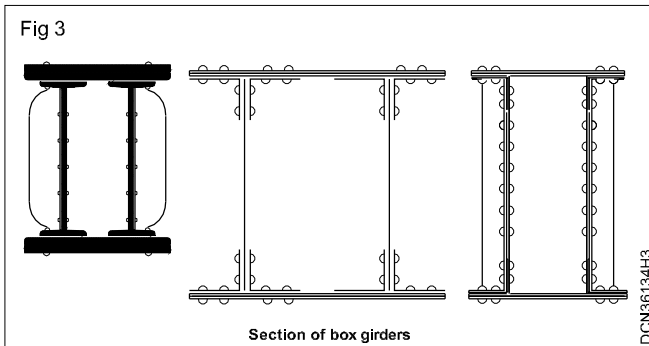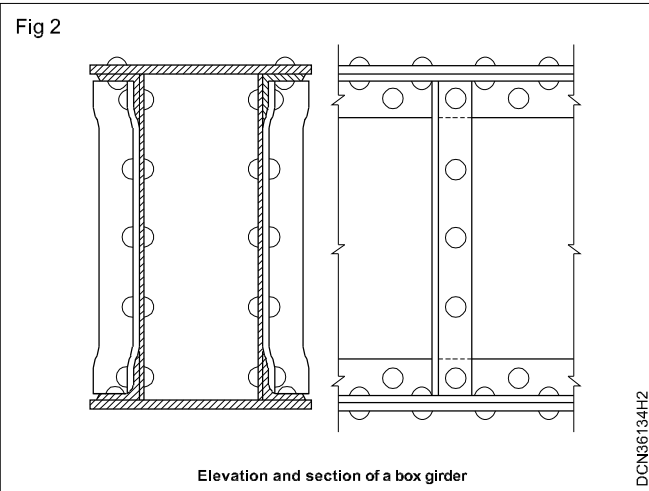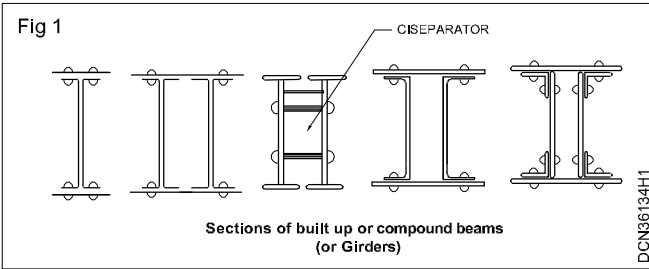
Various beam to beam connections (structural joints)

Objective : At the end of this exercise you shall be able to
• **draw various beam to beam connections.**

PROCEDURE

TASK 1 : **Draw various beam to beam connections**

DATA (Fig 1)

- Main beams ISLB 500.

- Cross beam ISLB 300.

- Cleat - angles ISA 90 x 90 x 8 mm.

- Rivets 20 mm @ 60mm c/c.

- Draw the connections using AutoCAD**.**

Fig 1

MAIN BEAM ISLB 500

CLEAT ANGLES
ISA 9090X8

300

150

180

500

CROSS BEAM
ISLB 300

180

MAIN BEAM ISLB 500
@75Kg/m

CLEAT ANGLES
2 ISA 9090X8

CROSS BEAM ISLB
300 @37.7Kg/m

ELEVATION WITH MAIN BEAM IN SECTION

MAIN BEAM ISLB 500

150

CLEAT ANGLES
2 ISA 9090X8
RIVETS Ø 20

CROSS BEAM ISLB 300

ELEVATION WITH CROSS BEAM IN SECTION
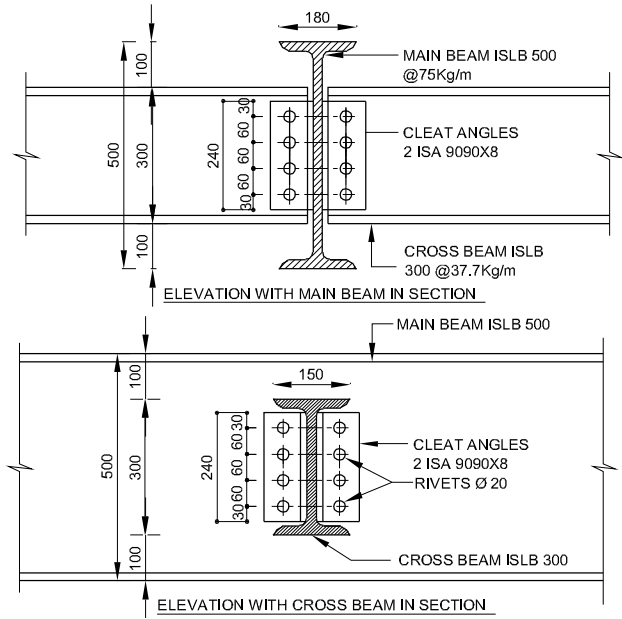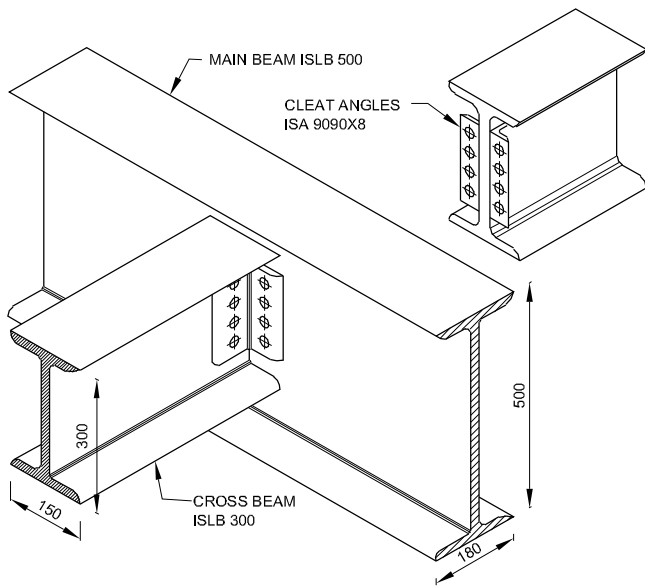
(a) FRAMED CONNECTION OF BEAM END TO BEAM - TOP OF MAIN & CROSS BEAM AT DIFFERENT LEVEL

MAIN BEAM ISLB 500
CLEAT ANGLES
ISA 9090X8

300

150

500

CROSS BEAM
ISLB 300

180

180

CLEAT ANGLES
2 ISA 9090X8

CROSS BEAM ISLB 300
MAIN BEAM ISLB 500

ELEVATION WITH MAIN BEAM IN SECTION

180

CLEAT ANGLES
2 ISA 9090X8

CROSS BEAM ISLB 300
MAIN BEAM ISLB 500

ELEVATION WITH CROSS BEAM IN SECTION
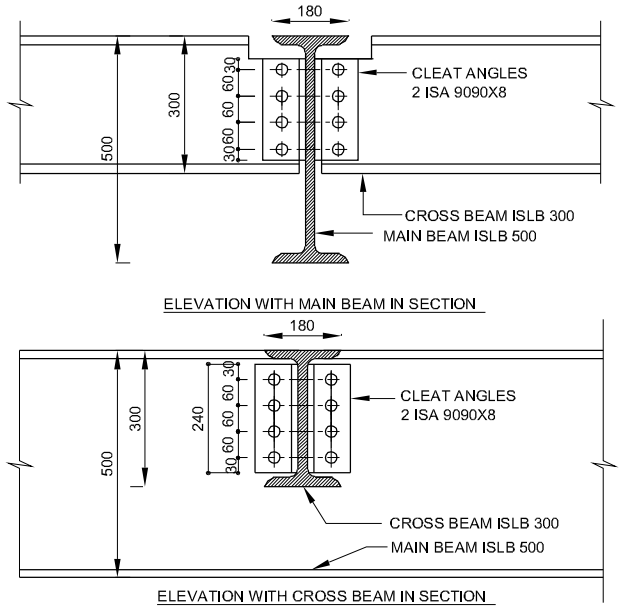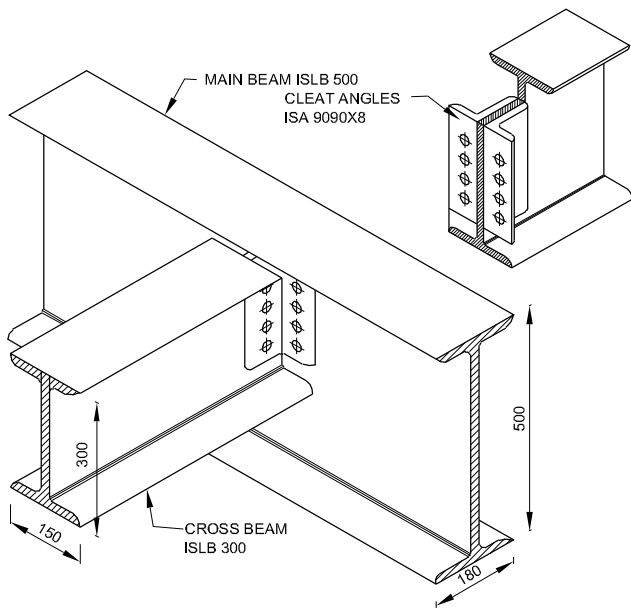
BEAM TO BEAM CONNECTION - TOP LEVEL SAME FOR MAIN AND CROSS BEAMS

DIMENSIONS ARE IN MM

DCN36135E1

BEAM TO BEAM CONNECTIONS

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.6.135

Drawing of beam and to column connection

Objective : At the end of this exercise you shall be able to
• **draw the various beam end to column connections.**

PROCEDURE

DATA

• Columb ISHB 250 (Fig 2)

• Beam ISLB 400

• Angle ISA 90 x 90 x 8 mm

• Flange angle ISA 100 x 75 x 8 mm

• Stiffening angle ISA 90 x 90 x 8 mm

• Filler plate 8mm thick

• Rivet ø 16 mm @60 mm c/c

• Draw the connections using various autocad commands.

Fig 2

PICTORIAL VIEW

COLUMN

ISHB 250@51Kg/m

ISLB 400 @ 56.9Kg/m

30
60
60
60
60
30

240

400

BEAM

250

2ISA 9090X8MM

SHELF ANGLE 90 X 90 X 8
FOR ERECTION

165

RIVETS 16 Ø

32.5   100   32.5

(a) FRAMED CONNECTION OF BEAM END TO COLUMN

PICTORIAL VIEW

COLUMN
ISHB 250
@ 51Kg/m

250

TACKING
RIVET Ø16

EXPANSION GAP

FLANGE ANGLE
ISA 100 75X8

BEAM ISLB 400
@56.9Kg/m

400

BEAM

SEAT ANGLE
ISA 100X75X8

STIFFENING ANGLE
ISA 90 X 90 X 8

FILLER PLATE 8mm THICK

100

30
60
60
60
60
30
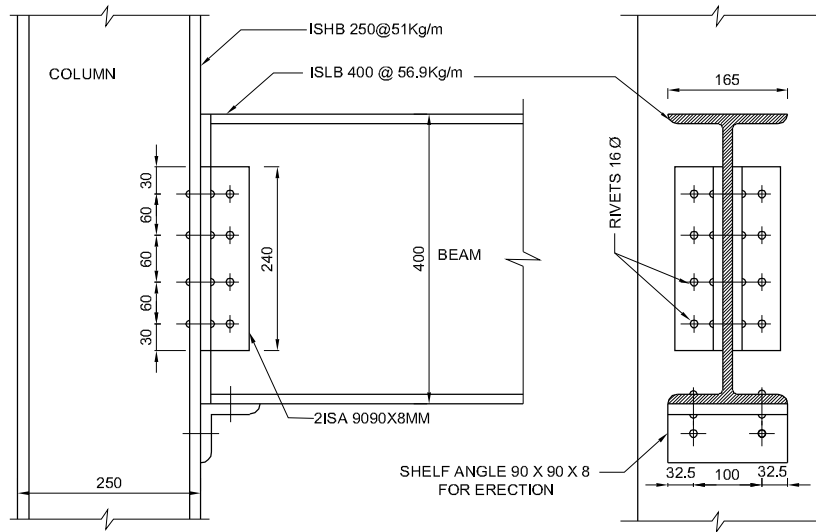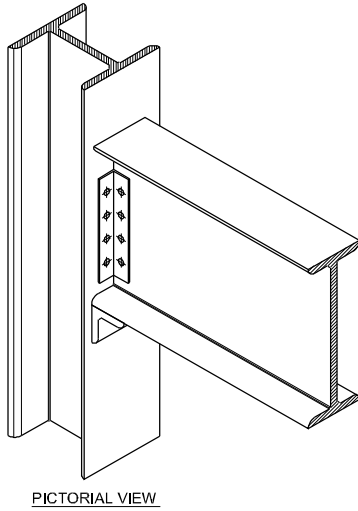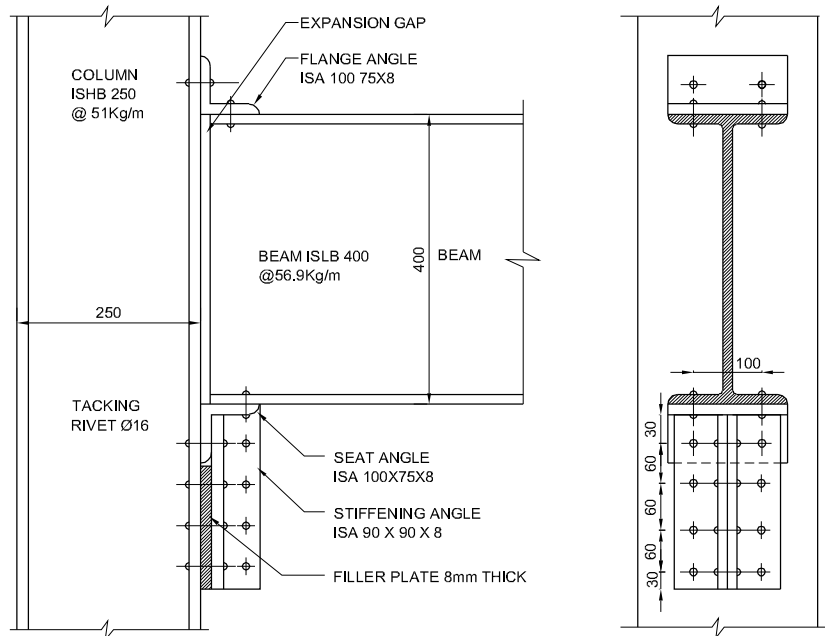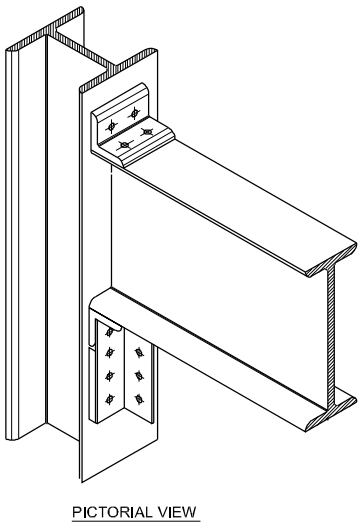
(b) STIFFENED SEAT CONNECTION OF BEAM END TO COLUMN

DIMENSIONS ARE IN MM

DCN36135E2

BEAM END TO COLUMN CONNECTIONS

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.6.135

Plate girder

Objective : At the end of this exercise you shall be able to
• **draw the plan elevation and section of a plate girder.**

PROCEDURE

DATA

- Overall depth - 1560 mm.
- Width - 450 mm.
- Web depth - 1500 mm.
- Web thickness 8 mm.
- Main flange plate - 450 x 12 mm.
- Outer flange plate 450 x 12 mm.
- Flange angle - ISA 150 x 150 10 mm.

- Web stiffner - ISA 100 x 75 x 10 mm.
- Sole plate - 450 x 450 x 20 mm.
- Web rivets ø 18 mm at 200mm c/c.
- Flange rivete ø 18mm at 120mm c/c.
- Select a suitable scale and draw the plan, elevation and section using Auto CAD. (Fig 1)
- Dimension the drawings and complete.

Fig 1

TYPICAL DETAILS OF A PLATE GIRDER
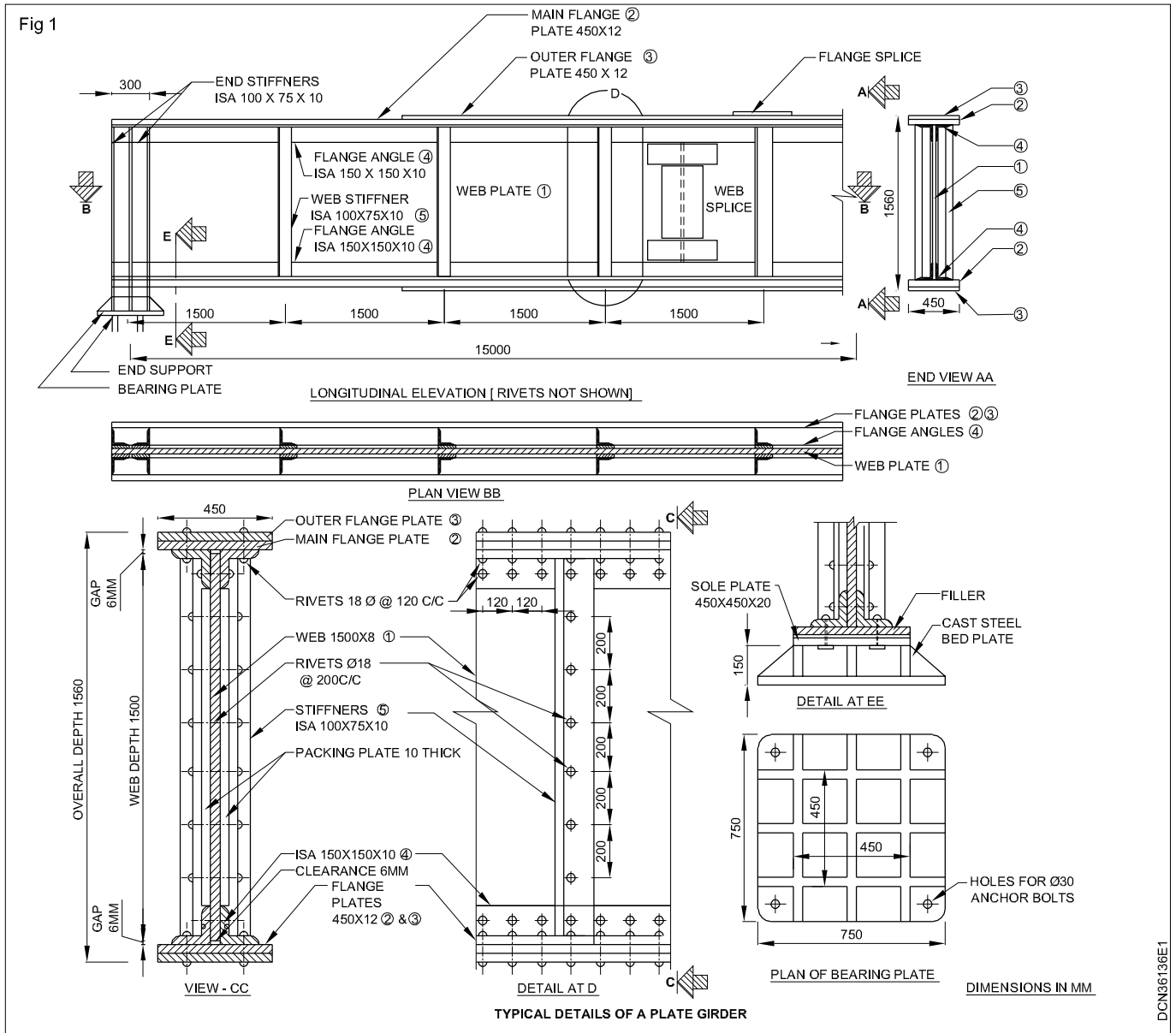
Steel roof truss

Objectives : At the end of this exercise you shall be able to
• **draw roof truss steel**
• **draw the joints details.**

PROCEDURE

DATA

• Span (effective) - 10 m.

• Slope of roof - 30°

• Principal rafter - ISA 90 x 60 x 6 mm.

• Main strut - ISA 75 x 75 x 6 mm.

• Short strut - ISA 50 x 50 x 6 mm.

• Tie beam - 2ISA 75 x 75 x 6 mm.

• Tie - ISA 60 x 60 x 6 mm.

• Main tie - 2ISA 60 x 60 x 6 mm.

• Purlin - ISA 100 x 75 x 6 mm.

• Sag tie - ISA 50 x 50 x 6 mm.

• Cleat - 75 x 75 x 6 mm.

• Gusset plate - 6 mm thick.

• Tack rivets 16 at 200 mm c/c.

• Draw the truss using Auto cad. (Fig 2)

• Complete the drawing with all dimensions and notes.

Fig 2
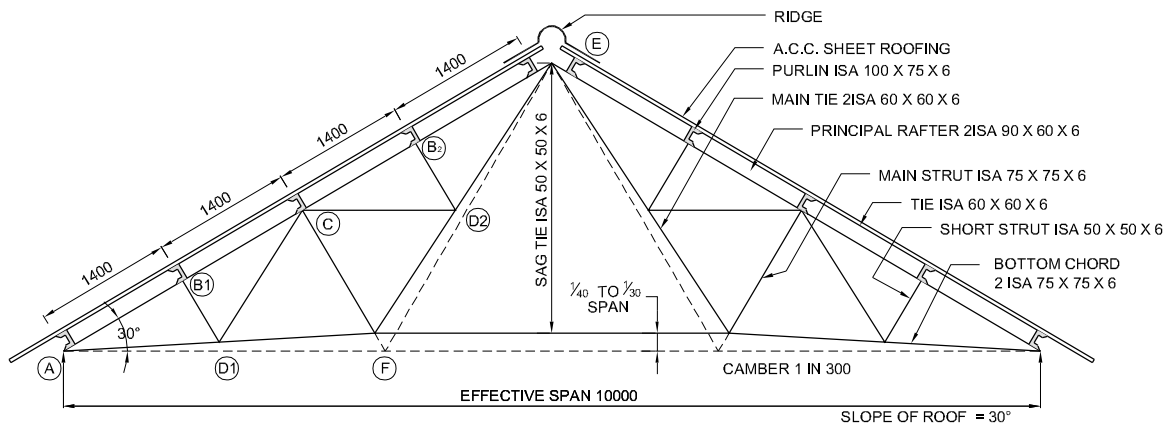
FRENCH ROOF TRUSS - 10M SPAN

DETAIL - A

DETAIL - B₂

DETAIL - C

DETAIL-D1

DETAIL - E

DETAIL - F

DIMENSIONS ARE IN MM
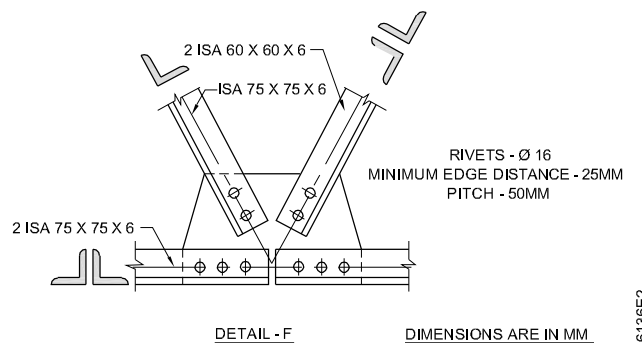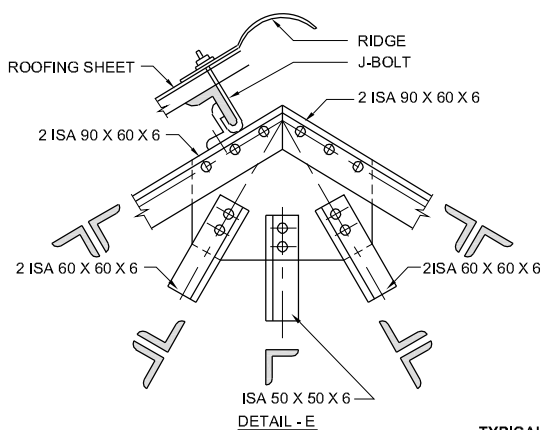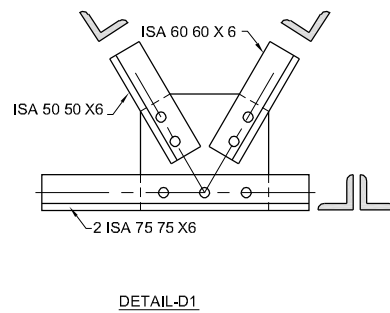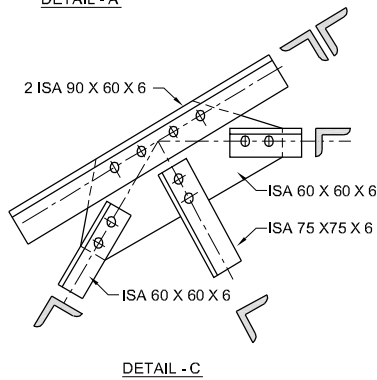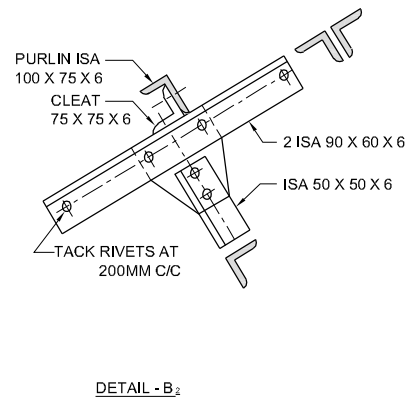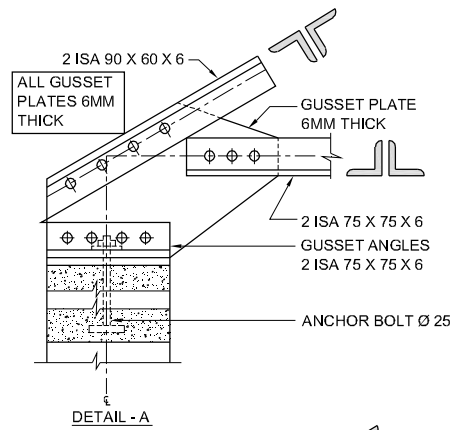
TYPICAL DETAILS OF JOINTS

DCN36136E2

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.6.136

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Isometric view of steel stanchion

Objectove : At the end of this exercise you shall be able to
• **draw the isometric view of a steel stanchion.**

PROCEDURE

DATA

• Concrete base - 1200 x 1200 x 600 mm.

• Base plate - 770 x 770 x 36 mm.

• Cleat angle - ISA 150 x 115 x 12mm.

• Gusset plate - 12 mm thick.

• Column - ISHB 250 x 150 x 12 mm.

• Beam - ISLB 225 100 x 8.6 mm.

• Seat angle - ISA 100 x 75 x 8 mm.

• Flange angle - ISA 100 75 x 8 mm.

• Draw the isometric view of the steel stanchion using autocad (Fig 1)

Fig 1

BEAM

FLANGE ANGLE 100 75 X 8 MM

BEAM ISLB 225 X 100 X 8.6MM

BEAM ISLB 225 100 X 8.6 MM

BEAM

BEAM

FRAMING ANGLE
ISA 40 40 X 5MM

SEAT ANGLE ISA 100 75 X 8MM

COLUMN ISHB 250 150 X 12MM

GUSSET PLATE 12 MM THICK

CLEAT ANGLE ISA 150 115 X 12MM

BASE PLATE 36MM THICK

770

770

600

CEMENT CONCRETE BASE

1200

1200

ISOMETRIC VIEW

DIMENSIONS ARE IN MM

DCN36136H1

STEEL STANCHION

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.6.136   173

Symbols used in welded joint

Objective : At the end of this exercise you shall be able to
• **draw various symbols used for welded joints.**

PROCEDURE

DATA

• Given sketches

• Sketch the attached symbols using AutoCAD (Fig 1)

Fig 1

SYMBOLS OF SOME COMMON WELDS FOR STRUCTURAL CONNECTIONS
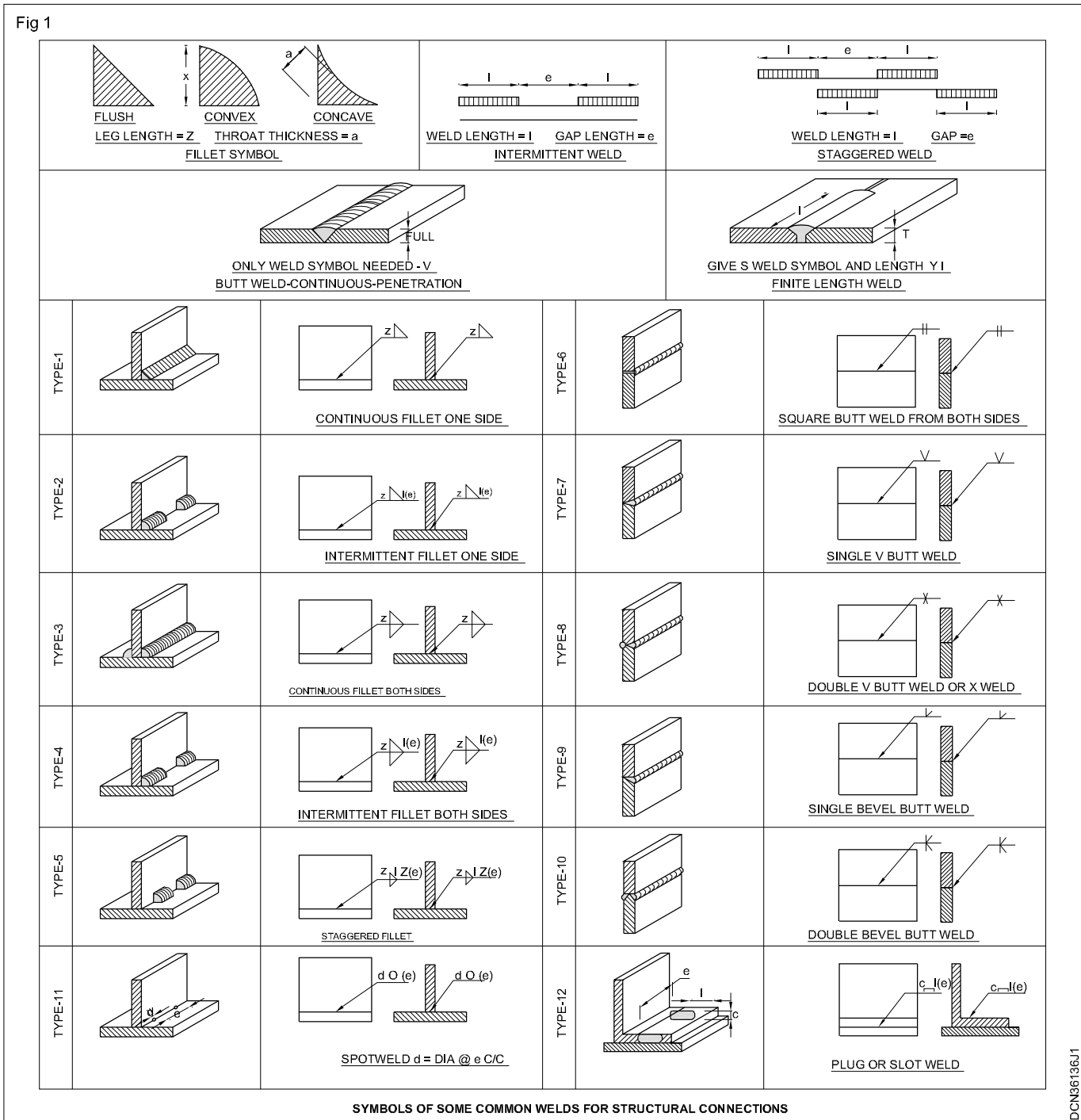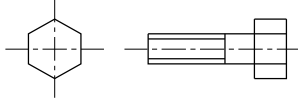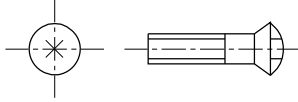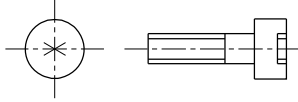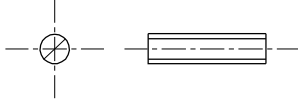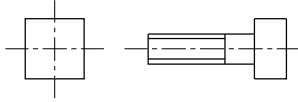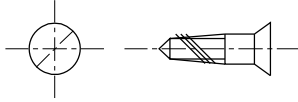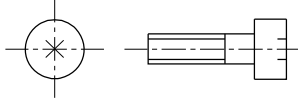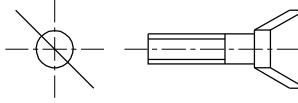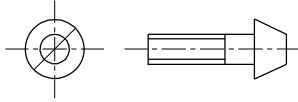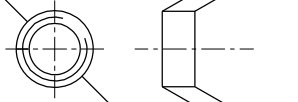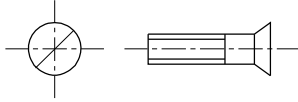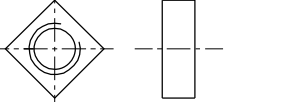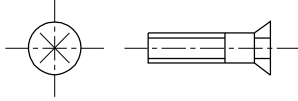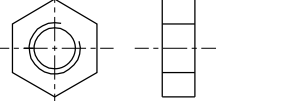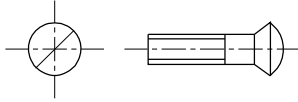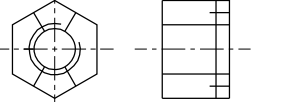
Symbols used in bolts and nuts

Objective : At the end of this exercise you shall be able to
• **draw various symbols used for nuts and bolts.**

• draw the various symbols used for nuts and bolts.
  (Fig 1)

Fig 1

NO.	TYPE	CONVENTIONAL SYMBOL	NO.	TYPE	CONVENTIONAL SYMBOL
1	HEXAGONAL BEADED BOLT		9	OVAL COUNTERSUNK HEADED SCREW CROSS SLOT	
2	HEXAGONAL SOCKET BOLT		10	SET SCREW SLOT	
3	SQUARE HEADED BOLT		11	WOOD AND SELT-TAPPING SCREW SLOT	
4	CYLINDER SCREW CROSS SLOT		12	WING SCREW	
5	CYLINDER SCREW PAN HEAD TYPE SLOT		13	WING NUT	
6	COUNTERSUNK HEADED SCREW SLOT		14	SQUARE NUT	
7	COUNTERSUNK HEADED SCREW CROSS SLOT		15	HEXAGONAL NUT	
8	OVAL COUNTERSUNK HEADED SCREW SLOT		16	CROWN NUT	

CONVENTIONAL SYMBOLS FOR NUTS AND BOLTS

DCN36136X1

Pipe joints for underground drainage

Objective : At the end of this exercise you shall be able to
• **draw the different types of pipe joints.**

PROCEDURE

DATA

• For collar joint.

• D - (Diameter of pipe) = 50 cm.

• t - (thickness of pipe) = 5 cm.

TASK 1 : **Draw the typical pipe joints**

• Draw the pipe joints as per given drawing and data using auto cad. (Fig 1 to 9)

• For other joints (2) to (7).

• D = Diameter of pipe = 10 cm.

• t = thickness of pipe = 1 cm.

• Take a print out in a A3 size paper.

Fig 1 — COLLAR JOINT

Fig 3 — FLANGED JOINT

Fig 2 — EXPANSION JOINT

Fig 4 — FLEXIBLE JOINT (UNIVERSAL JOINT)

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Fig 5

SHOULDER OR GROOVE

OUTER METAL HOUSING IN TWO HALVES BOLTED

U-SHAPED RUBBER RING

D/2

(a) VICTAULIC JOINT

MECHANICAL JOINT

DCN37137H5

Fig 6

t

D

t

(b) DRESSER COUPLING JOINT

MECHANICAL JOINT

DCN37137H6

Fig 7

COUPLING OR SOCKET

t

D

t

SCREWED JOINT

DCN37137H7

Fig 8

RUBBER RING (CIRCULAR CROSS-SECTION)

t

D

t

PIPE

SLEEVE OR COUPLING OF ASBESTOS CEMENT

SIMPLEX JOINT

DCN37137H8

Fig 9

STRANDS OF HEMP

t

D

t

SPIGOT END

BELL END

LEAD

SPIGOT AND SOCKET JOINT

DCN37137H9

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.137

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System of plumbing in multistoried building

Objectives : At the end of this exercise you shall be able to
• **draw the different types of plumbing system commonly used**
• **draw the diagram of one pipe system**
• **draw the diagram of two pipe system**
• **draw the pipe accessories.**

PROCEDURE

TASK 1 : **Draw the diagram of one pipe system in system of plumbing (Fig 1)**

• Draw the diagram of two pipe system. (Fig 2)

• Draw the details of pipe accessories such as bend, connector, junction etc. (Fig 3)

Fig 1

ONE PIPE SYSTEM

REFERENCE:-
MVP :- MAIN VENT PIPE
BSP :- BRANCH SOIL PIPE
BWP :- BRANCH WASTE PIPE
W.C. :- WATER CLOSET

MSWP :- MAIN SOIL AND WASH PIPE
BVP :- BRANCH VENT PIPE
BSP :- BRANCH SOIL PIPE
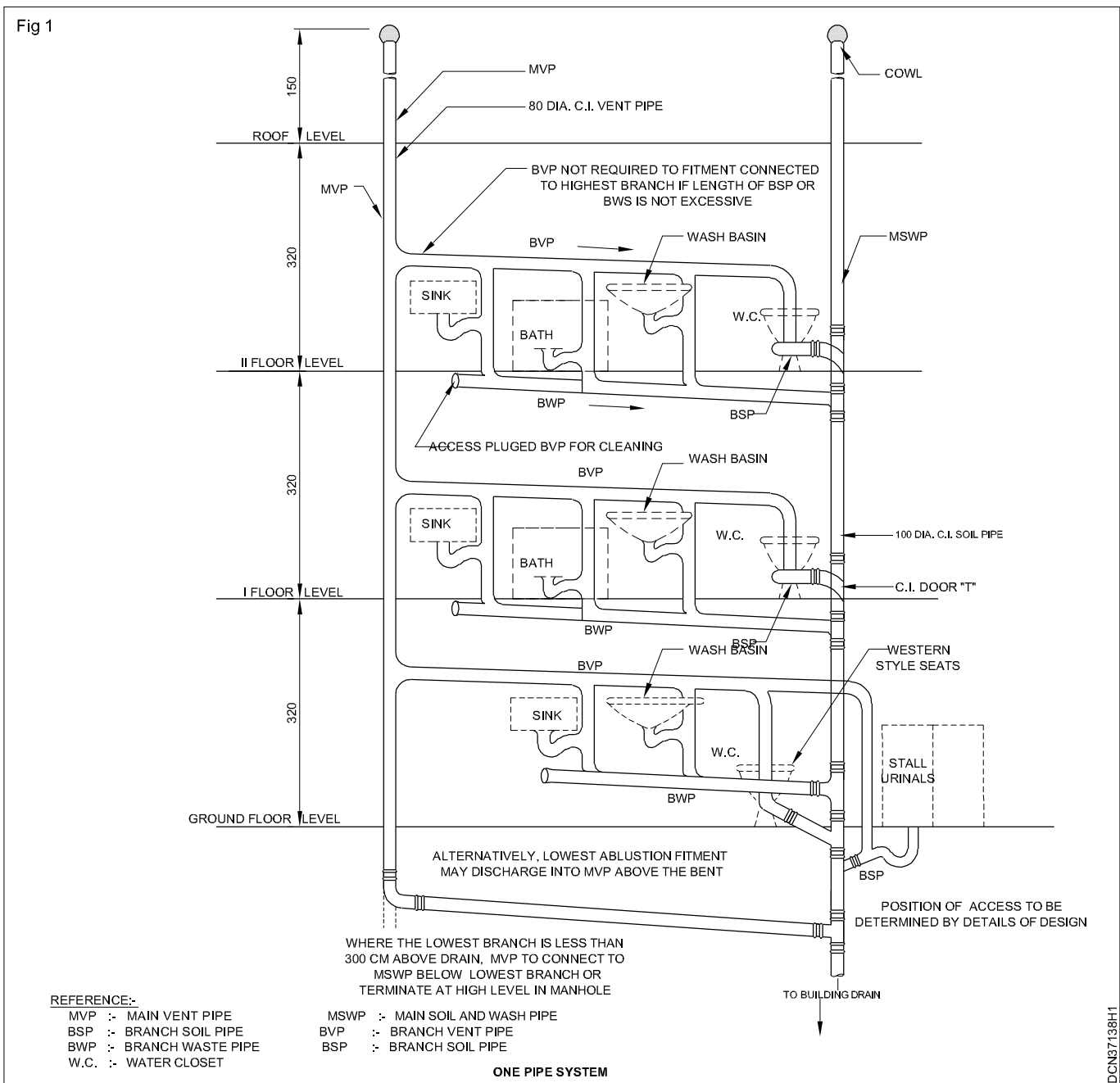
- Draw the diagrams of one pipe system and two pipe system in house plumbing by using auto cad.

- Draw the pipe accessories such as bend, connector, junction etc as per given sketch.

- Complete the drawing and take a print.

Fig 2

MVP

COWL

MWP   MVP   MSWP

BVP NOT REQUIRED TO
FITMENT CONNECTED TO
HIGHEST BRANCH IF
LENGTH OF BWP IS
NOT EXCESSIVE

ALTERNATIVELY, MVP MAY
CONNECT TO MSP OR MWP
ABOVE HIGHEST FITTING

150

FLOOR LEVEL

320

BVP

WASH
BASIN

SINK

BATH

BWP

W.C.

BSP

REFERENCE

MSWP = MAIN SOIL AND WASTE PIPE
MH   = MAN HOLE
MSP   = MAIN SOIL PIPE
MVP   = MAIN VENT PIPE
BSP   = BRANCH SOIL PIPE
BWP   = BRANCH WASTE PIPE
MWP   = MAIN WASTE PIPE
GL   = GROUND LEVEL
WC   = WATER CLOSET
S   = SINK
WB   = WASH BASIN
FT   = FLOOR TRAP

FLOOR LEVEL

ACCESS   BWP

80 DIA C.I. VENT PIPE

320

BVP

WASH
BASIN

SINK

BATH

BVP

W.C.

WESTERN STYLE SEAT

C.I. DOOR "T"

FLOOR LEVEL

ACCESS PLUGGED
FOR CLEANING

MVP

BSP

MVP

100 DIA C.I. SOIL PIPE

MSP

320

WASH BASIN

SINK

W.C.

URINALS

BWP

FLOOR LEVEL

BSP

POSITION OF ACCESS TO BE
DETERMINED BY DETAILS OF DESIGN

TO BUILDING DRAIN

TO BUILDING DRAIN
DIRECTLY OR
THROUGH GULLEY

TWO PIPE SYSTEM

DCN37138H2

Fig 3

SANITARY BEND — VENT PIPE, FLOOR LEVEL, W.C. PAN, WALL, SANITARY BEND, TO MANHOLE

LONG ARM BEND — WALL, C.I. GRATING WASHING PLACE FLOOR, TRAP, LONG ARM BEND, A.C. PIPE

W.C. CONNECTOR — WALL, A.C.VENT PIPE, FLOOR LEVEL, W.C. PAN, W.C. CONNECTOR, SANITARY BEND, TO MANHOLE

BEND AND COWLS — SLOTTED VENT COWL, CONE CAP COWL, BEND

SINGLE EQUAL JUNCTION

DOUBLE EQUAL JUNCTION

SINGLE UNEQUAL JUNCTION

DOUBLE UNEQUAL JUNCTION

SINGLE INVERTED JUNCTION

SWAN NECK

PIPE ACCESSORIES

DCN37138H3

Septic tank and soak pit dispersion trench

Objectives : At the end of this exercise you shall be able to
• **design septic tank soak pit and dispersion trench**
• **draw septic tank**
• **draw soak pit of empty type and filled up type**
• **draw dispersion trench**
• **draw cess pool.**

PROCEDURE

TASK 1 : **Design and draw septic tank, soak pit dispersion trench for 50 users.**

DATA

For septic tank

Rate of water supply = 135 litres/ capita/ day

Number of users = 50 Nos

Detension period = 24 hrs.

Cleaning period = 2 years interval.

Sludge storage / capit = 0.0708m³.

Clean space for sedimentation = 0.30 m deep.

Scum storage / capita = 0.01m³.

Sludge digestion / capita = 0.028 m³.

For soak pit

Percolating capacity of filter media as 1.25 m³ / day

For dispersion trench:

Percolation rate 0.204m³ / day.

Design of a septic tank for 50 users

Assuming the usage of water 135 litre per / capita / day.

No of users = 50.

Total quantity of sewage = 135 × 50 = 6750.00 litres = 6.75m³.

Assuming a detention period = 24 hours (normal range 12.00 - to - 24.00 hours).

$$\text{Tank capacity} = 6.75 \times \frac{24}{24} = 6.75\,\text{m}^3 \,.$$

Assuming the tank is cleaning period = 2 year.

The sludge storage per capita = 0.0708m³.

Sludge storage required = 50 × 0.0708 = 3.54m³.

Total capacity =6.75+3.54 =10.29m³ say 10.30m³ .....(1)

Add 25% extra for future expansion.

Then total design capacity.

$$= \frac{10.30 \times 125}{100} = 12.88\text{m}^3 = 12.90\text{m}^3 \,......(2)$$

Assuming the depth of septic tank ....say 2.00 metre.

Then the area of septic tank = 12.9/2.00 = 6.45 m².

Length - width ratio .... = 3:1 (ration may be in between 2.0 - to - 4.00).

Length x breadth = 3 x breadth x breadth = 6.45m²

(Breadth)² = 6.45/3 = 2.15.m

Breadth = 1.46m say 1.50 m.

Length = 1.50 × 3 = 4.50 m.

Assuming free board of 30.00 cm (normal range 40.00 cm - to - 60.00 cm).

Total depth = 2.00 + 0.30 = 2.30 m.

Hence provide septic tank of size (4.50 × 1.50 × 2.30) m

Check for spaces:-

Sedimentation volume for clear space of 0.30 m deep = clear space x surface area = 0.30 × 6.45 = 1.935m3

Scum storage 0.01m³ / capita = 50 × 0.01 = 0.50 m³

Sludge digestion 0.028m3 / capita = 50 × 0.028 = 1.40 m³

Sludge storage at 0.0708 m3 / capita = 50 × 0.028 = 1.40m³

Sludge storage at 0.0708 m³ /capita for 2 years of cleaning interval = 50 × 0.0708 = 3.54m³

Total space = 1.935 + 0.5 + 1.40 + 3.54 = 7.38 m³ against tank capacity of 10.3 m³

Hance the design is correct.

Soak pit

Flow of sewage/day = 6.75m3

Add 25% for future expansion, Then total flow of sewage/

day $= \circledR$ $\dfrac{6.75 \times 125}{100} = 8.44m^3 = 8.5m^3$

Assume the percolating capacity of filter media of well as 1.25m³/per day

Volume required for soak pit = 8.5/1.25 = 6.8m³..........say 7.00 m³.

If the depth of soak pit is 2.50 metre.

Area of soak pit = 7.00/2.50 = 2.80m².

$\pi d^2/4$ = 2.80 m²..

D =1.90 m say 2.00 m diameter.

A soak pit of diameter 2m, and 2.5m deep below the invert level of the inlet pipe may be provided.

Design of dispersion trench:-

Flow of sewage in the trench per day = 8.5 m³.

Assume width of dispersion trench = 1 m.

Percolation rate of sewage is 0.24 m³/day (Assume).

Length of trench required $= \dfrac{8.5}{0.204} \times 1 = 41.7m$ say 42m.

Provide 3 trenches each 14m long.

Dispersion trench width 30 - 50 m.

Depth 50 - 75 cm.

(By using Auto CAD).

1 Septic tank (Fig 1)

- Draw plan of the septic tank with inner dimension (4.50 m x 1.50 m) wall thickness 20 cm.

- Draw RCC baffle wall 90 cm from the inlet end.

- Draw 10 cm inlet and outlet pipe and complete the plan as per give drawing.

- Draw the L - section at XX by projecting lines from plan and total depth (at middle) 2.30m (2.00m water and 0.80mm free board.

- Draw inlet pipe above water level.

- Draw outlet pipe 10 cm ø with bottom level same as sewage level.

- Draw the cover slab 10 cm thick and provide a man hole cover 50 cm dia in the slab.

- Provide floor slope of about 1 in 10 or 1 in 20 and a vent pipe 8 cm with min depth 2 .00m.

- Draw the cross section of the depth tank. (Section at YY).

- Complete the drawing.

2 Soak pit (1) (Filled type) (Fig 2 & Fig 3))

- Draw the section of the pit with 2.00 m inner diameter and 2.5 m deep from the invert level of the inlet pipe.

- Draw 30 cm thick outer casing with coarse sand to a depth of 2.30 m and over it draw 20 cm thick brick or stone or concrete or brick masonry with mortar joints.

- Fill the inside with loose brick bats or stones.

- Show cement plaster layer on the inside of pit above the level of inlet pipe and draw R.C.C cover to the pit of 10cm thickness

- Complete the drawing as per given sketch.

3 Dispersion trench (Fig 4)

- Draw the plan of distribution chamber 1m $\times$ 0.9m with 10 cm wall thickness.

- Draw three trenches 1m wide and 14m long and connect to the distribution chamber with 10 cm earthenware pipes or concrete pipes.

- Mark the dimension and complete the plan.

- Draw the L - section at "YY" and cross - section at "XX" as per given sketch.

- Complete drawing and take a print in A3 size paper.

4 Cess pool (Fig 5)

- Draw the plan of the cess pool with internal diameter 1.5m

- Draw the sectional elevation.

- Dimension the drawings and complete.

Fig 1

C.I.COWL

80 DIA C.I. VENT PIPE

MIN. 2000

80 DIA.C.I. VENT PIPE

100 DIA. S.W. 'T' JUNCTION

500 DIA. C.I. MANHOLE COVER

100MM THICK R.C.C. 1:2:4 SLAB OR REMOVABLE SLAB

FREE BOARD

300

SEWAGE LEVEL

150

600

400

D=2000

600

OUTLET 100 DIA. S.W. PIPE

100 DIA. INLET

100 DIA. S.W.

40MM THICK R.C.C. BAFFLE WALL

FLOOR SLOPE 1 IN 10

100

250

FLOOR CEMENT CONCRETE 1:2:4

SECTION AT XX

550

4

40 MM THICK R.C.C. BAFFLE WALL

FLOOR CEMENT CONCRETE 1:2:4

SECTION AT YY

L=4500

200   100

100   200   L/5

L = 4.50M
B = 1.50M
D = 2.30M

100 DIA. S.W. 'T' JUNCTION

100 DIA. S.W.PIPE SEWER OUTLET

B=1500

500 DIA. C.I. MANHOLE COVER

INLET X

X

R.C.C. BAFFLE WALL

900

12 THICK PLASTER 1:3

B.B. MASONRY IN CEMENT MORTAR 1:4

100 WIDE FOUNDATION CEMENT CONCRETE 1:2:4 STEP

PLAN

SEPTIC TANK

DCN37139E1

Fig 2

MASONRY RING IN CEMENT MORTAR 1:5, 200 THICK

2000 DIA.

TURFED

450

S.W. PLAIN BEND

INLET

BRICK, STONE OR CONCRETE BLOCK LINING
WITH MORTAR JOINTS

150

150

400 X 400 BRICK CHAMBER WITH DRY JOINTS

EFFECTIVE DEPTH

2350

STONE OR BRICK BATS LOOSE FILLING

300 THICK OUTER CASING WITH COARSE SAND

SECTION OF A FILLED IN SEEPAGE PIT OR SOAK PIT

Fig 3

(OR)

CONCRETE ROOF OR PRECAST REMOVABLE CONCRETE SLABS

OPENING

TURFED

450

CEMENT PLASTER

900

INLET

150

75 MM THICK
OUTER CASING
WITH COARSE
AGGREGATE

BRICK, STONE OR
CEMENT CONCRETE
BLOCK LINING WITH
DRY JOINTS

2500

2350 EFFECTIVE DEPTH

2000 DIA.

SECTION OF A EMPTY SEEPAGE PIT OR SOAKPIT

SOAK PIT

DCN37139E2

Fig 4

3000 MAX.

1000

1.80 MIN.

DISPERSION TRENCH 500 TO 1000 DEEP

PLAIN PIPE BEND

100 DIA. SW PIPE INLET FROM SEPTIC TANK

100

1000

TIGHT JOINTS

EFFLUENT

50

DISTRIBUTION CHAMBER

900

OPEN JOINTS

X

1000

75 TO 100 MM DIA. UNGLAZED EARTHENWARE OR CONCRETE PIPES

Y

Y

DISPERSION TRENCH 500 TO 1000 DEEP

X

50 THICK CEMENT CONCRETE OR BRICK BAFFLE

100 THICK WALL IN CEMENT MORTAR 1:4

PLAIN PIPE BEND

75 TO 100 MM DIA. UNGLAZED EARTHENWARE PIPES

1.80 MIN.

1000

3000 MAX.

300 ORDINARY SOIL

TURFED

GROUND

150 MIN. LEVEL

FINISHED LEVEL

TURFED

600

ORDINARY SOIL

150MM COARSE AGGREGATE WELL GRADED

150 TO 250 GRAVEL OR CRUSHED STONE OF UNIFORM SIZE

DEPTH 1000

300 TO 1000

75 TO 100 MM DIA. UNGLAZED EARTHENWARE PIPES

OPEN JOINTS

75 TO 100 MM DIA. UNGLAZED EARTHENWARE PIPES

SECTION AT XX

L-SECTION AT YY

ENLARGED SECTION THROUGH FILLED IN DISPERSION

LAYOUT PLAN OF DISPERSION TRENCHES FOR THE DISPOSAL OF EFFLUENT FROM SEPTIC TANK

DISPERSION TRENCHES

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.139

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DCN37139E4

Fig 5

FRESH AIR INLET WITH
MICA FLAP VALVE

VENT PIPE

M.H.

2.00M

1.50M

20CM BRICK
MASONRY

WATER PROOF
CEMENT RENDERING

20CM PUDDLED CLAY

60CM

WATER TABLE

HARD CORE

SECTION

VENT

F.A.I.

INLET

BRICK MASONRY

PUDDLED CLAY

PLAN

CESS POOL

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.139

DCN37139E5

Man holes

Objectives : At the end of this exercise you shall be able to
• **draw shallow man hole**
• **draw deep man hole.**

PROCEDURE

TASK 1 : **Prepare the detailed drawings of a shallow manhole (depth below 2m) (Fig 1)**

DATA

• Working chamber - (80 x 80 x 90) cm.

• Walls - 20 cm thick brick masonry in cm 1:4, plastered inside with CM 1:3, 12 mm thick.

• Foundation - C.C 1:2:4, 20 cm thick, with a projection of 10 cm beyond walls.

• Covering slab - 10 cm thick R.C.C 1:2:4.

• Main sewer pipe - 20 cm dia.

• Branch sewer - 15 cm dia.

• manhole - 50 cm diameter.

• Draw sectional plan, longitudinal section (section at AA) and cross - section (section at BB) of the manhole as per given data and sketches.

• Mark the dimensions and complete the drawings.

• Take a print in A3 size paper.

Fig 1

SECTION AA

SECTION BB

SECTIONAL PLAN CC

DETAILS OF MANHOLE (DEPTH 1M & BELOW)

PICTORIAL VIEW

SHALLOW MAN HOLE

DCN37139H1

- - - - - - - - -

TASK 2 : **Prepare the detailed drawing of a deep manhole (Fig 2)**

DATA

- Working chamber - (120 x 90 x 140) cm.

- Entrance shaft - (90 x 50 x 60) cm.

- Wall - 30 cm thick brick wall for working chamber and 20 cm thick wall for entrance shaft.

- Slab - 12 cm thick RCC slab for working chamber, 10 cm thick RCC slab for entrance shaft.

- Man hole cover - 60 cm diameter.

> A man hole of 2m or above is called deep man hole.

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.139

Fig 2

R.C.C. OR CAST IRON
MANHOLE COVER Ø 60

R.C.C. COVER SLAB
10 CM THICK

ENTRANCE SHAFT
20   50   20

12CM THICK R.C.C. SLAB

Z

30   120   30

WORKING CHAMBER

15CM RUNGS @
30CM SPACING

140

OPEN CHANNEL

SECTION XX

20   20   50   20   20

DEPTH OF MAN HOLE
200

30   90   30

RING ARCH
BENCHING

6
1

10

20

SECTION YY

Y

MAIN SEWER

X   40   X

BRANCH SEWER

Y

SECTIONAL PLAN ON ZZ

RENDERING WITH
CEMENT MORTAR 1:2

6
1

SEWER PIPE

DETAILS OF BENCHING

DETAILS OF MANHOLE
(DEPTH 1.5M AND ABOVE)

ALL DIMENSIONS IN CM

DCN37139H2

DEEP MAN HOLE

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.139   189

Rain water harvesting tank

Objective : At the end of this exercise you shall be able to
• **draw rain water harvesting tank.**

PROCEDURE

TASK 1 : **Draw the details of a rain water harvesting tank (using Auto CAD) (Fig 1)**

DATA

- Storage tank capacity 6000 litres.

- Size of tank - (3.00 x 1.50 x 1.50) m.

- Free board - 15 cm thick.

- RCC wall - 15 cm thick

- RCC top slab - 10 cm thick.

- Man hole - 50 cm ø□□□ □

Filter tank

- Size of tank - (0.90 $\times$ 1.50 $\times$ 0.90) m.

- Filter media - 50 cm deep.

- (10 cm coarses and

- 20 cm fines and)

- Wall thickness - 15 cm.

- R.C.C top slab - 10 cm thick.

- Inlet chamber of rain water separator inside dimension (50 $\times$ 50) cm.

- Wall - brick masonry in CM 1:4, plastered with CM 1:3, 12 mm thick.

- Foundation - P.C.C 1:2:4, 10 cm thick.

- Inlet pipe - 10 cm ø

- Draw the sectional plan and longitudinal section of the storage tank, filter tank and rain water separator (inlet chamber) as per given data and sketches.

- Hatch the drawing wherever necessary and complete the dimensioning.

- Take a print in a A3 size paper.

Fig 1

RAINWATER PIPE

TO FILTER

R.C.C. TOP SLAB 10CM THICK

R.C.C. FILTER TANK (MAY BE MADE SEPARATE)

DISINFECTION UNIT

TO PUMP

RAIN WATER SEPARATOR

GALVANISED WIRE SCREEN

FINE FILTER SAND 20CM

COARSE SAND 10CM

FINE GRAVEL 10CM

COARSE GRAVEL 10CM

MANHOLE 50CMØ

OVER FLOW PIPE 10CM Ø

R.C.C. STORAGE TANK

DRAIN VALVE

TO DRAIN

SECTIONAL ELEVATION @ AA OF SEPARATOR, FILTER & STORAGE TANK

RAIN WATER PIPE 10CM Ø

DRAIN

TO FILTER

FILTER TANK

TO FILTER

MANHOLE COVER

STORAGE TANK (CAPACITY 6000 LITRES)

OVER FLOW

DRAIN

SECTIONAL PLAN @ BB

ALL DIMENSIONS IN CENTIMETRES

DETAILS OF RAIN WATER HARVESTING TANK

DCN37139J1

Bio gas plant

Objective : At the end of this exercise you shall be able to
• **draw a bio gas plant.**

PROCEDURE

TASK 1 : **Draw the detailed drawing of a bio gas plant (using Auto CAD (Fig 1)**

DATA

• Main plant

• Bottom level of plant: + 17.500

• Thickness of bottom concrete : 200

• Inner dia. of gas plant: 2500

• Thickness of brick work: 200

• Inner height of gas plant: 2000

• Rise of dome: 650

• Top dome consists of cement mortar 1:3, 25 thick over iron grill and chicken mesh

• Top level of dome : + 19.725

• Ground level : 19.250

• Slurry level in the gas plant: + 18.750

Inlet tank

- Top level of inlet tank : + 19.450

- Dimension of tank: 500 x 500

- Depth of tank: 800

- Thickness of concrete : 100

- Thickness of brick wall : 100

- Size of inlet opening : 300 x 300

Outlet tank

- Dimension of tank: 500 x 500

- Depth of tank: 1050

- Thickness of concrete: 100

- Thickness of brick wall: 100

- Size of outlet opening : 200 x 200

- (All dimensions are in mm)

- Draw the plan and sectional elevation of a bio gas plant as per given data and sketches.

- Hatch the portions wherever necessary and complete the dimensioning.

- Take a print out in A3 size paper.

Fig 1

BIO GAS PLANT
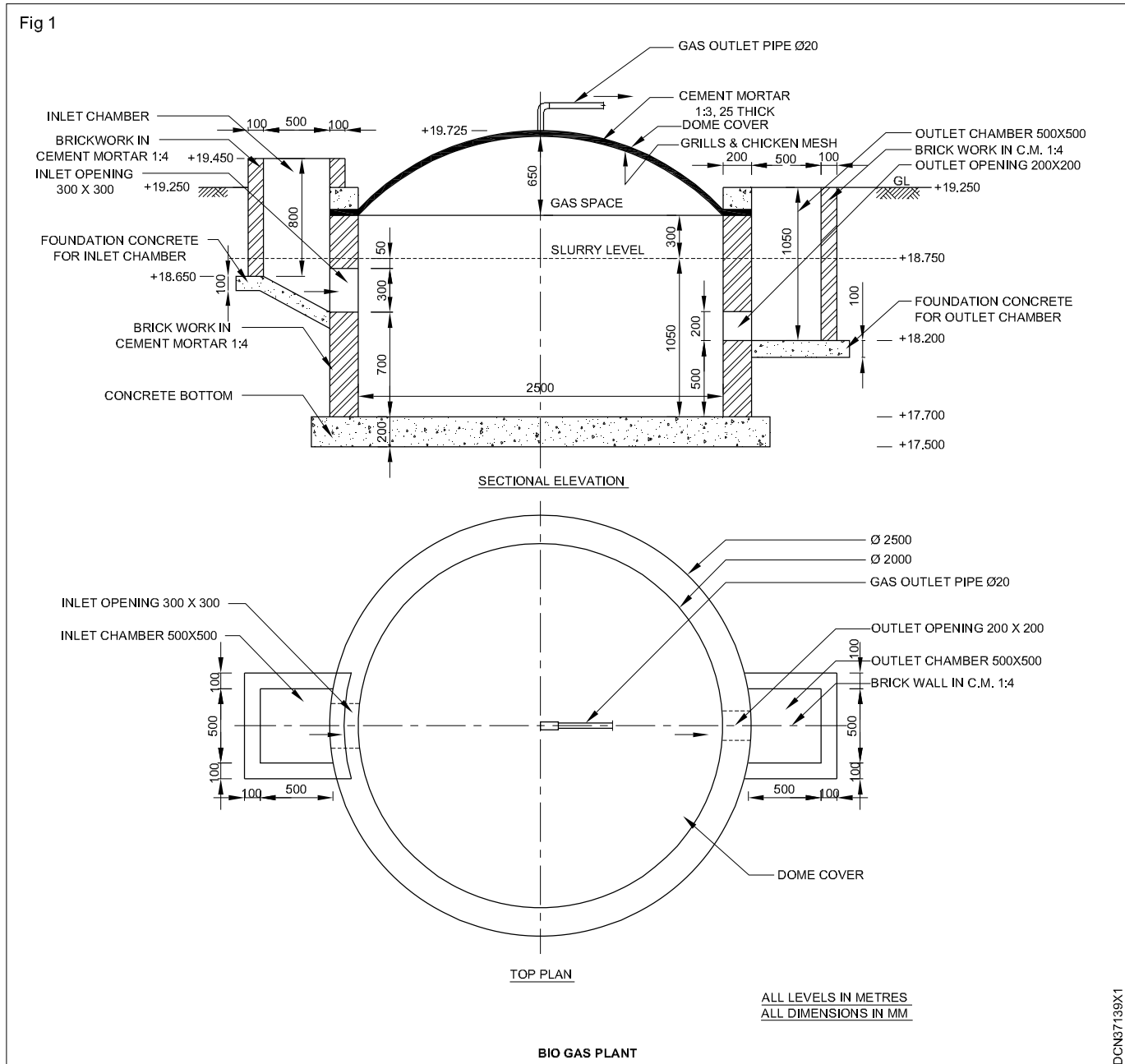
Diagram of water supply connection scheme

Objectives : At the end of this exercise you shall be able to
• **draw the chart of water treatment and storage operations**
• **draw the diagram of water supply connection to isolated residential building**
• **draw the diagram of water supply installation in a flat and in an isolated building.**

PROCEDURE

TASK 1 : **Prepare a schematic chart of water treatment and storage operations along with waste water treatment operations (Fig 1)**

Fig 1

(a) SCHEMATIC CHART OF WATER TREATMENT & STORAGE OPERATIONS

SCHEMATIC CHART OF WATER TREATMENT AND STORAGE OPERATIONS

(b) SCHEMATIC CHART OF WASTE WATER TREATMENT OPERATIONS

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.140
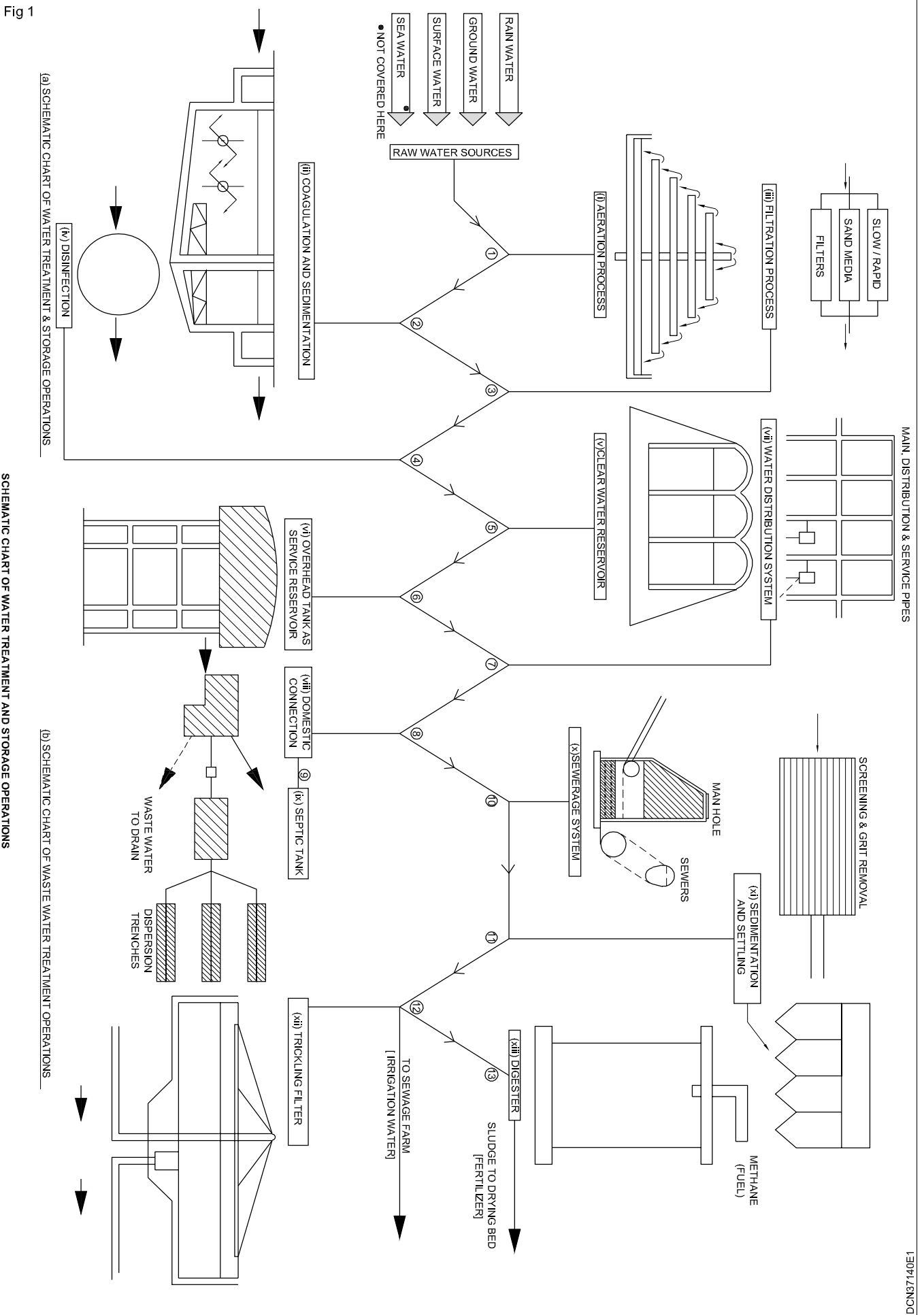
TASK 2 : **Prepare a schematic diagram for water supply connection to residential building (Fig 2)**

Fig 2

SCHEMATIC DIAGRAM OF WATER SUPPLY CONNECTION

DCN37140E2

— — — — — — — — —
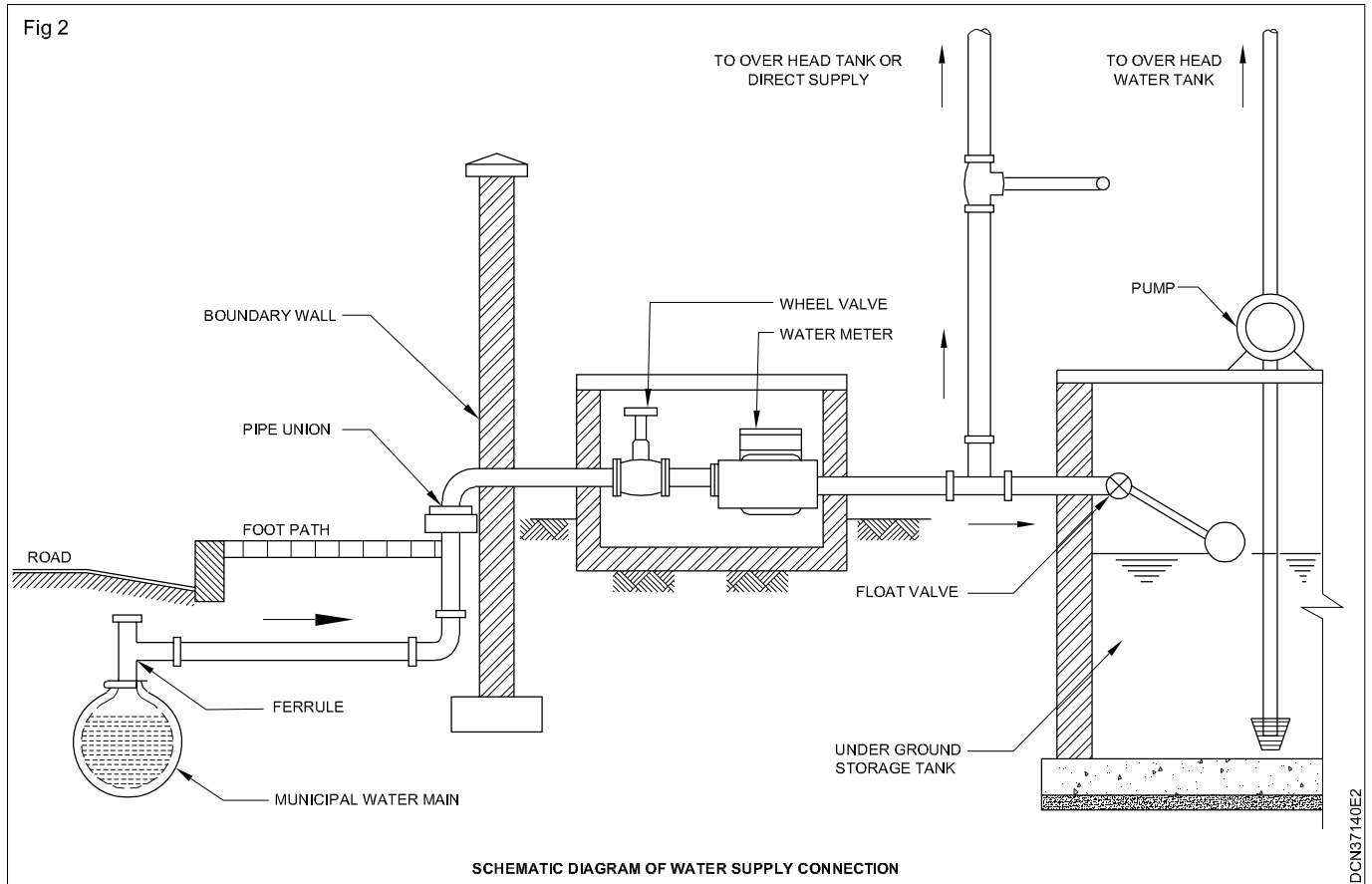
TASK 3 : **Prepare a schematic diagram of typical water supply installation in a flat and in an isolated building (Fig 3 & 4)**

• Draw the diagram in the chart as per given reference sketches.

Fig 3

SCHEMATIC DIAGRAM OF TYPICAL WATER SUPPLY INSTALLATION IN A FLAT

COMMON MAIN OVERHEAD WATER TANK

DIRECT WATER SUPPLY OR FROM PUMP

TO SEPTIC TANK

VENTILATING PIPE

SEWAGE PIPE

COLD WATER

HOT WATER

H

SHOWER

HOT WATER HEATER

FLOOR LEVEL

INDIVIDUAL OVER HEAD WATER TANK ONE FOR EACH APARTMENT

WASH BASIN

SUILAGE PIPE TO DRAIN

WATER CLOSET

FLUSHING TANK

FLOOR LEVEL

KITCHEN SINK

FLOOR LEVEL

DCN37140E3

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.140

Fig 4

AIR PIPE

WATER LEVEL

OVERFLOW PIPE

OVER HEAD TANK

SCOURING PIPE

G.I INLET

SHOWER

LOW LEVEL
FLUSHING CISTERN

V = WHEEL VALVE

WASH BASIN

V

VP

TAP

URINAL

TAP

EUROPEAN WATER
CLOSET

G.I OUTLET

FIRST FLOOR

WATER
HEATER

HIGH LEVEL
FLUSHING CISTERN

BATH TUB

INDIAN TYPE
WATER CLOSET

PUMP

TAP

FLOAT VALVE

GATE VALVE

WATER METER

G.L

STOP COCK

SUMP

WATER MAIN

DCN37140E4

WATER SUPPLY INSTALLATION IN AN ISOLATED BUILDING

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.140

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R.C.C square overhead water tank supported by four column

Objective : At the end of this exercise you shall be able to
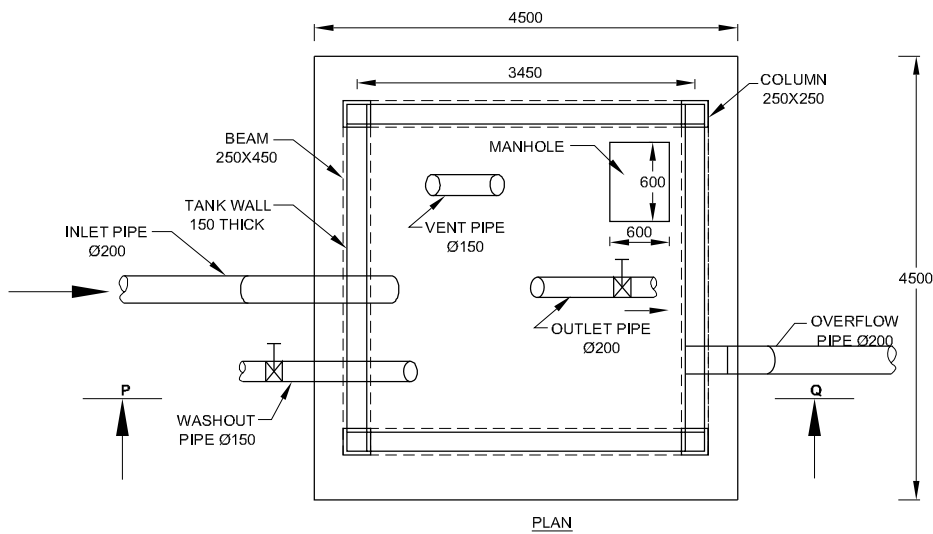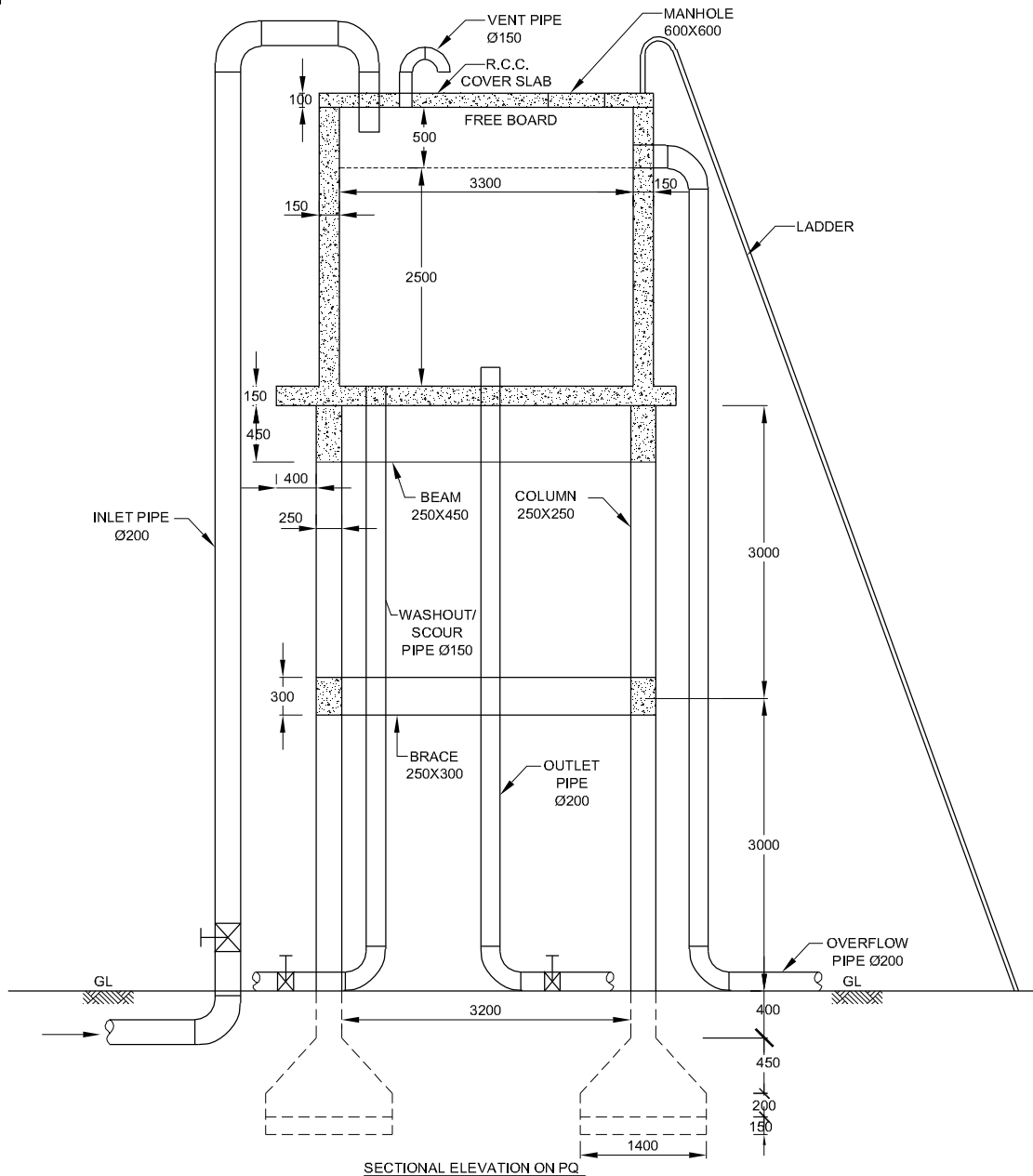• **draw the R.C.C overhead water tank.**

PROCEDURE

TASK 1 : **Draw the R.C.C square over head tank supported by four columns using Auto CAD software (Fig 1)**

DATA

- Size of the tank - 3300 x 3300 mm.

- Height of wall of the tank - 3m.

- Free board - 0.5 m.

- Thickness of bottom slab 150 mm.

- Thickness of tank wall - 150 mm.

- Thickness of cover slab - 100 mm.

- Size of beam at top of column - 250 x 250 mm.

- Size of column - 250 x 250 mm.

- Size of braces - 250 x 300 mm.

- Height of column from G.L - 6m.

- Size of manhole - 600 mm x 600 mm.

- Depth of water inside the tank - 2.5 m.

- Depth of foundation below G.L - 1200 mm.

- Size of column footing - 1400 x 1400 mm.

- Diameter of inlet, outlet and overflow pipes - 200 mm.

- Diameter of scour pipe - 150 mm.

- Diameter of vent pipe - 150 mm.

- Any more data required may be assumed suitably.

- Draw the plan and sectional elevation of the R.C.C overhead tank supported by four columns.

- Dimension the figure and complete the drawing as per given data and sketches.

- Take a print in A3 size paper.

Fig 1

VENT PIPE
Ø150

MANHOLE
600X600

R.C.C.
COVER SLAB

FREE BOARD

100

500

3300

150

150

2500

LADDER

150

450

400

BEAM
250X450

COLUMN
250X250

250

3000

INLET PIPE
Ø200

WASHOUT/
SCOUR
PIPE Ø150

300

BRACE
250X300

OUTLET
PIPE
Ø200

3000

OVERFLOW
PIPE Ø200

GL

GL

3200

400

450

200
150

1400

SECTIONAL ELEVATION ON PQ

4500

3450

COLUMN
250X250

BEAM
250X450

MANHOLE

600

TANK WALL
150 THICK

VENT PIPE
Ø150

600

4500

INLET PIPE
Ø200

OUTLET PIPE
Ø200

OVERFLOW
PIPE Ø200

P

Q

WASHOUT
PIPE Ø150

PLAN

R.C.C. SQUARE OVER HEAD TANK SUPPORTED BY FOUR COLUMNS

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.141

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DCN3714E1

Service plan for isolated building and sewer system

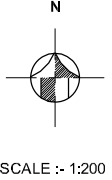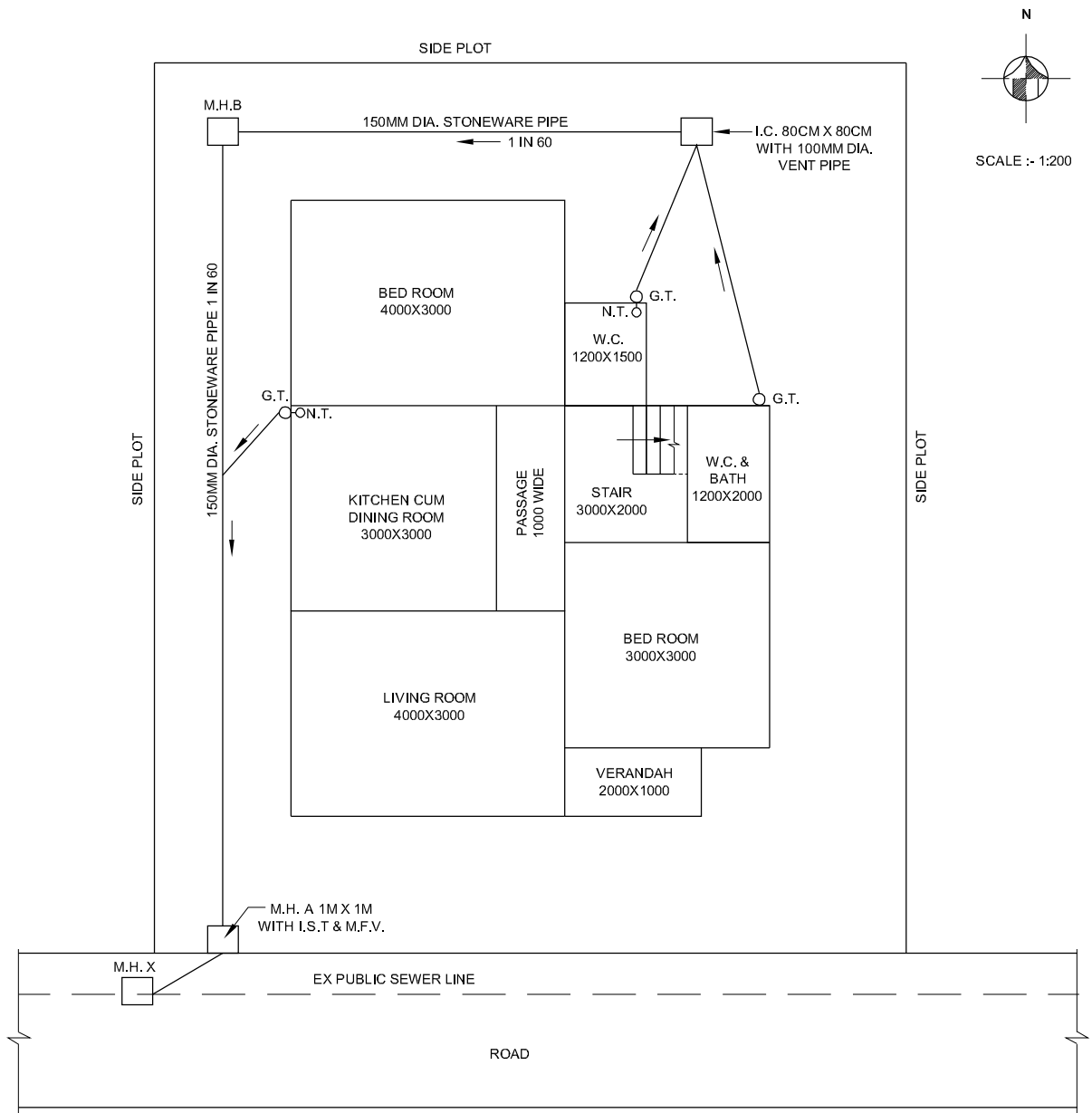**Objective :** At the end of this exercise you shall be able to
• **prepare drainage plan of a building.**

PROCEDURE

TASK 1 : **Prepare drainage plan of the building (Fig 1)**

• To a convenient scale, draw the site plan of the building.

• Draw the line sketch or detailed plan of the building in the site plan in the same scale.

• Mark the positions of sanitary appliamces and toilet fixtures in the building plan by conventional symbols and mark the positions of gully traps outside the building.

• Draw the sewer lines house sewer in the site plan and mark the positions of inspection chambers, manholes, etc.

• Draw connection from the gully trap to building sewer and show its direction also.

• Complete the drainage plan.

Fig 1

N

SCALE :- 1:200

SIDE PLOT

SIDE PLOT

SIDE PLOT

M.H.B

150MM DIA. STONEWARE PIPE

1 IN 60

I.C. 80CM X 80CM
WITH 100MM DIA.
VENT PIPE

150MM DIA. STONEWARE PIPE 1 IN 60

BED ROOM
4000X3000

G.T.

N.T.

W.C.
1200X1500

G.T.

G.T.

ON.T.

KITCHEN CUM
DINING ROOM
3000X3000

PASSAGE
1000 WIDE

STAIR
3000X2000

W.C. &
BATH
1200X2000

BED ROOM
3000X3000

LIVING ROOM
4000X3000

VERANDAH
2000X1000

M.H. A 1M X 1M
WITH I.S.T & M.F.V.

M.H. X

EX PUBLIC SEWER LINE

ROAD

DCN37142E1

DRAINAGE PLAN OF A BUILDING

# Types of sanitary fittings and toilet fixtures

Objective : At the end of this exercise you shall be able to
• **draw the different sanitary fittings in building**
• **draw the arrangement of sanitary fittings in toilet and bathroom.**

PROCEDURE

TASK 1 : **Prepare the detailed drawings of the sanitary fittings in toilet and bathrooms (Fig 1)**

• Draw the details of sanitary fittings as per given drawing using auto CAD and take a print in A3 size paper.

Fig 1

SECTION AB

CHAIN STAY HOLE 10MM Ø

SECTION CD

PLAN

WASH BASIN
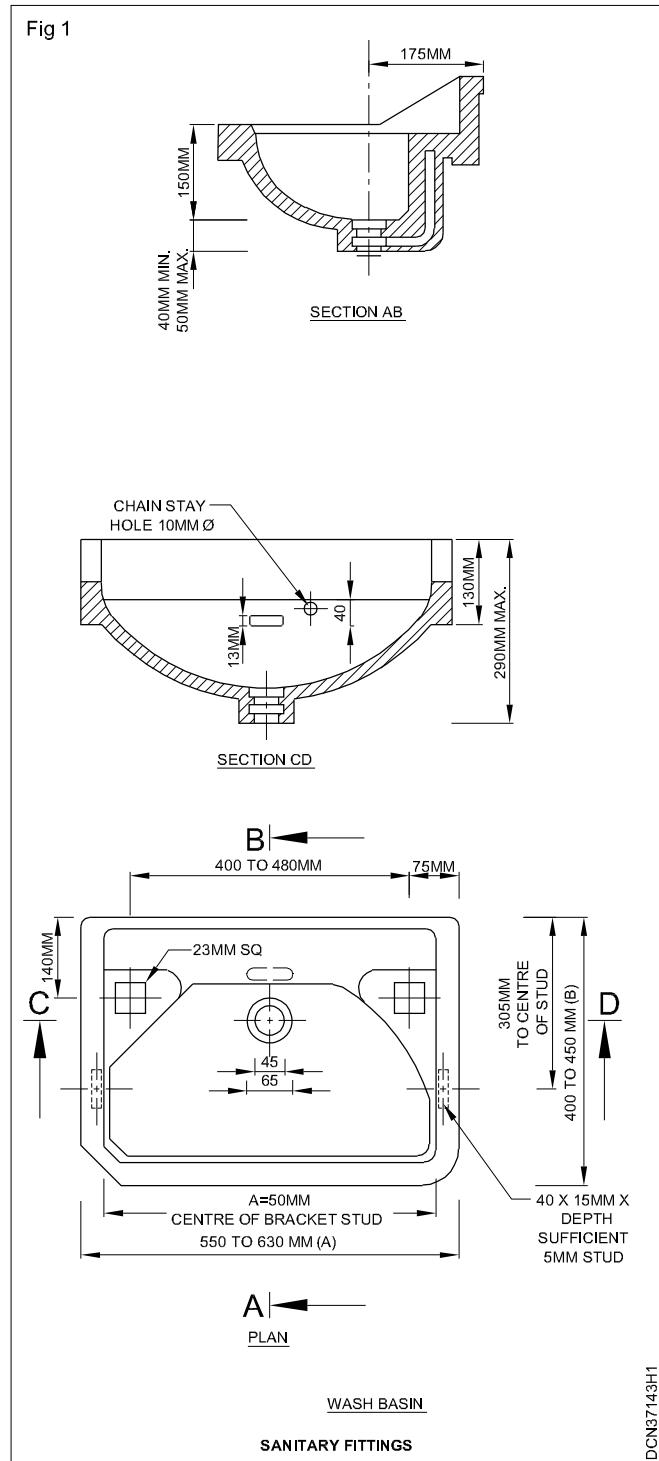
SANITARY FITTINGS

TASK 2 : **Prepare the drawing showing the arrangement of sanitary fittings in toilet and bathrooms.**
(Fig 2 to 19)

- Draw the plan of toilet with (1) ordinary W.C and (2) European W.C (3), Bath room with separate W.C (4) combined bath and W.C (5) public lavatory showing all details as per given drawing using Auto CAD.

- Show the arrangement of sanitary fittings in the plan.

- Mark the dimensions and complete the drawing.
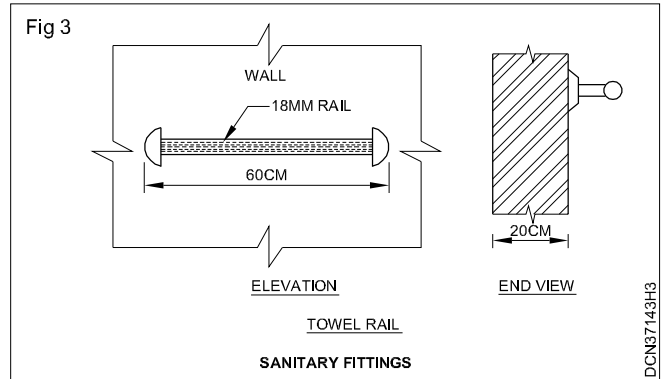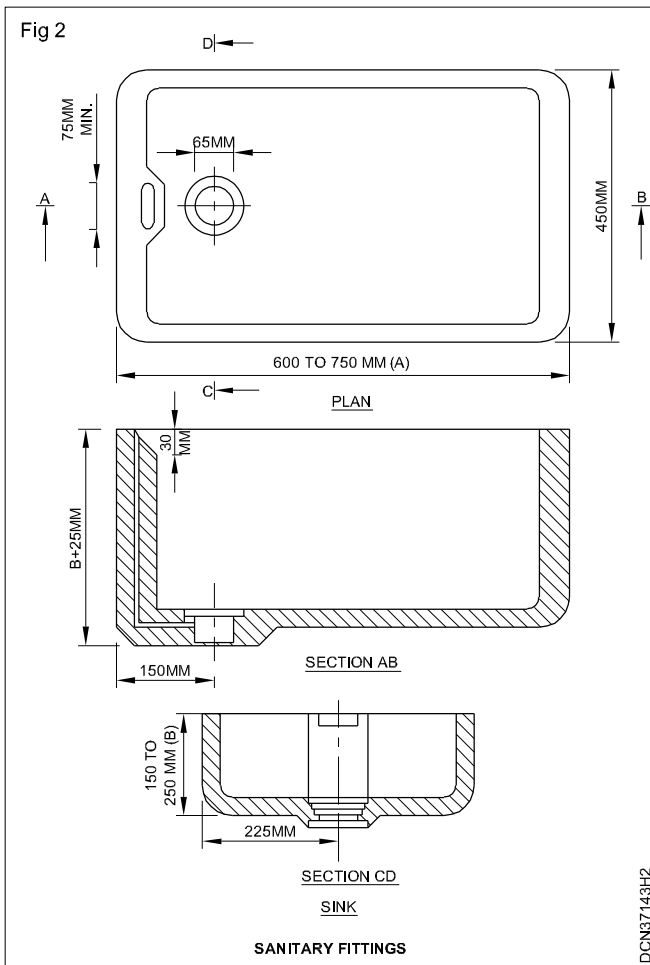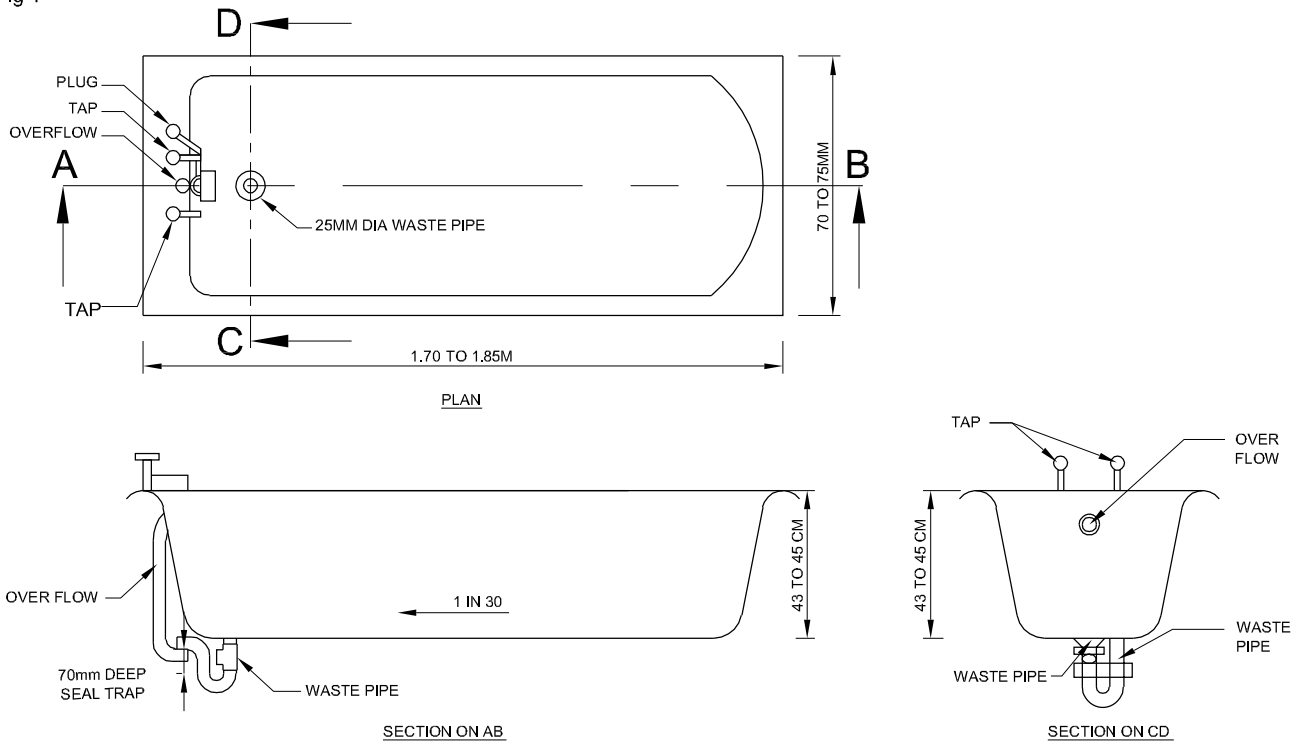
- Take a print in A3 size paper.

Fig 2

SANITARY FITTINGS

Fig 3

TOWEL RAIL

SANITARY FITTINGS

Fig 4

PLUG
TAP
OVERFLOW

A

D

B

25MM DIA WASTE PIPE

70 TO 75MM

TAP

C

1.70 TO 1.85M

PLAN

OVER FLOW

1 IN 30

43 TO 45 CM

70mm DEEP
SEAL TRAP

WASTE PIPE

SECTION ON AB

TAP

OVER
FLOW

43 TO 45 CM

WASTE PIPE

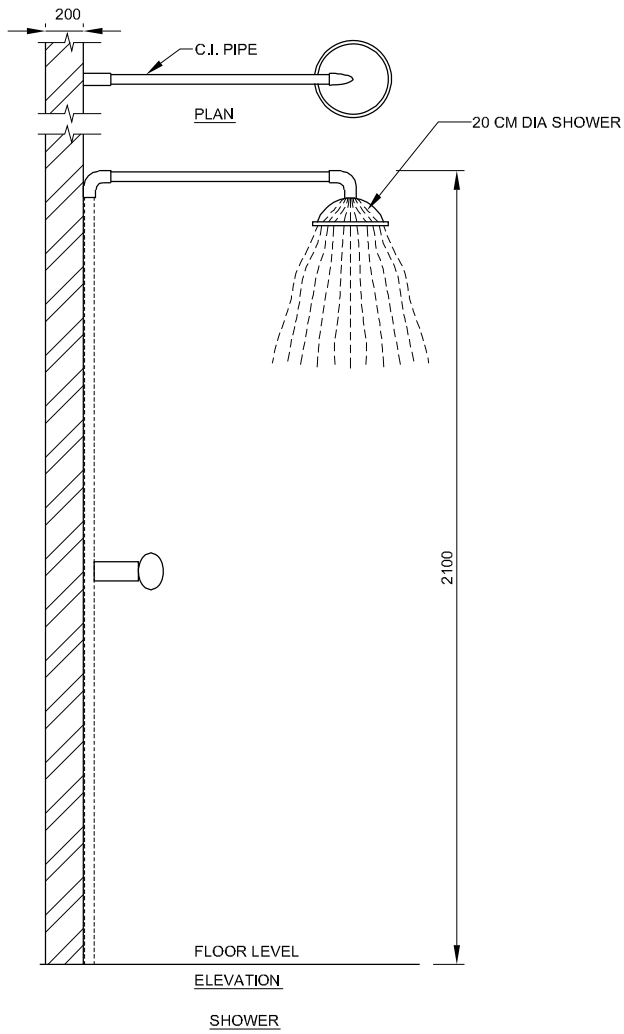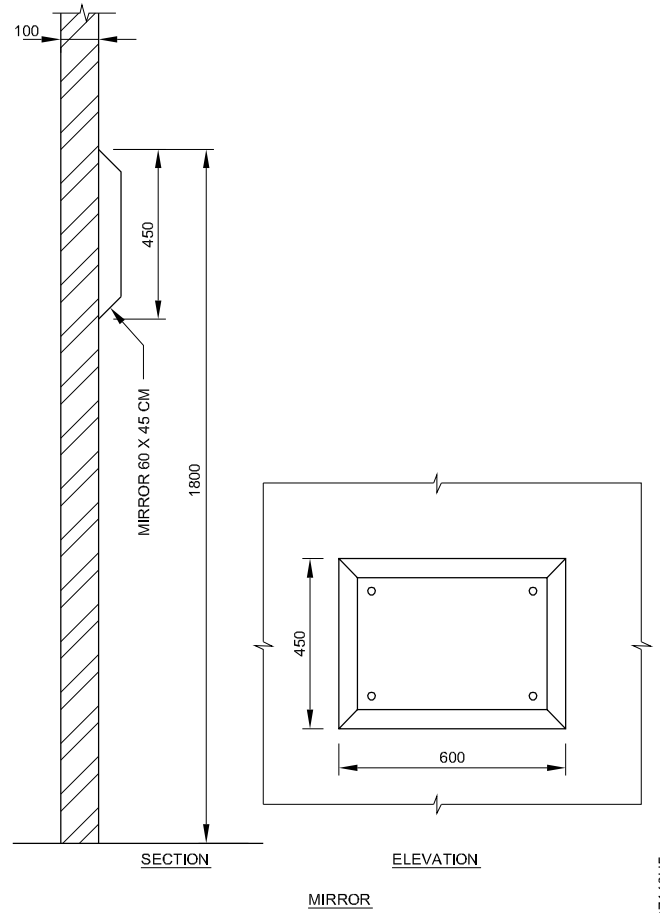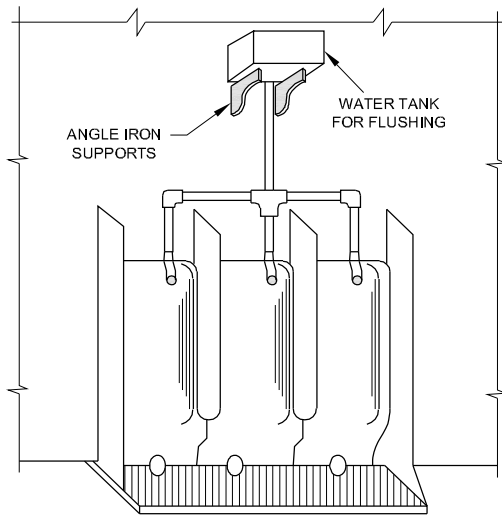WASTE
PIPE

SECTION ON CD

DETAIL OF BATH TUB

SANITARY FITTINGS

DCN37143H4

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.143

Fig 5   Fig 6

PLAN

ELEVATION

SHOWER

SECTION   ELEVATION

MIRROR

SANITARY FITTINGS

DCN37143H5

Fig 7

ANGLE IRON SUPPORTS

WATER TANK FOR FLUSHING

SLAB AND STALL TYPE URINAL

Fig 11

40

40

100 MM

100

10

350MM

125-165 MM

450-600 MM

50

85 MM
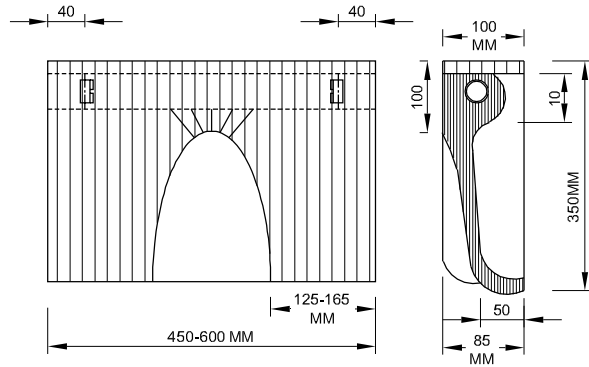
SQUATTING PLATE URINAL

Fig 8

MICA FLAP VALVE

FRESH AIR INLET

50X50CM M.H. COVER

R.C.C. SLAB

G.L.

FROM HOUSE DRAIN

75 X 75 CM MANHOLE

PLUG

CHANNEL

INSPECTION ARM

TO PUBLIC SEWER

80CM

15CM

INTERCEPTING TRAP

10 CM   20 CM   75 CM   20CM   10CM

INTERCEPTING TRAP

Fig 12

FROM HOUSE DRAINAGE

STONE WARE OR C.I. PIPE

TRAP

TO SEWER

C.CONC.
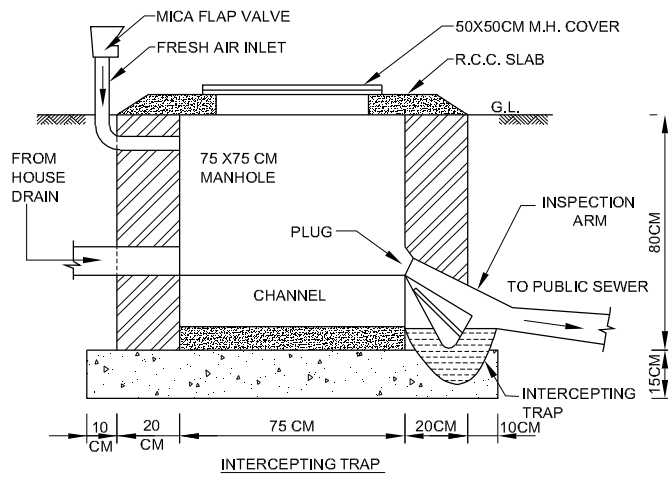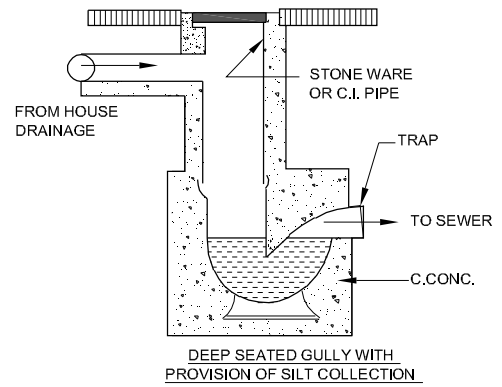
DEEP SEATED GULLY WITH PROVISION OF SILT COLLECTION

Fig 9
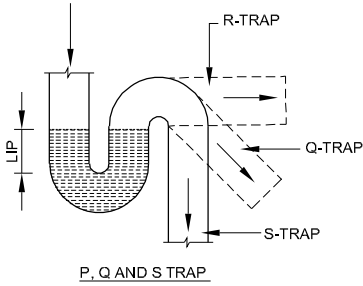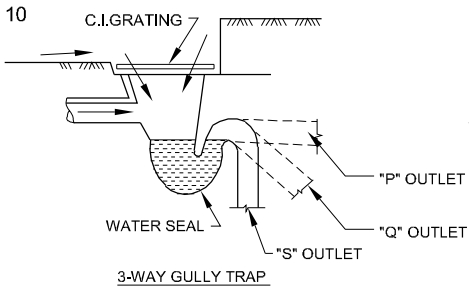
R-TRAP

Q-TRAP

S-TRAP

LIP

P, Q AND S TRAP

Fig 13

100MM CIRCULAR GRATING

220MM

80

50

40

100MM

300MM

FLOOR TRAP

Fig 10

C.I.GRATING

"P" OUTLET

"Q" OUTLET

WATER SEAL

"S" OUTLET

3-WAY GULLY TRAP

SANITARY FITTINGS

DCN37143H6

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.143

Fig 14

PLAN

SECTION

Fig 15

EUROPEAN TYPE WATER CLOSET

SECTION OF TRAP
WATER CLOSET LONG PATTERN SQUATING PAN WITH TRAP

Fig 16

BOWL PATTERN URINAL

Fig 17

FLUSHING CISTERN (U-TYPE)

SANITARY FITTINGS

Fig 18

PLAN

SECTION X-Y

SECTION A-B

SECTION C-D
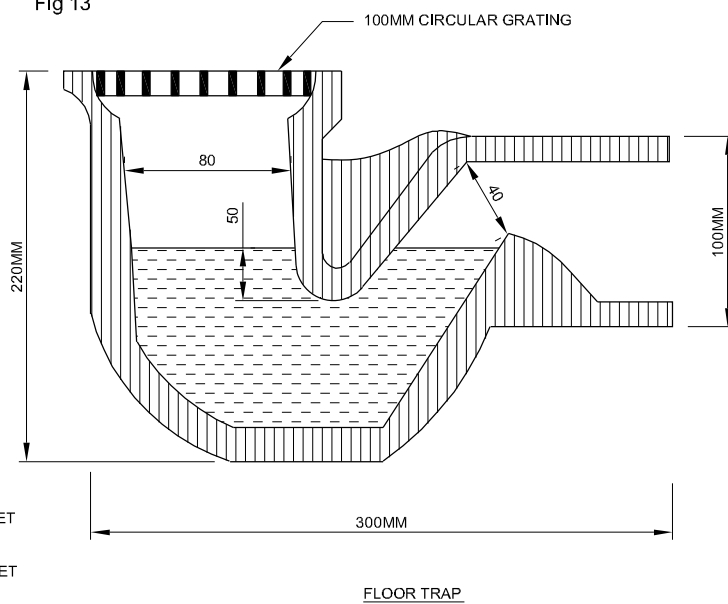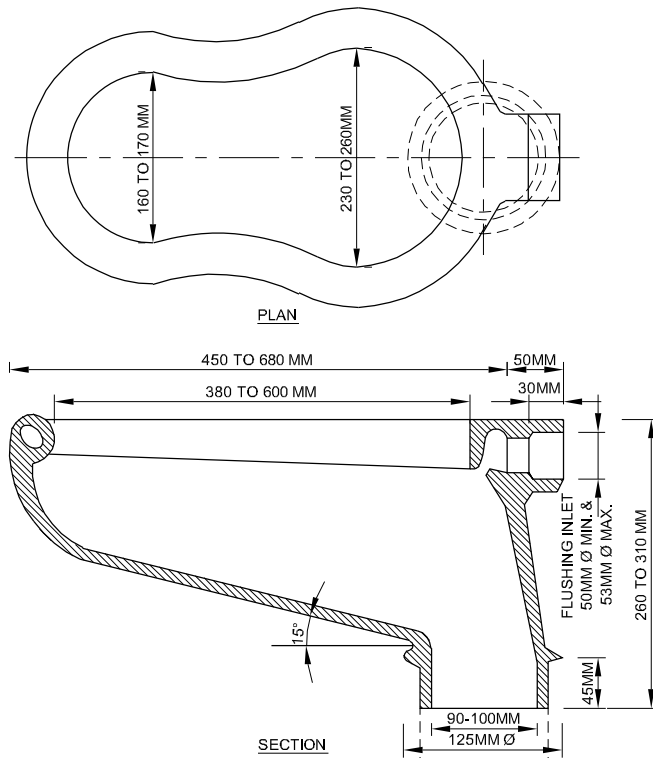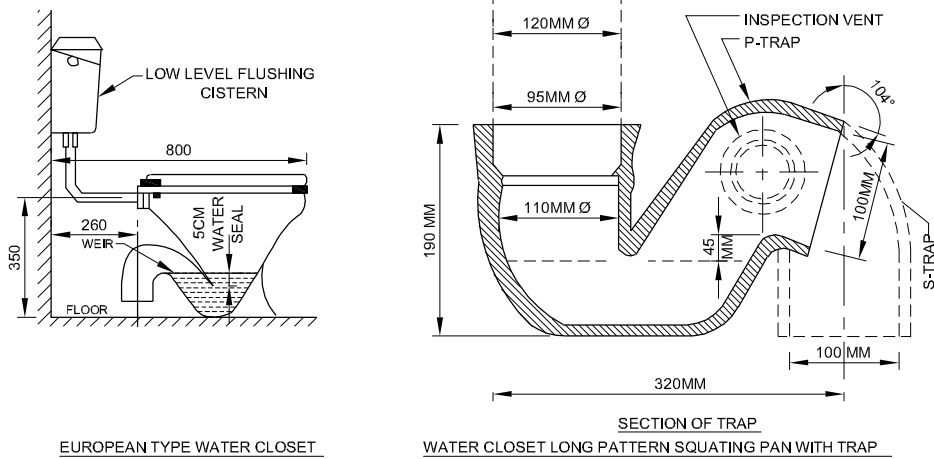
ARRANGEMENT SHOWING SANITARY FITTINGS IN W.C. AND BATH (INDIAN TYPE W.C.,
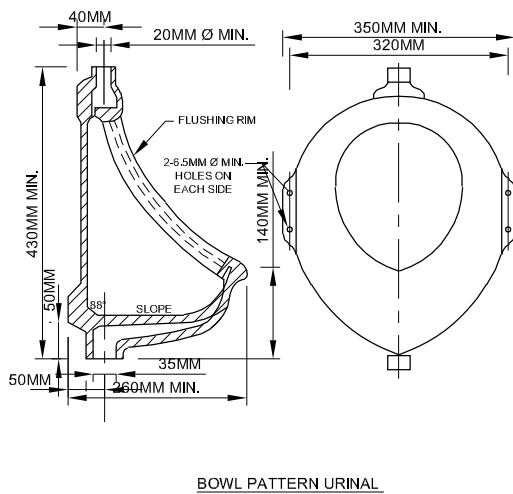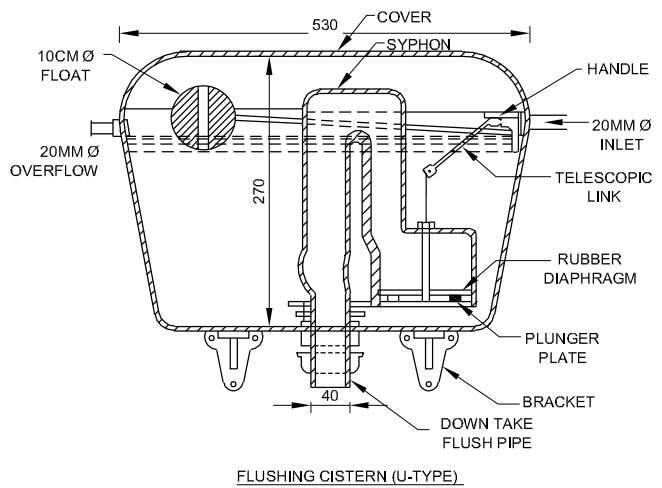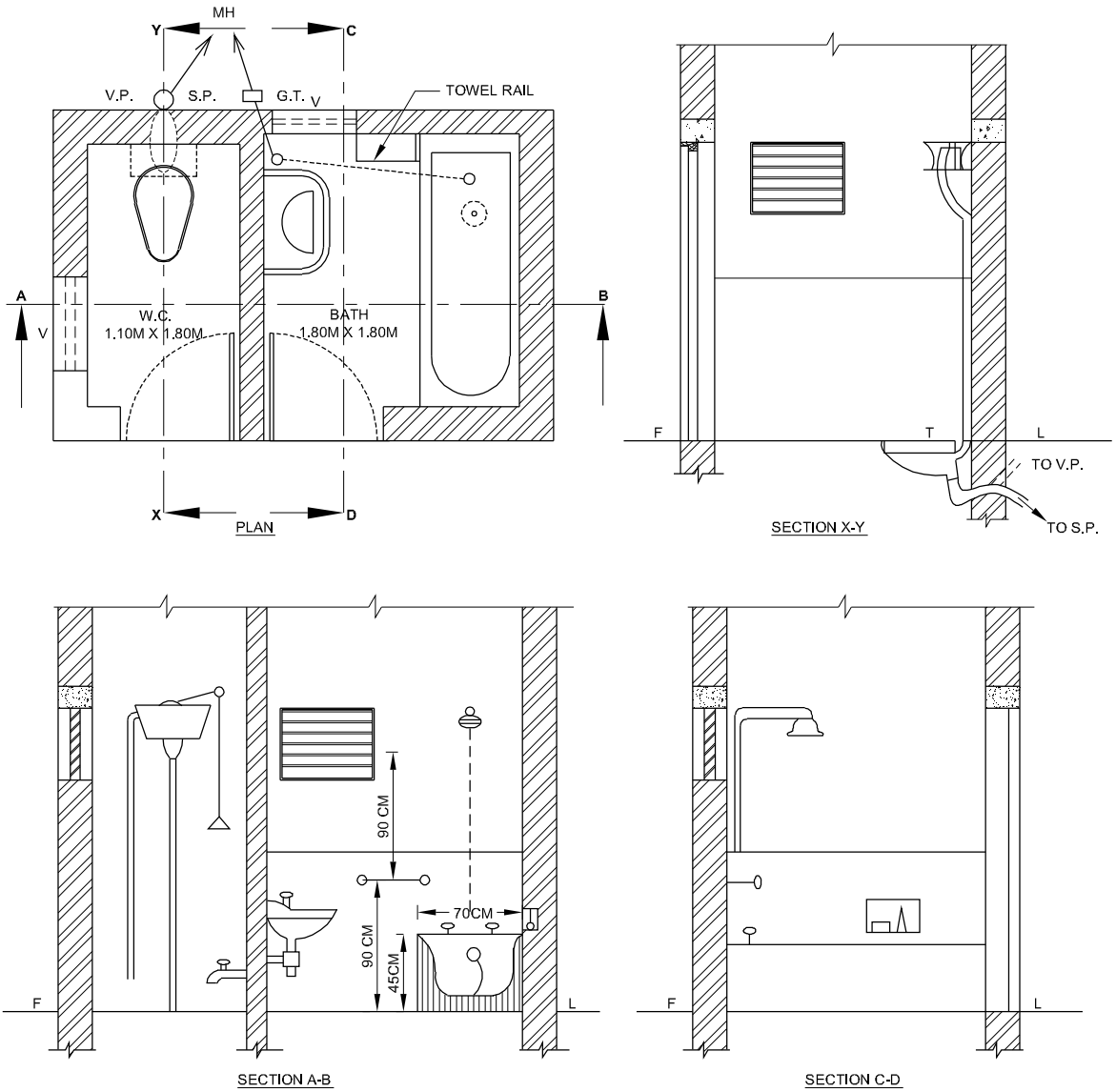FLUSHING CISTERN, WASH BASIN, FLOOR TRAP, SHOWER, TOWEL RAIL AND BATH)

SANITARY FITTINGS

DCN37143H8

Fig 19
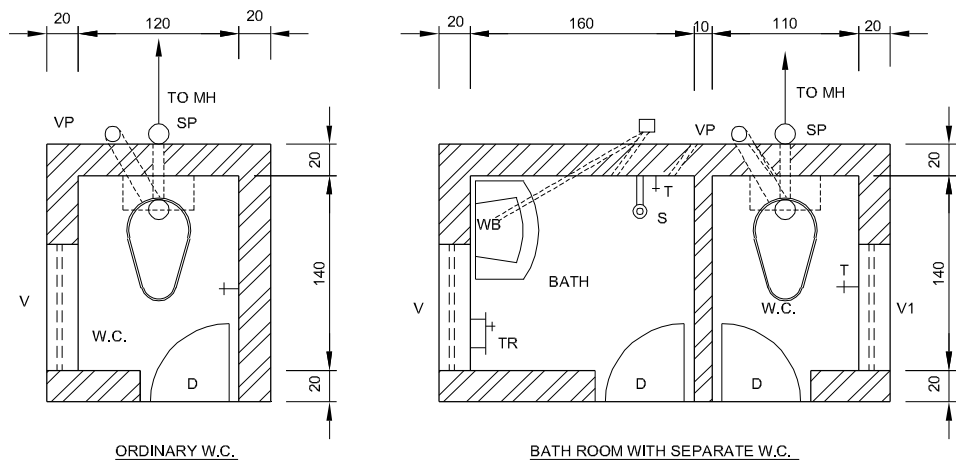
ORDINARY W.C.

BATH ROOM WITH SEPARATE W.C.
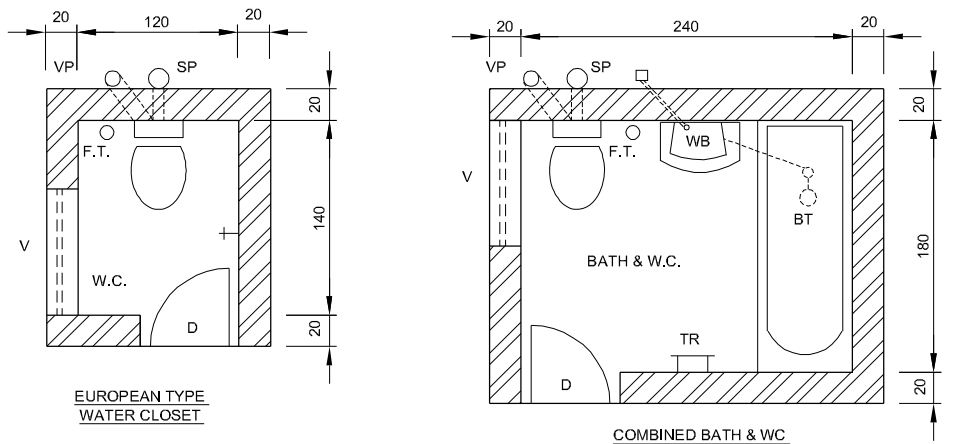
EUROPEAN TYPE
WATER CLOSET

COMBINED BATH & WC
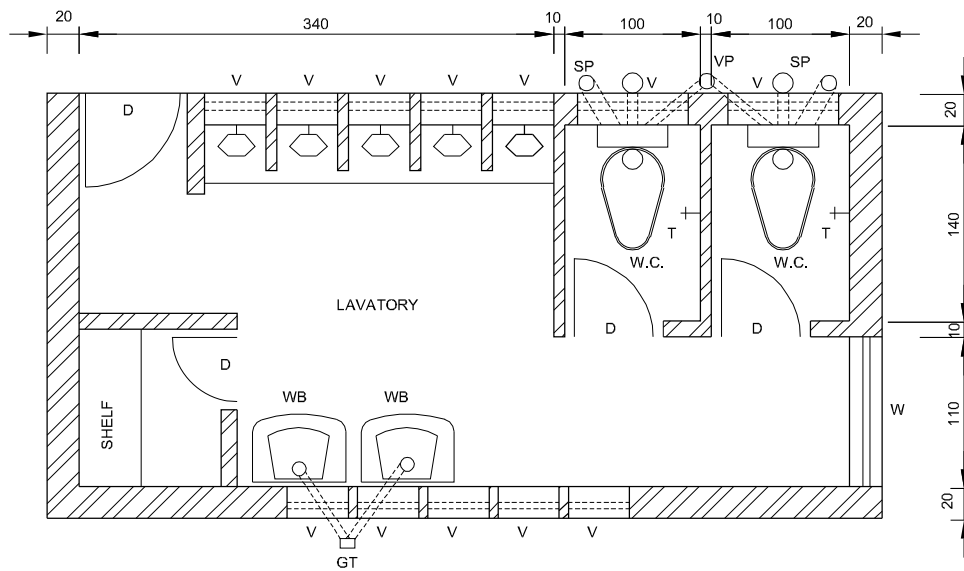
A PUBLIC LAVATORY

NOTE:-

S.P. - SOIL PIPE   V.P. - VENT PIPE
M.H. - MAN HOLE   W.C. - WATER CLOSET
FT   - FLOOR TRAP   WB - WASH BASIN
T.R. - TOWEL RAIL   T   - TAP
GT   - GULLY TRAP   BT - BATH TUB

ALL DIMENSIONS ARE IN CENTIMETERS

A PUBLIC LAVATORY

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.143

Rapid sand filter - water treatment plant (WTP)

Objectives : At the end of this exercise you shall be able to
• **draw the details of rapid sand filter**
• **identify the different layers of filter media.**

PROCEDURE

TASK 1 : **Draw the rapid sand filter using Auto CAD (Fig 1)**

DATA

• Size of filter unit - (6.00 x 4.00) m.

• Size of inlet chamber - (1.00 x 4.00) m.

• Wall thickness - 30 cm.

• Thickness of foundation - 45 cm.

• Dia. of main drain - 30 cm.

• Laterals - 4 cm dia @ 30 cm c/c.

• Slope of laterals 1 in 50.

• Raw water inlet - 20 cm ø.

• Wash water drain pipe - 20 cm ø.

• Wash water troughs - (30 x 30) cm - 2 nos.

• Free board - 50 cm.

• Bottom of wash water trough is 30 cm above the surface of filter media.

• Filter media

• Gravel layer - 60 cm (4 layers each 15 cm thick).

• (3-6, 6-12, 12-20, 20-40 mm size).

• Filter sand - 90 cm depth (effective size (0.4 to 0.6 mm)

• (By using Auto CAD).

• Draw the plan of the filter unit.

• From the plan develop longitudinal section and cross section of the filter.

• Complete the drawing and take a print in A3 size paper.

Fig 1

HEAD LOSS OR FILTER HEAD

WATER LEVEL WHILE FILTERING

WATER LEVEL WHILE BACK WASHING

FILTER SAND
(EFFECTIVE SIZE D10 = .4 - .6 MM)
GRAVEL IN 4 LAYERS EACH 15CM THICK
(3-6, 6-12, 12-20, 20-40MM SIZE)
MANIFOLD & LATERAL DRAIN SYSTEM

WASH WATER

HEAD LOSS INDICATOR

INLET RAIN WATER

FILTERED WATER

WASH WATER TO DRAIN

LONGITUDINAL SECTION AA

WASH WATER TROUGHS
30CM X 30CM - 2 NOS.

AIR COMPRESSOR

RAKER PIPES
40MM Ø @ 50 C/C

LATERAL DRAIN PIPES
40MM Ø @ 30 CM C/C

MAIN DRAIN PIPE
(MANIFOLD) 300MM Ø

CROSS SECTION BB

INLET CHAMBER

300 MM Ø MAIN DRAIN

40MM Ø LATERAL PIPES
@ 30 CM C/C

WASH WATER TROUGHS

PLAN
(SHOWING DRAIN SYSTEM)

A RAPID SAND FILTER

WASH WATER TROUGHS

WASH WATER

INLET

FLOW CONTROLLER

WASH WATER TO DRAIN

FILTERED WATER

COMPRESSED AIR INLET
MAIN DRAIN & LATERALS

(a) SCHEMATIC PICTORIAL DRAWING

DCN37144E1

FILTER UNIT

— — — — — — — —

Flow diagram of sewage treatment plant (STP)

Objectives : At the end of this exercise you shall be able to
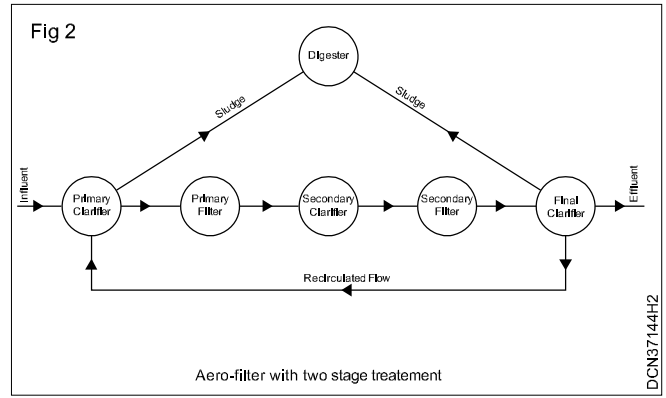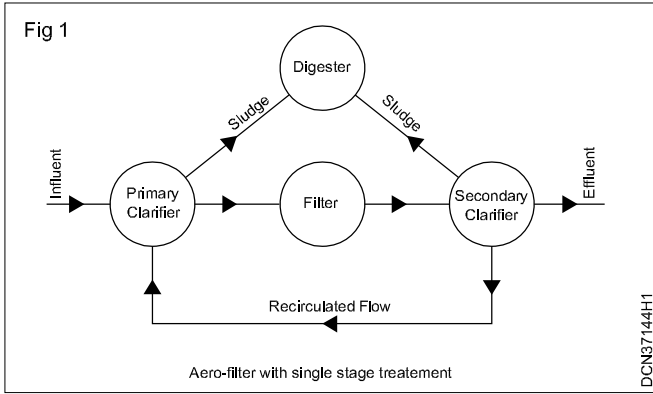• **drawing of the flow diagram of aero filter with single stage and two stage treatment**
• **drawing of the flow diagram of bio filtrarion with single stage treatment and two stage treatment.**

TASK 1 : **Draw the flow diagram of aero filter with single stage and two stage treatment (Fig 1 & 2)**

Construction: Draughtsman Civil (NSQF LEVEL 5) - Exercise 3.7.144

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Fig 1

Aero-filter with single stage treatement

DCN37144H1

Fig 2

Aero-filter with two stage treatement

DCN37144H2

— — — — — — — —

TASK 2 : **Draw the flow diagram of bio filtration with single stage treatment and two stage trearment (Fig 3 &4)**

Fig 3

Biofilter with single stage complete treatement

DCN37144H4

Fig 4

Biofilter with two stage complete treatement

DCN37144H4

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